ZI-KA-WEI OBSERVATORY

NEAR SHANGHAI, CHINA

THE TYPHOONS

OF THE CHINESE SEAS

IN THE YEAR

1881

BY

MARC DECHEVRENS S. J.

DIRECTOR OF THE OBSERVATORY.

ZI-KA-WEI

PRINTED AT THE CATHOLIC MISSION'S PRESS, TOU-SAI-WAI.

1882.

KELLY & WALSH — Shanghai.

National Oceanic and Atmospheric Administration

ERRATA NOTICE

One or more conditions of the original document may affect the quality of the image, such as:

Discolored pages
Faded or light ink
Binding intrudes into the text

This has been a co-operative project between the NOAA Central Library and the Climate Database Modernization Program, National Climate Data Center (NCDC). To view the original document, please contact the NOAA Central Library in Silver Spring, MD at (301) 713-2607 x124 or Library.Reference@noaa.gov

HOV Services
Imaging Contractor
12200 Kiln Court
Beltsville, MD 20704-1387
March 04, 2010

ZI-KA-WEI OBSERVATORY

NEAR SHANGHAI, CHINA

THE TYPHOONS

OF THE CHINESE SEAS

IN THE YEAR

1881

BY

MARC DECHEVRENS S. J.

DIRECTOR OF THE OBSERVATORY.

ZI-KA-WEI

PRINTED AT THE CATHOLIC MISSION'S PRESS, TOU-SAI-WAI.

1882.

KELLY & WALSH — Shanghai.

PREFACE.

The following pages are devoted to the study of the Typhoons of 1881. The investigation has been carried further than last year, thanks to the greater number of available documents and to the active cooperation of many who evinced a truly incredible zeal in supplying me with information. It is a grateful duty for me to acknowledge my obligations to them, but I cannot possibly name all those to whom I am indebted for collaboration and I shall only mention a few : — Capt. F. W. Schulze of the S. S. **Keelung,** whose zeal for the advancement of Meteorology in the China seas is above all praise, — Lieutenants Carpenter and Belam R.N. of H.M.S. **Magpie** who took the initiative of sending me in full the valuable series of the observations they had made all through the past season, when on surveying duty in the China Sea, — the Harbour-Master at Hong-kong who, together whith his own observations, sent me at various times many valuable reports he had obtained from Ship Captains, — the board of Chinese Customs to whom I am indebted for a complete and regular communication of the daily observations in the harbours and light-houses on the coast, without which I should have found the present investigation impossible. — The translation of these pages originally written in French, was made by one of us whom a former residence in England and in America had somewhat qualified for this irksome task : let him receive here again my heartfelt thanks.

The present work, on perusal, is anything but entertaining. It will no doubt appear dry and tedious ; there will be found repetitions and lengthy discussions about seemingly insignificant facts. The object however has been, not to amuse or to move the reader, but to give him information, and still better to furnish him with the means of studying by himself questions of equal interest to meteorologists and sea-faring men.

I have, as much as possible, given all the principal documents used in laying out the tracks of the Typhoons : they may be useful for going over that work again. My interpretation of the observations will perhaps sometimes appear fanciful. To say the truth, all difficulties have not been solved and there have been cases where, in spite of the great number of documents come to hand, information has yet been deficient in completeness. It is particularly in regard to secondary whirlwinds or half-spent Typhoons after a run over the continent, that the investigation is more difficult, but the tracks I have marked out for them are at least likely, however strange some of them may seem.

I trust this long investigation notwithstanding its defects will not be without some useful result. In the course of it I have repeatedly found a confirmation of those general principles concerning the nature and shape of atmospheric whirlwinds which I had laid down after making a special study of the Typhoon of July 31st 1879 and of the fourteen Typhoons of 1880. I hope the summer of the present year 1882 will yet shed light on many a point and give us the means of further improving our knowledge of those grand natural phenomena.

Zi-ka-wei, June 1st 1882.

TABLE.

ERRATA.

Page 1 — Track : 27th Noon : latit. 15.°20′

23 — Track : 19th Noon : ,, 34. 30

27th Noon : ,, 40. 30

In the middle of the page : Documents relating *to* this Typhoon.

25 — In the table of the observations at Cuguegaro suppress the column of the *Velocity of the wind*.

46 — 25th line, read : *away* instead of *avay*.

56 — Track : 27th Min. 2nd Centre : longit. 119.°40′

91 — At the top of the page, read : September — "Amoy and Tai-wan-foo" Typhoon.

152 — 12th line from the foot of the page, read : 31st instead of 21st.

THE TYPHOONS

OF THE CHINESE SEAS

IN THE YEAR 1881.

"ELGIN" TYPHOON

First Typhoon: May 22d — June 1st.

TRACK :

Date			Latitude N.	Longitude E.
22d May	Midn.		12° 15′	126° 30′
	Noon	SE. coast	13. 0	125. 45
23d ,,	Midn.	of	13. 30	124. 45
	Noon	Luzon	14. 0	123. 30
24th ,,	Midn.		14. 15	122. 10
	Noon	Manila	14. 25	121. 0
25th ,,	Midn.		14. 30	119. 45
	Noon		14. 30	118. 30
26th ,,	Midn.		14. 35	117. 20
	Noon	China	14. 45	116. 0
27th ,,	Midn.	Sea	14. 55	114. 15
	Noon		15. 0	112. 30
28th ,,	Midn.		15. 45	111. 0
	Noon	Coast	15. 50	109. 30
29th ,,	Midn.	of	16. 15	108. 0
	Noon	Cochinchina	16. 45	108. 0
30th ,,	Midn.		17, 30	108. 15
	Noon	Back to	17. 40 ?	109. 15 ?
31st ,,	Midn.	Chinese	18. 0 ?	110. 30 ?
	Noon	Sea	18. 0 ?	112. 0 ?
1st June	Midn.		18. 30 ?	113. 30 ?

EVENTS:

Great violence at Manila : squalls 88 miles — calm at 1h. p.m. on the 27th — lowest reading of the barometer 29in52 *from 1h. to 2h. p.m.— Winds : NE. N. NNW. E. ESE.*

Wreck of the British Steamer Elgin *on the Bombay Shoal (Paracels group, in the Chinese Sea) on the 28th at 2h.* 15m *a.m. — lowest reading of the barometer* 29in21 *at 4h. p.m. on the 27th — Winds : N by W. N. NE. E. SE. SE by E. — Winds of hurricane force.*

Curious backing of the Typhoon on the Chinese Sea after having touched the coast of Cochinchina.

Before the Typhoon :

Manila — For the first fortnight of May very steady SE. winds prevailed at Manila; the barometer was high, ranging between 29in.85 and 29in.95. From the 14th the temperature rose almost everywhere on the island and the barometer took to sinking. At the same time a complete change took place in the direction of the

winds which then oscillated between NE. and NW. In the afternoon of the 22d the wind settled in a NE-NNEly direction, which was also invariably that of the lower clouds: there was no more doubt that a centre of depression formed somewhere to the South-east of the Archipelago: the constancy of the wind in a NEly direction showed clearly enough that it was following up the eastern coast. *(Note of the R.F. Faura).*

Chinese Sea South of Hainan — The change in the state of the atmosphere observed at Manila about the middle of May was not confined to the Philippinas Archipelago: at Hongkong (Victoria Peak, Cape d'Aguilar), as early as the 9th, E. and NE. winds had suddenly succeeded to the SW. wind that had been blowing since the beginning of the month and the barometer rose. But on the 14th., owing to a storm that, between the 14th. and 19th., crossed China from West to East at the longitude of Shanghai, SE. and S. winds came to prevail.

On the 24th. E. winds obtained again in the South with a further fall of the barometer; the depression this time was to extend over the China Sea, Cochinchina and Tonkin: it seems to have influenced the Typhoon formed to the South-east of Luzon and deflected it from its original direction causing it to traverse Luzon by the latitude of Manila and run over the China Sea which it crossed from East to West.

The high pressure elicited by the whirlwind on its outer edge all along its track, soon filled up the atmospheric depression: a barometric minimum was observed on the 26th. about the Southern coast of China, *viz.* $29^{in}.820$ at Hong-kong and $29^{in}.719$ on board the H.M.S. *Magpie* near the Northern coast of Hainan. The Centre of the Typhoon, at that moment (4 p.m.), was in the middle of the China Sea, 450 miles South-east of the *Magpie:* that vessel had then E. wind force 3-4.

The Typhoon:

1st Period: Crossing the Philippinas Archipelago.

The Typhoon was probably formed between the Pelew Islands and the Philippinas Archipelago, about 135° longitude and between 8° and 10° latitude N.; it must have commenced about May 14th. when the prevailing wind at Manila changed suddenly; but its progress was at first very slow and its presence was not certain for the Observer at the Manila Observatory before the 22d. On the 23d, 8 a.m., a telegram from Tayabas, about 60 miles SE. of the Capital, showed that the barometer at that station was $^{in}.08$ lower than at Manila. On the eastern coast of the southern part of Luzon, wind already blowing strongly from NE., heavy rain, Typhoon evidently approaching.

The German barque *Patagonia* from Hamburg and the British ship *Wemyss Caslle* from Cardiff (Wales) report having encountered bad weather off the island of Lueban,in Minoro (South of Manila); it began to blow hard on the afternoon of the 23d; wind from the NW.; the gale at its greatest force between 5h. and 10h. on the following morning. The *Patagonia* lost a suit of sails; there were much rain and high sea.

At Manila, between 9 a.m. and 4 p.m., on the 23d, barometer sinking notably; from 4h. to 9 or 10 p.m., the rise due to the daily normal oscillation is indicated by an interruption in sinking; wind, after 4 p.m., frequently oscillating between N. and NW. At sunset all the horizon of a purple coppery hue ressembling the blaze of an immense fire. At 10 p.m. strong wind from NW.; squalls with heavy showers, the wind then oscillating from WNW. to W. (winds strongly convergent).

On the 24th, 8 a.m., the Centre of the Typhoon was East of Manila, it entered the Laguna, thus proceeding straight westwards. It is interesting to observe what way the Typhoon follows to avoid the high mountains of the northern part of Luzon to which its first direction carried it: it is the shortest way to the China Sea and

also the easiest, since the narrow isthmus is mostly occupied by the large water expanses of the Laguna and of Manila Bay.

The marked convergence of the winds at Manila must necessarily have been accompanied by a strong inclination upwards, to carry into the upper and colder regions of the air the enormous mass of vapour taken up from the Laguna and Manila Bay; hence heavy rains during the night of the 23d-24th and the morning of the 24th (1^{in}.88 at Manila up to Noon); hence probably also on that part of the great Island an absolute minimum of pressure or at least an extension more decided to the west of the low pressures which attracted the Centre of the whirlwind in that direction and immediately caused it to deviate from its first course, bearing to the North-west.

About 10h. 30^{m} a.m., according to observations made on board the Steamer *Lipa* anchored at Santa Cruz, the central calm extented over the Laguna. Now, as the Director of the Manila Observatory judiciously remarks, the wind which then, according to the circular winds theory, must have been blowing over the town, would have been N. with a slight inclination to E.; and yet it was NW. with frequent excursions as far as W. A deviation of the aerial currents by the mountain chains of the island would not be sufficient alone to account for such a convergence of the winds, particularly as it was from the West that the strongest squalls came.

At 1 p.m. on the 24th, the wind abated and ceased for a few moments. At 1h. 15^{m} it shifted suddenly from NNW. to ESE. immediately taking a greater intensity than before (53.2 miles). The barometer was at its lowest point (29^{in}.52) and kept there till 2 p.m.; it then took to rising whilst the wind oscillated between E. and SE.; its violence constantly increased till 2h. 45^{m}, when its velocity attained 75.4 miles. It then settled ESE., thus keeping a direction of marked convergence to the Centre which was running away westward and entering the China Sea.

It appears then that Manila, if not on the very path of the Typhoon, at least was within the narrow circle of central calm. The observations made at the Observatory compared with those made on board the sloop of war *Doña Maria de Molina* lying at anchor at Canacao and with those made on Corregidor Island at the entrance of Manila Bay, show that the Centre must have passed in the South-west about 1h. 30^{m} p.m.

During the passage of the Storm, the wind was far more violent after than before the barometric minimum, from ESE. than from NW. The strongest squalls gave a velocity of 88 miles an hour, but such violent blows were infrequent and of short duration; the maximum velocity generally did not exceed 72 miles an hour.

We may remark that the directions successively taken by the lower clouds, Cumuli and Nimbi, during the passage of the Typhoon at Manila, were much less convergent to the centre than the directions of the winds at the surface of the soil.

The following Table gives the observations taken at the Manila Observatory.

Observatory of the Ateneo municipal at Manila (Philippinas Islands).

DIRECTOR: R.F. FAURA S.J.

Date	Hours	Barometer	Winds Direct.	Veloc.	Temp. of the air	Humidity. %	Tens. of vap.	Clouds Upper	Lower	Rain	Remarks
		in		miles	°		in				
May 22d	Noon	29.85	NW	4.4	85.6	71	0.870	K 2	C 9 ENE	inc.	The Southern region of the sky, up to the zenith, overspread with very high vaporous Cirri. In the lower regions a great deal of Cumuli from ENE. To the South-east lowering sky, a sign of bad weather; continued all the following night.
	1 P. M.	.82	NW	5.5	85.3	73	0.886	K 2	C 8		
	2	.72	NW	4.8	84.9	70	.839		C 8		
	3	.76	NNE	11.0	87.3	63	.815	Ac 8			
	4	.75	NNE	9.2	88.2	59	.780	Ac 6			
	5	.78	NE	8.8	89.1	54	.733	Ks 3	C 8		
	6	.80	NE	11.0	87 8	55	.721	K 2	C 8		
	7	.82	NE	8.8	82.6	73	.815		Cn 10	0.004	At 7 p.m. drizzling rain.
	8	.84	NE	4.4	82.2	69	.760	K 2	Cn 4		
	9	.85	NE	5.5	81.7	70	.766	Ks 2	Cs 2		
	10	.86	NNE	5.3	81.0	73	.768	Ks 7	Cn 4 NE		A 10 p.m. horizon overcast to the East and East-south-east. High clouds as before up to the zenith; low isolated clouds running swiftly from North-north-east — *Barometer : only a slight* evening maximum.
	11	.85	NNE	5.3	81.0	77	.815	Ks 9	Cn 5		
May 23d	Midnight	.85	N	6.6	81.0	77	.807	Ks 9	Cn 4		
	1 A. M.	.83	NNE	7 5	79.5	81	.811	Ks 9	Cn 4		
	2	.84	NE	4.2	79.5	83	.835	Ks	Cn 7		
	3	.80	NNE	5.3	77.7	82	.827	Br	Cn 7		
	4	.80	NE	6.4	77.0	91	.847		Cn 8		May 23d, 4 a.m : Sky as before, though darker to the East and South-east.
	5	.82	NE	2.2	78.6	85	.831		Cn 8 ENE		
	6	.82	NE	2.2	78.8	88	.862		Cs 2 NE		8 a.m. Despatches from Daet and Atimonam bringing notice of fresh NE. wind with rain. Information given to the Harbour master and to the telegraph office.
	7	.83	NNE	0.7	79 5	85	.851	Ac 8 NNE			
	8	.84	N	2.2	81.3	79	.843		Cn 9 ENE		
	9	.85	N	4.4	83.1	75	.843		Cn 9 ENE		
	10	.83	NNE	3.7	86.5	64	.803		Cn 9 NE		
	11	.82	NNE	7.3	87.4	70	.906		Cn 9		
	Noon	.82	NNE	8.8	83.3	85	.965		Cn 9 ENE		Daily barometric oscillation but trifling — Sky getting darker and darker to the South-east and East-north-east.
	1 A. M.	.78	NNE	5.9	85.8	69	.847		Cn 9 NE		
	2	.77	NNE	5.9	86.4	61	.764		Cn 9		
	3	.74	N by E	15.4	86.5	61	.764		Cn 9		
	4	.72	NNE	11.0	86.2	62	.768		Cn 9		
	5	.72	NNW	10.8	84.2	71	.827	Br	Ni 10 ENE		Towards sunset the clouds to the East take a bright coppery hue, giving the appearance of a huge fire.
	6	.74	N by E	10.3	84.2	71	.835		Ni 7 NE		
	7	.74	NNW	7.5	83.8	72	.862		Ni 10		
	8	.74	N	7.3	83.5	73	.839		Ni 10		
	9	.76	N	10.3	78.6	86	.859		Ni 10 NNE		
	10	.74	NW	18.3	80.1	80	.818		Ni 10		10 p.m. : wind freshening, often shifting to WNW. and NW.
	11	.74	N by W	20.7	80.1	82	.835		Ni 10 NE		
May 24th	Midnight	.71	NNW	25.1	79.7	83	.843		Ni 10 NNE		During the night heavy rain; N. and NNW. wind; barometer continues to fall.
	1 A. M.	.69	N by W	28.4	79.7	85	.859		Ni 10		
	2	.67	N	15.9	78.8	93	.910		Ni 10		
	3	.65	NNW	18.5	78.8	92	.902		Ni 10 NNE		
	4	.65	NNW	11.9	75.2	92	.902		Ni 10 N		
	5	.65	NNW	11.0	77.7	92	.874		Ni 10		
	6	.67	NNW	11.2	77.4	91	.851		Ni 10 NNE		May 24th, 6 a.m., weather continues the same; wind getting settled NNW.; barometer falling.
	7	.69	N	13.2	76.8	92	.851		Ni 10		
	8	.70	NNW	12.8	76.1	90	.807		Ni 10 N		
	9	.69	NNW	13.0	76.1	88	.791		Ni 10		
	10	.67	N	23.5	75.9	87	.779		Ni 10		10 a.m. } No change.
	11	.63	N	31.9	76.1	87	.783		Ni 10 NNE		11 a.m. }
	Noon	.60	N by W	20.9	76.1	83	.748		Ni 10 N	1.851	
	1 P. M.	.52	NNW	17.6	74.1	87	.729		Ni 10 N		1 p.m. *Calm* for a few moments; clouds forming a bar running from North-west to South-east. Then all at once furious wind from ESE.; a deluge of rain.
	2	.52	E	64.2	74.1	97	.818		Ni 10 SE		
	3	.60	E by S	75.2	74.1	99	.835		Ni 10 SE		
	4	.62	ESE	?	74.1	99	.835		Ni 10 SE		
	5	.64	ESE	?	74.1	99	.835		Ni 10 SE		
	6	.67	ESE	?	75.6	92	.811		Ni 10 SE		
	7	.71	ESE	?	75.7	84	.744		Ni 10 SE		Typhoon moving westward. Telegraphed to Hongkong.
	8	.74	E by S	?	75.6	84	.744		Ni 10 SE		
	9	.79	ESE	?	75.4	82	.721		Ni 10 SE		
	10	.80	E by S	?	75.7	80	.709		Ni 10 SE		
	11	.79	ESE	?	75,4	86	.756		Ni 10 SE		
May 24th	Midnight	.79	ESE	?	76.1	83	.748		Ni 10 SE	4.214	
	1 A. M.	.78	ESE	?	76.1	80	.717		Ni 10 SE		
	2	.77	E	?	76.1	80	.717		Cn 9 SE		
	3	.76	E	?	76.8	88	.717		Cn 9 SE		
	4	.76	E by S	?	75.6	82	.725		Cn 9 SE		
	5	.77	E	?	77.4	75	.701		Cn 9 SE		
	6	.78	E	6.6	77.7	84	.799		Cn 9 SE		
	7	.79	ESE	5.5	77.7	86	.815		Cn 9 SE		
	8	.81	ESE	3.3	79.2	87	.822		Cn 9 SE		
	9	.83	ESE	1.3	82.4	75	.827		Cn 9 SE	0.736	
	10	.85	ESE	5.9	84.9	72	.858		Cn 9 SE		

Second Period : Through the China Sea.

The loss of the British Steamer *Elgin* on the Bombay shoal of the Paracels and the rough weather that prevailed on the 28th of May along the coast of Cochinchina in the vicinity of Touron, leave no doubt with regard to the path of the Typhoon.

Proceeding from Manila it passed a little to the South of the Paracels and touched the coast of Cochinchina somewhat above the 15th degree of latitude.

The wreck of the *Elgin* is the only noteworthy incident in this run of the Typhoon over the China Sea. We shall give a relation of it by Mr. Ross, chief Officer, as we find it in the Hongkong *Daily Press;* we also shall further on reproduce the complete report which that Officer gave to Mons. Rivière de la Mure, commanding the French Transport ship *Le Drac* which received part of the shipwrecked men and which has been kindly communicated to us. The Steamer *Elgin* had left Saïgon for Hongkong on May 24th, with a cargo of rice and 50 persons on board.

"Left Saïgon on May 24th about 11.30 and passed Cape St. James at 6 o'clock same day. The weather was fine, clear, and dry, with light, variable winds; the same conditions were experienced on the following day and up to noon of the 26th, when a northerly swell set in; the wind, which was increasing, had by evening developed into a regular NNW. gale. The sea increased considerably as night came on; awnings were furled. At midnight a high sea was running and the vessel shipped tremendous quantities of water. This weather continued all night. The morning of the 27th showed no improvement. The engines were slowed at 2 a.m.; by noon a hard gale was blowing, and at 2 p.m. it had attained hurricane force, and the ship was labouring heavily. Heavy seas were continually being shipped, and by one of these six Chinese members of the crew were badly injured, and afterwards another sea carried away the ventilator from the forecastle and filled that part of the ship with water. At 4 p.m. the barometer read 29.21, which reading was the lowest reached during the storm. The same weather continued throughout the night. On the morning of the 28th, the *Elgin* struck a reef, bumping forward and amidships. The engines were immediately put full speed astern, but without any visible movement of the vessel. Finding her immovable, cargo was thrown overboard; this had no effect. At 4 a.m. the vessel, continuing to bump heavily, commenced to fill. Soundings were taken of the water round the vessel. More cargo was thrown overboard, and the process of lightening the ship was continued all day. By this time the vessel had acquired a considerable list to port. All efforts to right her were fruitless. As the tide fell her list increased and her fore and main holds were full of water, the dry reef becoming visible to the eastward as the tide went down. By 11 a.m. the men were unable through exhaustion to work longer. The ship had by noon settled into a quiet position, and the vessel was getting by this time quite full of water. On the morning of the 29th, the tide rising and a heavy sea running over the reef, it was determined that, as the ship commenced to bump again, and there was, to all appearance, no possibility of getting her off, the boats should be provisioned and got ready. This work proceeded at all intervals approaching a quieter condition which occurred during the day, and the work was completed by sundown. The boats lay by the ship all night, and at sunrise next morning all left in the three boats. Eight Europeans and 42 others, crew and passengers, mostly Chinese, left the wreck in safety; two or three died of exposure or exhaustion. The boat in charge of Mr. Ross made most headway, so much so that just before sunset he put about to hail the captain, whose boat was astern of the other two. Mr. Ross last saw the captain and second officer and their respective boats at sundown on Monday evening; he saw both their lights up to 11 o'clock that night. They were then steering a NE. course with a not unfavourable wind; on Tuesday he was enabled to take an observation and found his position to be lat. 17°.1′ N., long. 113°.26′ E. All this day nothing was sighted. The next day a disagreeable change in the weather took place, and heavy rain with variable winds was experienced, lasting all night, varied by occasional squalls up to noon Thursday, when the wind came steady out of the NE. continuing till Friday evening,

when the breeze moderated. On Saturday morning a light easterly wind sprang up, and about 10 a.m. Mr. Ross made out the top-gallant-masts of a vessel which subsequently proved to be the French Transport *Drac*, which in some two hours more picked them up, in latit. 21°.4' N. — long. 113°37' E."

Of the two other boats carrying the remainder of the shipwrecked men, one was picked up by the steamer *Londoun Castle* on June 2d, by 18°.46' latitude: "At 1h. 45m a.m., there was observed a light flashing on starboard bow, bearing SW by W. Bore down for it and came upon a boat belonging to steamer *Elgin*. Took all hands on board out of the boat, comprising Captain Miller, Mr. Mitchell chief engineer, W. Shields donkey-man, an Annamite woman, a Chinese woman, 13 Chinamen and a child." — They were all safely landed at Singapore on the 6th June.

I append an abstract of the log book of the *Elgin*, from the French translation of the Commandant of the *Drac* Transport ship who had received it from Mr. Ross.

Abstract of the Logbook of the British Steamer **ELGIN.**

CAPTAIN MILLER

Bound from Saïgon for Hongkong and wrecked on the Bombay Shoal (Paracels).

Date 1881	Hours.	Courses steered	Speed	Wind	Barom.	Events
			k.			
May 26th	Noon	NNE	8.0	NNW 5		Noon: Fresh breeze. Heavy head sea — shipping a good deal of water over the cathead.
	2 P. M.	NNE	8.0	NNW 5		
	4	NNE	7.0	NNW 5		
	6	NNE	7.0	NNW 5		
	8	NNE	7.0	NNW 6		8 p.m. Strong breeze — sea getting higher.
	10	NNE	6.0	NNW 7		
May 27th	Midnight	NNE	6.0	NNW 8		Midn. Fresh gale—hard sea—shipping a great deal of water over the bows.
	2 A. M.	NNE	6.0	NNW 9		
	4	NNE	4.0	N 9		The day begins with a fresh gale — high sea breaking heavily.
	6	NNE	3.0	N 9		
	8	NNE	3.0	N 10		8 a.m. Sea rising — ship labouring heavily.
	10	NNE	3.0	N 10		
	Noon	NNE	3.0	N 11		Noon: A Cyclone — sea breaking frightfully — shipping enormous quantities of water.
	1 P. M.	NNE	3.0	NNE 11		
	2	NNE	3.0	NNE 11		3 p.m. Shipping an enormous sea at the bows. A large wind pipe carried away — Forecastle filled with water.
	3	NNE	3.0	NE 12	lowest	
	4	NE	2.6	ENE 12	29.21	
	5	NE	2.6	ENE 12		4 p.m. Barometer sinks down to 29in21. All sails torn away—wind frightfully strong — heavy sea breaking over.
	6	ENE	2.6	E 12		
	7	ENE	2.6	ESE 11		
	8	E	2.6	ESE 11		8 p.m. No change in the wind or sea. Shipping enormous quantities of water — Ship labouring heavily.
	9	E	2.6	SE 11		
	10	E	2.6	SE 11		
	11	ESE by E	2.6	SE 11		
May 23th	Midnight	ESE by E	2.6	SE 11		A sad beginning of the day — sea breaking over. — blowing a hurricane.
	1 A. M.	ESE by E	2.6	SE 0		
	2	ESE by E	2.0	SE by E 9		1. 15 a.m. Striking on a reef slightly amidship and forward.
	3	,,	,,	SE by E 9		
		,,	,,	—		4 p.m. Ship begins to strike violently amidship and to fill with water. Taking the men from off the cargo and lowering life boats.
		,,	,,			
May 29th	Midnight	,,	,,	ESE 6		Midnight — Fresh breeze ESE. Sky cloudy.
	at sunset	,,	,,	E 5		2 a.m. Ship striking again and taking much water in amidship — At daybreak got the boats alongside on the lee side — Ship striking violently — hard sea from the North — At sunset fresh wind from E.; enormous seas from the North. (1)

(1) I beg, in the interest of Science and of Navigation to be allowed to give here the sentence of the Marine Court of Inquiry which sat at Singapore to inquire into the loss of the steamer *Elgin* — It is perfectly plain and clear: a further discussion of the foregoing report will then be unnecessary.

"*The Court consider that the master of the vessel committed an error of judgment in pursuing his course of NNE. for so many hours with the wind at NNW. and a low barometer, instead of running to the southward. They also consider that the loss of the vessel was due to the master's lack of confidence in the recognised rules of the law of storms. After the ship struck everything that could be attempted was done. The Court did not think it necessary to deal with the certificates of the officers or master, but were of opinion that the master should be reprimanded; which was done. They also suggest that more particular examinations should be held regarding the laws of storms for candidates passing for command of vessels engaged in the waters of the China Sea.*"

Between the Paracels and the coast of Cochinchina we have no information beyond the following document, and that meagre enough: "The British barque *Hotspur*, Captain Jack, was towed into Hongkong on the 12th June by the steamer *Yottung* in a disabled condition, she having experienced she full fury of a Typhoon on the 28th of May, while at anchor in the roadstead of Quanghai, coast of Cochinchina. It appears that the vessel began to drive, and Captain Jack was compelled to cut away the masts to prevent her from being driven among the breakers. After the masts were cut away the vessel managed to hold, and ultimately the steamer *Yottung* called in, took the *Hotspur* in tow and brought her to Hongkong, *viâ* Touron. Fortunately the hull of the barque has not sustained material damage: she does not leak and it is hoped that she will soon be refitted. Part of her cargo, sugar, is destined for Hongkong, and as little or no damage was sustained by it, the lucky escape of the vessel may be imagined." *(China Mail)*.

Some steamers are reported to have met the same storm on the coast of Cochinchina: but no other details.

Third Period: The Typhoon turns back towards the East: it finally disappears.

This last period is not the least interesting. The whirlwind which, on crossing the China Sea, seemed to be attracted by the land is now repelled; its track, reflected on the coast, turns back upon itself and this furious Typhoon, on getting to the open sea rapidly abates and soon vanishes entirely.

We have said that a barometric minimum had been observed, on the 26th, all along the Southern coast of China. On the 27th, 28th and 29th, the barometer rose again in spite of the proximity of the Typhoon whose diameter N-S. in this region must consequently have been inconsiderable. Thus, on the 28th, the Centre was only 240 miles South of Hoihow where the *Magpie* was riding at anchor; her barometer on the rise marked 29in.805, wind feeble (force 1) EbyN. That wind already belonged to the whirlwind; for higher up on the Gulf of Tonquin, at Pakhoi, there was blowing a strong wind WbyN. evidently belonging to the preceding depression that was running off over China.

The barometer at Pakhoi and Hoihow did not begin to fall before the afternoon of the 29th. The direction of the wind was at the end of the Gulf of Tonquin NE., North of Hainan SE. On the 28th and 29th, the observer on board the *Magpie* (Hoihow) noticed a great deal of Cirri whose direction varied from SE. to S., a sure indication of the centre of the whirlwind lying in that direction. Flashes of lightning at intervals in the North-West.

The progress of the Typhoon from the 30th is clearly enough set out in the following extracts from several reports:

Pakhoi (latit. 21°.29′ longit. 109°.6′): Chinese Steamer *Fung-feng* — "May 30th 31st blew hard from N. and NE. with heavy squalls of cold rain and occasional flashes of lightning to the East: barometer ranging between 29.85 and 30.00. — On the evening of the 30th the weather looked so bad that I moved to a more secure anchorage under the lee of the Sandbank North of Pakhoi. — Afternoon of the 31st moderated and the weather looked fine. — June 1st, fine...."

Hoihow (latit. 20° 3′ — longit. 110° 20′): H.M.S. *Magpie*.

Date	Hours.	Wind	Barometer	Temp.	Humidity	Nebulosity	Swell	Remarks
			in	°				
30th May	Midnight	SE 2	29.868	82.0	87	2 Cirri S	,,	Lightning to NWd.
	2 A. M.	SE 1	.875					
	4	SE 1	.873	80.0	93	3 Cum.-Cirri.	,,	3.10 a.m. — Lightning ceased.
	6	SE 1	.831					
	8	SE 2	.824	82.5	83	5 Cum.-ster.	,,	
	10	SE 2	834					
	Noon	SE 2-3	.798	81.7	89	6 Cum.-ster.	,,	12.10 — A small shower lasting a few minutes.
	2 P. M.	SSW 2-3	.739					1.10 — Dark nimbi forming to the SWd. gradually extending round to Nd. and Wd. — 1. 45 — a heavy shower with thunder and lightning; wind shifted to SSW.
	4	SSW 2-3	.745	79.8	87	8 Str.	,,	
	6	SSW 2	.750					
	8	SSE 1	.765	79.8	91	10 Str.	,,	3.30 — Rain ceased and nimbi passed away to the Eastd.
	10	SSE 1	.777					7.45 — Wind backed to SSE.
31st May	Midnight	SE 1	.781	79.0	91	10 Str.	,,	A few passing showers between 2 and 4 a.m.
	2 A. M.	calm	.727					5 a.m. — A drizzling rain set in, increasing to steady rain
	4	calm	.727	78.8	90	10 Str.	,,	7.45 — A light breeze sprung up from WSW [6.30.
	6	calm	.733					8.10 — Rain fall on last 24 hours 1. 26 inches.
	8	WSW 1	.747	80.0	91	10 Nimbi	,,	8.50 — Wind shifted suddenly to NNE and freshened rapidly A swell coming up at same time.
	10	NNE 3	.752					
	Noon	NNE 3-4	.749	77.0	87	10 Str.	NNE 2	p.m. — Squall all the afternoon.
	2 P. M.	NNE 3-4	.738					
	4	NE by N 3-4	.714	76.5	88	10 Str.	NNE 2	
	6	NNE 3-4	.724					
	8	NNE 2-3	.724	77.2	86	10 Nimbi	NNE 2	
	10	NNE 1	.778					10.30 — Wind veered to E by S.
1st June	Midnight	E by S 1	.775	77.0	91	10 Str.	NNE 2	10.45 — Drizzle ceased.

Macao (latit. 22° 11′ — longit. 113° 34′): Harbour Master's Office.

Date	Hours	Barometer	Wind	Nebulosity	Remarks
		in			
30th May	9 A. M.	29.842	N 1	Alto-cumuli	
	Noon	.821	E 4	id	
	3 P. M.	.803	N 5	id	
	4	.777	N 5	Cumulo-nimbi	
	5	.777	N 5	id	Lightning
	6	.785	NNW 5	id	id
	9	.809	NNW 5	Nimbi—cum-ni.	id — rain
31st May	3 A. M.	.770	NNW 5	id	Heavy rain
	6	.780	NNW 5	id	Rain
	9	.792	N 5	id	Rain
	Noon	.797	N 5	id	Heavy rain
	3 P. M.	.717	E 4	Cumulo-nimbi	Blue sky — clouds
1st June	9 A. M.	.788	N 4	Alto-cum.	id id
	Noon	.796	N 3	Alt.-c. — strati	id id
	3 P. M.	.756	N 3	id	

At Cepe d'Aguilar (height 170 feet), on the 31st Wind: 9 a.m. N. 8 — Noon: N. 6 — 3 p.m. ENE. 4.

Swatow (latit. 23° 20′ — longit. 116° 43′): Harbour Master's Office.

Date	Hours	Barometer	Wind	Nebulosity	Rain	Remarks
		in			in	
30th May	Midnt.	29.89	NE 3	Ni		
	4 A. M.	.89	NE 3			
	9	.93	NE 2	Ni NE		*Noon*: temperature 68°
	Noon	.92	NE 1			
	3 P. M.	.88	NE 1	Ni	0.60	9 hours of Rain
	8	.90	E 2			
31st May	Midnt.	.91	E 2	Ni		
	4 A. M.	.91	SE 1			
	9	.85	NE 1	Ni E		
	Noon	.88	NE 1			Noon: temperature 68°
	3 P. M.	.87	NE 1	Ni	0.75	13 hours of Rain
	8	.78	NE 2	C		
1st June	Midnt.	.78	NE 2	C		
	4 A. M.	.88	NE 1			
	9	.83	NE 1	Blue sky		
	Noon	.85	E 1	id		Noon: temperature 71°
	3 P. M.	.83	E 1			
	8	.83	NE 2	id		
2d June	Midnt.	.88	NE 1			

Tai-wan-fou (Formosa) (latit. 22.59′ — longit. 120.13′): Harbour Master's Office.

Date	Hours	Barometer	Wind	Rain	Remarks
		in		in	
30th May	8 A. M.	29.858	NE		Fine weather — swell on bar.
	4 P. M.	.773	N		
	8	.776	N		
31st May	8 A. M.	.791	NNW		Cloudy and rainy weather all day, swell on bar, wind
	4 P. M.	.767	NNW		fresh from N a.m., NNW. p.m. strong with rain squalls.
	8	.759	NNW	0.90	
1st June	8 A. M.	.765	NNW		Cloudy weather with rain at intervals all day.—Wind
	4 P. M.	.763	N		NNW. to N. fresh breeze, moderate swell on bar.
	8	.772	calm		
2d June	8 A. M.	.816	WNW	1.21	Clear weather.

At Manila the barometer stood at $29^{in}.893$, on May 20th, 8 a.m.; on the 31st, 4 p.m., it had fallen to $29^{in}.705$, to rise again. All that time the wind was very feeble and had no connection with the whirlwind: there was nothing more than the regular alternation of the land breeze (NE.) in the morning and of the sea-breeze (SW.) after noon. But the constant direction E. to W. of the clouds, even in the lower regions, sufficiently proved the existence of a Centre of depression west of Luzon, towards which the air was called in.

Thus, on May 28th, the *Elgin Typhoon* certainly reached the coast of Cochinchina. On the 29th a centre of depression took to return towards the Sea in the opposite direction; it rose somewhat to the North in the direction of Formosa and vanished on the open sea in the evening of the 31st.

Velocity — Diameter — Gradient.

Velocity — From the 22d to the 24th of May, the mean velocity of the *Elgin Typhoon* along the eastern coasts of the Philippinas Archipelago seems to have been 4 to 5 miles an hour. Between the 24th and the 28th, across the China Sea, it increased to an average of 13.5 miles. After the 28th, we have no data to estimate the velocity.

Diameter — The Typhoon, at the time its central region passed near the town of Manila, seems not to have exceeded 172 miles in its greatest diameter from North to South. As for the region of calm and of barometric minimum, it must have been about 18 to 20 miles in diameter; for, according to trustworthy observations made on board she sloop of war *Doña Maria de Molina*, the Centre pased over S. de Cavite, 9 miles from Manila which itself was on the limit of this central calm. The inconsiderable size of the *Elgin Typhoon* off Hainan, at least from S. to N., has already been mentioned.

Gradient — The inconsiderableness of the central depression in this Typhoon is truly surprising. It is probably due to the influence of the mountains of Luzon which thwarted its development and progress. At Manila the barometer only sank $^{in}.34$ (down to $29^{in}.52$); but at sea the depression must have been greater, thanks to the absence of obstacles and to the abundant formation of vapour which hereafter fell in the shape of diluvial rains. Thus on board the *Elgin*, though she did not pass through the Centre, the barometer sank to $29^{in}.21$, and it may well be supposed that right at the Centre the atmospheric pressure did not exceed $29^{in}.00$.

Over Luzon, the amount of depression was only $^{in}.53$ for 100 nautical miles, very small indeed.

At sea, on the 28th midnight, the Centre where the barometer must probably have marked $29^{in}.00$, was about 240 miles South of the *Magpie* (Hoihow — Hainan), whose barometer then stood at $29^{in}.81$ with a slight tendency to rise. The depression did not then exceed $^{in}.35$ per 100 miles, that is even less than at Luzon. It is true that at that moment the masses of air which the whirlwind tended to throw upon the continent were

already being forced back: the central depression, far from increasing, was getting filled up and vanishing.

A last remark on the *indications of a storm coming on.*

The detailed observations reported by the Observatory of Manila; the facts carefully observed by Lieutenant H. Belam R.N. on board the *Magpie* and my own exprience warrant me in taking the following phenomenon as an almost certain forerunner of a storm.

Generally speaking, in these Chinese seas, especially in the southern regions, as also for the West - India hurricanes, the situation of the Centre of the storm is pretty well indicated by the disposition of the clouds. Whenever the storm is getting nearer or farther, the mass of clouds within the whirlwind is to be seen in the shape of an arc of circle more or less developed whose summit lies upon the line drawn from the Centre to the observer. During the passage of the *Anticyclone* (1) and after that of the storm, there appear Cirri usually feathery, on the edges of that bar of clouds whose motion drives them away from the Centre of depression. Often those Cirri clouds are scattered over the sky, gradually forming a mass of stratus, the apex of which turns towards the point from which the first blow will come. Thus the phenomena are the same for the anticyclone and for the cyclone; but clouds in the former are Cirri in the highest regions of the air with their apex turned towards the Centre and in the latter they are lower Cumuli or Nimbi with their apex turned towards the Observer in the very direction of the Centre.

In the present Typhoon at Manila, the cyclonic phenomenon, less distinct during the first period while the Centre was in the East, became very interesting during the second, the storm raging on the China Sea. The bar of Nimbi formed a well defined arc, the apex of which bore W by N. and when about to disappear, formed gorgeous Cirro-strati which converged to the same point of the horizon.

---

(1) Meteorologists give the name of *Anticyclone* to a system of facts, gyration of the wind, barometric pressure, humidity of the air and temperature the very opposite of what is usually observed during the passage of a cyclone or storm: the wind turns from left to right (N-E-S-W.), the barometer rises, the temperature sinks, the humidity increases as the centre of an anticyclone is drawn nearer to. Hence the conception of an inverse circular whirlwind accompanying the main whirlwind as a forerunner, and the anticyclone is classed among atmospheric phenomena by the side of the Cyclone as a satellite wheel revolving in gear with a moving main wheel. This conception is clearly nothing but fancy. In every well defined Cyclone the special phenomena of the Anticyclone may usually be observed on the outer limit of the whirlwind which progresses alone, without any satellite, at least of a different species from itself. An Anticyclone may exist by itself: it is then mostly stationary, being in fact nothing more than a circumscribed area of high atmospheric pressure. Those stationary Anticyclones are sometimes remarkable for the very low temperature they bring about in very small areas, as for instance the Anticyclone of December 1879 during which there was such severe cold in Paris.

Second Typhoon: June 27th — July 2d.

TRACK :

Date			Latitude N.	Longitude E.
26th June	Midn.	SE. coast of Luzon	11. 30' ?	126. 0' ?
	Noon		12. 15 ?	125. 25 ?
27th ,,	Midn.		13. 15	124. 30
	Noon		13. 60	123. 45
28th ,,	Midn.	Luzon Manila	14. 25	122. 55
	Noon		14. 40	122. 0
29th ,,	Midn.		15. 0	120. 30
	Noon		15. 35	119. 30
30th ,,	Midn.	China Sea	17. 00	113. 30
	Noon		18. 15	118. 0
1st July	Midn.		19. 45	117. 20
	Noon		21. 0	117. 0
2d ,,	Midn.		22. 30	116. 30
	Noon		23. 45	116. 15
3d ,,	Midn.		25. 15	116. 0
	Noon	Swatow Fokien	26. 15	116. 30
4th ,,	Midn.		27. 0	117. 15
	Noon		27. 30	118. 45
5th ,,	Midn.		27. 45	120. 0
	Noon		27. 45	121. 15
6th ,,	Midn.	Back to Sea	27. 30 ?	122. 30 ?
	Noon		28. 0 ?	122. 30 ?

EVENTS :

Great violence at Manila: squalls 90 miles — lowest reading of the barometer 29in 50 on the 28th, 7h. 35m p.m. — Winds: NNE., NNW., W., SSW., ESE.

Great violence at Swatow: wind force 11 — lowest reading of the barometer 29in 24 on the 2d July, 8 a.m. — Winds: E., NE., E., SE. S. — It did considerable damage to property.

A Telegram from Manila to Hongkong.

A Telegram sent from Manila to Hongkong on June 29th 11h. 10m a.m. was unaccountably belated and was not received before July 2d: it gave notice of a violent Typhoon having passed over Manila the day before and of its running towards the West-north-west.

The course indicated was wrong. But on considering the true track of the Typhoon and particularly its situation on July 2d, when the telegram was received, one may well wonder at the levity of the Hongkong paper *China Mail* in commenting upon it: "The weather here is anything but typhoonish in its character. In the first place, the wind is blowing free from the SW." — what is to be paid particular attention to is not what wind is blowing, but how it gradually varies. — "Then there have been heavy falls of rain, and thunder has been heard frequently and loudly the whole day long. No typhoon gun has been fired" — a most reliable indication indeed! — "Those interested in the shipping at the present moment in harbour do not appear to have paid much attention to the warning, as no such precautions appear to have been taken as are readily enough made when there is any reason to believe that there is a storm of any moment brewing (!). We may have a *big blow* to-night or to-morrow, another *swish of the tail of a Typhoon*, as these occurrence have with more force than elegance come to be called, but that we are on the eve of any great disturbance of the elements is not at all within the calculations of those best versed in such matters (? !). The glass is low, but steady 29in 70, which is not at all a threatening reading taken by itself." — An error again, for on the preceding days the barometer was high but sinking and a variation of 0in 27 in three days with the wind by turns from ENE., NE., N., NW., W. and SW. with a force between 5 and 7 was a clear indication of the approach, pas-

sage and moving away of a not inconsiderable depression. There was no attention paid to it.

In fact the Typhoon passed very close to Hongkong, precisely on the morning of that day July 2d.

Before the Typhoon.

I have not received from Philippinas any other document than the observations made at Manila during the passage of the Typhoon, to enable me to determine in what atmospheric conditions it was formed on June 25th and 26th to the North of Mindanao in pretty much the same region as the preceding Typhoon; but the observations made in China allow us at least to inquire for the cause of its direction being so different from that of the Typhoon of May 24th-28th. The former Typhoon seems to have been indraughted towards an area of low pressure that obtained at that moment on the China Sea and the great neighbouring Peninsula. The latter obeyed to a similar call and proceeding NW. made for the interior of China, where during the last fortnight of June we find a low pressure together with a high temperature.

In fact, if barometric observations on the coast of China, at Hongkong, Swatow, Zi-ka-wei, Chefoo are compared with those made at a distance from the sea, as at Hankow (420 miles west of Shanghai) and Chang-kia-chwang (SE. Chilih, 100 miles south of Pekin), it appears that there was an area of minimum pressure extending over the centre of China and northwardly. As an illustration of the fact, we give the mean barometric height (reduced to sea level) at 1h. p.m. all through June, also the mean temperature at the same hour and the amount of rainfall.

	Barometer	Temper.	Rainfall
	in	°	in
Nagazaki (Japan)	29.85	78.7	21.69
Hongkong (China)	29.84	83.8	7.55
Swatow	29.85	83.0	3.72
Zi-ka-wei	29.80	80.4	6.72
Hankow	29.69	81.5	8.12
Chang-kia-chwang	29.67	88.0	5.31

The deficiency of pressure in the interior had to be partly made up, and it must be from the South where it was maximum. The movement of the air seems to have commenced about June 12th or 13th; the wind, at Hongkong, till then from E. or NE. turns to S. and SW. and gets fresher. At the same time the barometer rises and keeps pretty high till the 27th. From the 25th the Easterly winds had taken the upper hand again to go on turning to NE. and NNE., whilst on the top of the Victoria Peak (1823 feet) it still blew from SE., a manifest indication of a centre of depression just then forming far away in the South or South-east: above, the air has a tendency to fly from this Centre; below, it tends to get to it. Now the immediate cause of the Typhoon passing precisely between Hongkong and Swatow seeems to be nothing else than that it is the shortest and most direct way from Manila towards the centre of the area of minimum pressure. That centre must have been somewhere North of Hankow, for at Hankow the lowest reading of the barometer was 29^{in}.39 on the 30th June and 1st July, the mercury rising afterwards. Just at the same time (30th June in the afternoon) there was a barometric minimum 29^{in}.46 at Chang-kia-chwang situated on the line drawn from Manila through Hankow. At that date also we had, at Zi-ka-wei, East of Hankow, the glass at 29^{in}.65 and all the western side of the sky was all the day overspread with Cirri running N. and NNE., whilst the lower Cumuli were bearing from SSE. to NNW; there was then at that moment in central China an area of minimum pressure, a sort of aspiration focus calling in the air from the surrounding regions, chiefly from the South-east where the pressure seemed to be highest. The Typhoon then naturally selected this route and it rushed into it after swerving aside to clear the high mountains of Luzon.

The Typhoon in the Archipelago.

Observatory of the Ateneo municipal at Manila (Philippinas Islands).

DIRECTOR: R.F. FAURA S.J.

Date	Hours	Barometer	Winds Direct.	Winds Veloc.	Temp. of the air	Humidity %	Tens. of vap.	Clouds Upper	Clouds Lower	Rain	Remarks
		in		miles	°					inc.	
June 27th	Noon	29.86	calm		86.4	71	0.886	K—Br C 8	ENE		A curtain of Cirri overspreading the whole sky.
	1 P. M.	.86	NE	1.1	86.4	71	.886	,, Cn 9	E		A few Nimbi from the East.
	2	.84	N	3 7	83.8	80	.922	,, Ni 9	E		id id
	3	.82	NNE	4.4	82.4	79	.890	,, Ni 10	E	0.039	id id
	4	.80	NE	3.3	81,7	81	.890	,, Ni 10	E		id id
	5	.79	NNE	2.2	82.4	78	.859	,, Cn 9	E		
	6	.82	N	2 2	82.9	79	.930	,, Cn 9	E		At Sunset clouds of a light pink colour.
	7	.87	NNE	2.2	82.0	81	.882	,, Cn 9	E		
	8	.85	NNE	1.1	81.5	85	.910	,, Ni 10	E		
	9	.87	calm		79.5	88	.882	,, Ni 10	ENE	0.039	
	10	.86	NNE	1.8	79.9	85	.862	,, Ni 10	NE		
	11	.84	NNE	2.6	79.5	88	.890	,, Ni 10			
June 28th	Midn.	.83	NNE	2.0	79.5	91	.914	,, Ni 10			
	1 A. M.	.80	N	4.4	79.5	91	.914	,, Ni 10			
	2	.78	N by E	4.8	78.6	94	.914	,, Ni 10			
	3	.77	N by E	4.8	78.4	93	.901	,, Ni 10			
	4	.79	NNE	5.1	78.4	89	.859	,, Ni 10			
	5	.80	NNE	6.2	77.7	89	.849	,, Ni 10	NNE		
	6	.81	NNW	8 8	76.8	92	.851	,, Ni 10	NNE	0.398	Sky to the East all dark and lowering.
	7	.80	N	8.4	77.4	90	.843	,, Ni 9	NNE		Curtain of Cirri still remaining — Nimbi
	8	.80	NNW	11.0	77.4	93	.866	,, Ni 9	NNE		running very rapidly from N. to S.
	9	.79	NNW	15.4	79.2	92	.910	,, Ni 10	N	0.047	
	10	.78	N	8.8	78.8	93	.910	,, Ni 10	N		The horizon to the NE. getting darker and
	11	.76	N	7.3	78.6	93	.910	,, Ni 10	N		Barom. normal daily oscillation suppressed.
	Noon	.74	NNW	3.3	77.7	90	.851	,, Ni 10	N	0.295	Sky getting overcast to the NW. — Nimbi
	1 P. M.	.73	NNW	17.6	78.1	95	.910	,, Ni 10	N		more compact and lying closer.
	2	.71	N	17.6	78.1	92	.878	,,			
	3	.68	NNW	22.0	77.4	92	.862	,, Ni 10		0.922	Sky entirely overcast.
	4	.67	NW	44.0	77.0	92	.855	,, Ni 10	NNW		Nimbi leaning somewhat to the W.
	5	.63	NW	43.2	75.6	99	.874	,,			Nimbi running from NW. to SE.
	6	57	WNW	52.8	75.4	100	.882	,, Ni 10	NW	0.997	
	7	.51	W by N	61.6	75.4	100	.882	,,			
	7. 30	.50	W by N	67.1	75.4	100	.882	,, Ni 10	WNW		
	8	.51	WSW	63,8	75.4	100	.882	,,			
	9	.53	WSW	88.7	75.4	100	.882	,, Ni 10	W by S	2.048	
	10	.61	SW	72.6	75.4	100	.882	,, Ni 10	WSW		
	11	.68	SSW	66.0	75.4	100	.882	,, Ni 10	SW		
June 29th	Midn.	.79	SW	57.2	75.4	100	.882	,, Ni 10	SW		
	1 A. M.	.71	SSW	50.6	75.4	100	.882	,,			Loose Cumuli clouds running from SW. to
	2	.73	S	23.1	75.4	100	.882	,, Ni 10	SSW		NE.
	3	.74	S	19.8	75.4	100	.882	,, Ni 10	SW		
	4	.76	S	16.5	75.6	91	.803	,,			
	5	.76	ESE	7.7	76.3	87	.787	,, Ni 10	SSW		id id id from SSW. to NNE.
	6	.79	SE	7.9	75.9	88	.787	,,		3.978	
	7	.81	ESE	10.1	75.6	90	.791	,, Ni 10			
	8	.82	ESE	8.8	76.1	87	.783	,,			
	9	.82	ESE	7.3	76.3	86	.779	,, Ni 10		0.315	
	10	.83	ESE	6.6	76.3	87	.787	,,			
	11	.83	SSE	6.2	76.1	87	.783	,, Ni 10			
	Noon	.82	ESE	3.7	76.1	87	.783	,, Ni 10	SSW	0.512	
	1 P. M.	.80	ESE	5.5	77.4	87	.811	,,			
	2	.78	S	5.9	78.8	77	.752	,, Ni 10			

The preceding Typhoon gave us occasion to point out how the winds were much more convergent towards the Centre at the surface of the earth than at a comparatively small height, such as that of the Cumuli and Nimbi. In the afternoon of the 27th the fact was evident: down below, wind NNE. and N., consequently bearing almost straight towards the Centre; above, Cumuli and Nimbi coming from the E., borne away by a slightly divergent wind. — On the 28th, wind in the morning NNE. and NNW. below, NE. and NNE. above, the Typhoon lying to the East-south-east; in the afternoon, the wind having reached its maximum of force, its convergence diminished and its direction got nearer to that of the clouds that were running perpendicular to the direction of the Centre of the whirlwind.

After the passage of the Storm, just in the first hours of the 29th, the wind was between SW. and S. and soon settled ESE. whilst the lower clouds continued to run from SSW. to NNE. Both directions of wind and

clouds were nearly converging to the Centre. These facts must be noted down as of great import.

The course of the Typhoon is well set out by the Manila Observations, particularly by the direction of the lower clouds. After coming from the region of Mindanao, it rose along the eastern coast of the islands to the latitude of Manila. On the 28th, 8h. a.m., it lay to the East of that town and turned aside from its original track to cross Luzon at that point where the ground consisting of numerous deep gulphs and large lagoons cut by narrow isthmuses connecting the southern with the northern provinces, is such as to facilitate the passage of storms from one sea to the other. It is clear in this case that the high mountain chain that runs along the eastern coast of Luzon repelled the whirlwind though its first direction would have led it to the same place of the eastern coast of China, and it is the accumulation of the mass of air of the foremost portion against that obstacle that caused the comparatively high atmospheric pressure ($29^{in}.50$.) observed at Manila on the passage of the Centre (June 28th, 7h. 30^{m}. p.m.). Before the passage, with the wind blowing from NE. and NNW., there was but little rain; after the passage, the wind blew from SSW. and S. and there was a heavy rainfall (6 inches during the night of the 28th-29th). This is easily accounted for : the polar winds on passing over the high mountains, to the north of Manila, were almost entirely deprived of moisture, whilst on the equatorial winds being forced up against the sides of the same mountains there must have been a considerable condensation and consequently a diluvial rain on the southern side of the chain.

The Typhoon on the coast of China.

I have abready explained the probable cause for which the Typhoon, on leaving Luzon, took to running to the North-West towards China instead of following to the west a track already marked out by its forerunner of the preceding month and by so many before. On July 1st, about midnight, it crossed the 20th parallel by 117° longitude, and passing to the right of Hongkong came to penetrate into the continent a few miles below Swatow, about 8h a.m. on the 2^{d} of July.

Whilst the Typhoon was running NWdly over the China Sea, the wind blew feeble from E. on the northern coast of Hainan island, at Hoihow were H. M. S. *Magpie* was anchored. Two barometric minima were observed, viz. on June 30th 4 p.m. ($29.^{in}614$) and on July 1st 4 p.m. ($29^{in}.608$). At the time of the first minimum there began a gentle swell from the E. that lasted till about the beginning of the next day. The Centre of the Typhoon lay at a distance of upwards of 400 miles to the East. The sky had been strewn with Cirri since June 27th. On July 1st, their bearing was between NE. and E., that is divergent.

In the run from Manila to Swatow, there was no casualty at sea worth noticing. We shall then take the Typhoon on its reaching the continent and seek to follow its trace.

Swatow

Meteorological observations taken at the Harbour Master's Office

HARBOUR MASTER: W. RAE

Date	Hours	Barometer	Wind		Temper	Humidity. %	Clouds	Rain	Weather and Remarks
		in						in.	
June 29th	Midnight	29.63	Calm						
	4 A. M.	.63	Calm				O. C		Weather very close and sultry, very appressive wind. Clouds coming very fast from the Northward.
	9	.82	E	1	85	82	B		
	Noon	.80	E	1	85	82	B		
	3 P. M.	.81	E	1			B		
	8	.77	Calm				B		Barometer falling gradually, wind increasing.
June 30th	Midnight	.71	Calm				B		
	4 A. M.	.71	Calm				B		
	9	.81	NE	1	83	79	B		
	Noon	.75	SE	1	86	68	B		
	3 P. M.	.77	SE	1			B		
	8	.75	W	1			B		
July 1st	Midnight	.69	Calm				B		
	4 A. M.	.68	Calm				B		Weather very close and sultry, very oppressive wind. Clouds coming fast from Northward.
	9	.68	SE	1	84	83	B		
	Noon	.67	ESE	4	83	83	O C		
	3 P. M.	.66	E	4			O. C		Barometer falling gradually, wind increasing to a gale with heavy rain and seas.
	8	.68	NE	5			Rain		
July 2d	Midnight	.62	NE	7			Rain		
	2 A. M.	.54	NE	8			Rain		
	3	.52	E	8			Rain		
	4	.46	E	9			Rain		
	5	.45	E	9			Rain		
	6	.42	E by S	10			Rain		
	7	.36	SE	11			Rain		
	8	.34	S	11			Rain		
	9	.49	SSE	10	79	91	Rain		
	10	.50	S	9			Rain		
	11	.52	S	9			Rain		
	Noon	.53	S	8	79	82	Rain		
	3 P. M.	.55	S by W	4			Squally	2.400	
July 3d	8	.70	S	2			Squally		Fine clear weather; stars all out : no clouds over head.
	Midnight	.76	S	2			Squally		
	4 A. M.	.76	S	1			O. C		
	9	.79	S	1	84	83	B		
	Noon	.80	S	1	85	79	B		
	3 P. M.	.79	S	1			B		
July 4th	8	.87	S	1			B		
	Midnight	.88	S	1			B		

This gale did a considerable damage to property in Swatow. The tide rising 3 feet above the usual level; the settlement being completely flooded about 2 hours, from 8 a.m. to 10 a.m, on the 2d.

Instead of going on in the same direction, the atmospheric depression seemed about to fill up after it had once reached the continent. Ahead of it, at Hankow, on the Yang-tze-kiang, there fell no rain whatever and the barometer was on the rise, though but slowly at first, since June 30th. But to the right hand of the track, there were heavy rains at Foochow, at Ningpo, at Zi-ka-wei and at sea on the 3d and still more on the 4th. These condensations in the eastern part of the whirlwind seem to have greatly influenced its direction. The inequalities of the ground, by diminishing the velocity and the convergence of the winds, tended to destroy the whirlwind which also, with the vapour of water, had lost the best support of its energy. To the East, on the contrary, over the sea, it had with a low barometric pressure (Nagazaki, July 5th, afternoon, $29^{in}.609$) all the most favourable conditions for preservation and development.

It then naturally ran to those parts : after remaining on the Chinese continent the 2nd, 3d, 4th and 5th of July, it took to sea again between Foochow and Ningpo, about 28° latit. Except at sea, where notwithstanding the great distance of the Centre, the S. and SW. winds continued to blow rather hard (1), all along the coast,

(1) Report of Capt. Th. Shaw of SS. *Hoihow*, from Chingkiang to Canton . Wind S. 5, on the 4th, noon, latit. 29°. 20′ — SW. 5, on the 5th, midn. — SW. 6, at noon on the same day, latit. 27°. 4′.

at Zi-ka-wei, Ningpo, Foochow, Swatow, the winds both Easterly in the North and SW. or S. in the South, kept blowing feebly until the Typhoon had left the continent.

The following observations made at Hankow by Mr. N. Titoushkin show that the Typhoon must have altered its course or have vanished somewhere between Swatow and Hankow, for there is no indication of its having passed near Hankow.

Hankow

Latit. 30° 34′ — Longit. 114° 20′

Date	Hours	Barometer	Thermom.	Wind	Nebulosity	Rain
		in	°			
July 1st	7 A. M.	29.47	86.5	SSE	6 Ac	,,
	7.45 P. M.	.43	86.7	SE	10	,,
,, 2d	7 A. M.	.50	88.2	ESE	4 Ac	,,
	7.45 P. M.	.56	81.0	NE	5	,,
,, 3d	7 A. M.	.62	80.7	E	6 Cn	,,
	7.45 P. M.	.53	85.0	E	9	,,
,, 4th	7 A. M.	.62	82.5	WNW	10 St	,,
	7.45 P. M.	.54	84 0	calm	10	,,
,, 5th	7 A. M.	.61	78.7	calm	10 Ni	,,
	7.45 P. M.	.60	75.0	calm	10	0.06

The barometric readings are reduced to sea level.

The return of the Typhoon to sea shortly after passing over Swatow and alighting on the continent may easily be made out in the following documents, though the original energy and fury of the storm had entirely disappeared.

2 Stations to the South of the track.

Foochow

Latit. 26° 8′ — Longit. 119° 38′

Date	Hours	Barometer	Wind	Rain
		in		
July 2d	9 A. M.	29.723	SW 2	,,
	3 P. M.	.716	SW 3	
,, 3d	9 A. M.	.789	SW 2	0.70
	3 P. M.	.755	SW 2	
,, 4th	9 A. M.	.799	SW 2	,,
	3 P. M.	.716	SW 2	
,, 5th	9 A. M.	.705	SW 2	,,
	3 P. M.	.610	SW 2	
,, 6th	9 A. M.	.643	SW 1	,,
	3 P. M.	.571	SW 3	
,, 7th	5 A. M.	.807	NE 4	0.18
	3 P. M.	.801	NE 3	
,, 8th	9 A. M.	.877	SW 1	,,
	3 P. M.	.817	NE 2	

Tamsui (Formosa)

Latit. 25° 10′ — Longit. 121° 25′

Date	Hours	Barometer	Wind	Rain
		in		
July 4th	7 A. M.	29.831	SE 2	nil
	1 P. M.	.773	W 4	
	7 ,, ,,	.756	SE 1	,,
,, 5th	7 A. M.	.746	SE 2	
	1 P. M.	.691	SW 4	,,
	7 ,, ,,	.684	SE 1	
,, 6th	7 A. M.	.697	SE 3	,,
	1 P. M.	.651	SW 4	
	7 ,, ,,	.743	SE 1	,,
,, 7th	7 A. M.	.786	calm	
	1 P. M.	.753	N 4	,,
	7 ,, ,,	.773	calm	
,, 8th	7 A. M.	.826	SE 2	,,
	1 P. M.	.805	NW 3	
	7 ,, ,,	.768	SE 7	,,

2 Stations to the North of the track

Ningpo

Latit. 29° 52′ — Longit. 121° '

Date	Hours	Barom.	Wind	Rain
July 4th	4 A. M.	29.84	W 1	
	8	.86	S 1	
	4 P. M.	.78	Calm	Rain
	8	.84	N 1	
,, 5th	4 A. M.	.84	N 1	Rain
	8	.84	E 1	Rain
	4 P. M.	.76	E 2	Rain
	8	.76	S 1	Rain
,, 6th	4 A. M.	.68	Calm	
	8	.76	E 1	Rain
	4 P. M.	.77	NW 1	Rain
	8	.82	Calm	
,, 7th	4 A. M.	.88	Calm	
	8	.94	W 1	
	4 P. M.	.96	Calm	
	8	.98	NW 1	

North Saddle lighthouse

Latit. 30° 50′ — Longit. 122° 41′

Date	Honrs	Barom.	Wind	Rain
July 4th	3 A. M.	29.68	S 2	
	9	.70	N 2	
	3 P. M.	.63	NE 4	Rain
	9	.66	NE 4	
,, 5th	3 A. M.	.66	N 3	
	9	.68	NE 3	
	3 P. M.	.65	SE 3	
	9	.63	S 2	
,, 6th	3 A M.	.55	SE 2	
	9	.60	S 1	
	3 P. M.	.60	W 2	
	9	.69	SW 1	
,, 7th	3 A. M.	.75	NW 3	
	9	.85	N 3	
	3 P. M.	.89	NE 2	
	9	.92	ENE 2	

Zi-ka-wei Observatory

Latitude 31°. 12′ — Longitude 121°. 26′

Date	Hours	Barom.	Ther.	Wind		Nebulosity					Rain
			°		miles						
July 4th	4 A. M.	29.716	77.4	NNE	2.74	10	br				
	10	.729	75.7	ENE	11.20	10	Ni	ENE			0.54
	4 P. M.	.715	72.1	ENE	13.40	10	Ni				0.79
	10	.771	71.4	NE	1.00	10	Ni				0.05
,, 5th	4 A. M.	.707	70 9	N	1.06	10	Ac	W			,,
	10	.713	80.6	SE	7.92	8	K	W	C	E	,,
	4 P. M.	.668	78.3	SE	10.60	10	Ac		C		,,
	10	.677	74.3	SSE	4.00	10	Ac				,,
,, 6th	4 A. M.	.594	74.1	E	0.61	10	Ac	W			,,
	10	.654	80.6	NW	2.74	10	Ac	W	Cn	NE	,,
	4 P. M.	.632	84.4	NNW	7.90	10	Ks		C		,,
	10	.739	73.9	NNE	3.20	10	Ac	W			,,
,, 7th	4 A. M.	.820	70.5	NW	2.45	10	Ac	WSW			,,
	10	.910	80.6	NNE	2.34	10	Ac	WSW			,,
	4 P. M.	.910	79 9	E	8.70	8	Ac	WSW	C		,,
	10	.954	69.3	ESE	0.82	4	ks	W			,,

The winds from SW. and SE. to the South of the track have then been more regular and stronger than the winds from N. and E. to the North of it. On both sides the convergence is marked, often even perfect. Leaving aside North-Saddle for the present, we find that the barometer was altogether lower at the stations marked as being South of the track than at those to the North; moreover at the northern stations the barometer rose rapidly after the minimum of the morning of July 6th, whilst at Foochow and Tamsui the minimum took place a few hours later and the rise of the mercury was slow. It appears then that the Centre of the depression (it can no more be called a Typhoon) returned to sea between Foochow and Ningpo or rather between 27° and 28° latit. and vanished in the ESE. or in the SE. For there was no indication of it in Japan beyond the high pressures (Nagazaki 30^{in}074 on the 9th) which followed the depression observed in that region on the 5th.

As for the observations made at the North-Saddle Light-House (height 273 feet) the comparatively low reading of the barometer seems to indicate that the whirlwind maintained itself better in the middle regions of the atmosphere than in the lower strata; it is probable that the decrease in the density or in the pressure of the layers of air varied rapidly with the height. Unfortunately no observations of the temperature of the air at the height of the Light-house have been made and there is no means of comparing it with the temperature at sea level, at Zi-ka-wei.

Diameter — Velocity — Gradient.

Like all its fellows, this Typhon was remarkable by its small size, at least between the limits of the Storm proper. As for the atmospheric depression, it is difficult to say how far it may commonly extend and be still appreciable. The Typhoon passed Manila between June 28th 8 a.m. and the 29th 10 a.m., with a speed that must not have exceeded 4 or 5 miles : the diameter from East to West had therefore a length of about 120 miles.

It left Luzon in the morning of June 29th, and reached Swatow on July 2d 8 a.m., having gone over about 510 miles in 72 hours, corresponding to a mean velocity of 7 miles an hour. It afterwards took 24 or 26 hours to pass over Swatow with a speed that can be estimated at about 10 miles : hence it would appear that in its run over the sea it had taken a considerable development, provided however that at Luzon its diameter from North to South did not exceed the East-West diameter, which is highly probable.

During the passage of the Typhoon over Luzon there may be considered distinct slopes of the atmospheric depression or two gradients on either side of the barometric minimum. The centre passed Manila on the 28th

between 7h and 8h p.m. On that same day the barometer read, at 9 a.m., 29^{in}.79. and at 4 p.m. 29^{in}.67 : the corresponding gradient was 0.38 per 100 miles. From 4 p.m. to 7.30 p.m. (29^{in}.50) it was 1.08 per 100 miles. After the passage of the Centre, from 7.30 p.m. to midnight (29^{in}.70) the gradient reached a maximum of 1.78 per 100 miles. Lastly on the 29th, from midnight to 10.30 a.m. (29^{in}.84) it can be estimated at only 0.27 per 100 miles.

The barometric variation at Swatow was uncommon. The barometer stood at its maximum (29^{in}.82) on the 29th about 10h a.m.; it afterwards sank but very slowly till July 1st 8h p.m. (29^{in}.68). This already seemed to indicate beforehand that the whirlwind, drawn towards that side, would not extend very far. The storm began that day about noon with ESE. and E. wind force 4, but the barometer did not begin to fall before 8h p.m. (29^{in}.68). In 11 $^1/_2$ hours it fell ^{in}.35 (on the 2nd, 7h.30^m a.m. 29^{in}.33). The distance run over during that interval of time was about 100 miles : consequently 0.35 is the coefficient of gradient for Swatow at that moment. That station however lay somewhat to the north of the Centre and the true gradient may have been a little higher. If there is no mistake about the observation of 9h a.m. (29 ^{in}.49), the barometric slope must have been very steep between 8h a.m. (29^{in}.34) and 9h a.m. For a velocity of 10 miles an hour gives a gradient of 1.50 per 100 miles miles back of the centre. The same case, it may be remembered, occurred at Manila where the back gradient was found equal to 1.78. The whirlwind then seems to have well retained its former shape on the run from Luzon to the coast of China.

Violence — Manila stood a few miles below the Centre and had probably to bear the great violence of the wind. The mean velocity of the wind, on the 28th of June, between 7h. 45^m and 9h. 40^m p.m. was 81. 4 miles per hour. It even reached 90.2 miles during some of the squalls. This velocity, according to Admiral Fitz-Roy, corresponds to a pressure of 41 lbs per square foot. But the following fact, which we find in the Manila papers, will perhaps give a more precise idea of the violence of the wind at such a speed. Two iron benches of Cervantes Square, though they did not stand against the whole force of the wind and on account of their small height did not offer any good hold, were torn out and overthrown.

In Manila Bay the British barque *Queen of the Seas* dragged her anchor and, to avoid striking the English brigantine *Birker*, cut away two of her masts.

The devastation wrought by the Typhoon appears to have extended over a large area. There seems to have been several disasters amongst the coast shipping, amongst others the steamer *Merivales* went ashore on the coast of Legaspi, and four Chinese passengers were drowned.

At Swatow (China) the Typhoon did considerable damage to the houses near the river and destroyed several jetties. Most of the buildings on the Swatow side were inundated to a depth of three feet. We believe that the Ka-chio side came out of the storm with better fortune.

"HAINAN" TYPHOON

Third Typhoon: July 6th — 12th.

APPROXIMATE TRACK :

Date			Latitude	Longitude
July 6th	Midn.	Archipelago of Philippinas	10° 0′	122° 0′
	Noon		11. 0	121. 30
,, 7th	Midn.		12. 0	121. 0
	Noon		12. 30	120. 30
,, 8th	Midn.	China Sea	13. 15	119. 30
	Noon		15. 0	117. 30
,, 9th	Midn.		17. 0	116. 30
	Noon		18. 0	114. 30
,, 10th	Midn.	Hainan	18. 30	112. 15
	Noon		18. 40	110. 0
,, 11th	Midn.		18. 45	107. 30
	Noon			
,, 12th	Midn.	Tonquin		
	Noon			

We call this Typhoon the *"Hainan Typhoon"* to recall the peculiarities of its track. In 1880 there were several whirlwinds to cross this chinese island which lies at the eastern entrance of the Gulph of Tonquin. This year there was but one Typhoon, that of 6th-12th July, to touch that coast so inhospitable to shipwrecked mariners.

Before the Typhoon.

The atmospheric conditions which, at the and of June, had given rise to the Swatow Typhoon, did not disappear at once in the South of the Philippinas Archipelago on the Typhoon moving away, but they continued to maintain a state of instable equilibrium in all that region. Whilst at the surface the wind varied from ESE. to WSW. (through S.) and blew now fresh, now light, there could be observed a strong polar current in the middle strata of air above Luzon. A collision was unavoidable between those superimposed currents: hence the changeableness of the wind, unceasing and abundant rains and lastly an atmospheric pressure relatively low for the region, though absolutely high if compared to that of our more northern regions: all conditions best suited to give rise to other whirlwinds. And in fact there appeared two to the South of Luzon, during the first fortnight of July: viz. the first about the 5th and 6th to the west of Mindanao in the Solo sea or the Celebes sea; the second about the 9th and 10th to the East of Mindanao. We shall follow them both.

Beginning of the Typhoon.

We find in the Manila paper *El Comercio* a document published by the director of the observatory, thanks to which we may, as it were, witness the start of this atmospheric whirlwind: it is the report of the sailing ship *Marina* from Shanghai to the islands of the Archipelago.

Date	Barometer at noon	Wind		Weather	Latitude	Longitude
July 4	30.02 in	calm, SSW, WSW	0—4	Raining	10° 7′	127° 14′
,, 5	29.98	SW, WSW	1—5	Cloudy	8. 47	129. 7
,, 6	29.96	SW	4—6	Raining	6. 47	129. 31

On the next day, the barometer rose a little as the ship moved towards the South-East. All the region of the Archipelago then was experiencing a strong perturbation at that time, and the whirlwind just formed had taken time to make a start and move away.

Direction followed by the Typhoon.

On the 6th of July, when the Typhoon seems to have started on its course over the China Sea, the wind blew feeble from E. and there was observed a slight fall of the barometer at Pakhoi on the Northern coast of the Gulph of Tonquin, and also on board H.M.S. *Magpie* at Hoikow (Hainan). It is impossible to ascribe this fall of the barometer to the same cause which at that moment made the barometer to sink at Foochow, Tamsui, Ningpo and Zi-ka-wei, viz. to the Swatow Typhoon turning to Sea, again: it must then have been connected with some depression which probably extended over the land west of Hainan and perhaps also over the sea south of that island. In fact, a slight swell from ENE. and masses of thick dark clouds rising from the ESE. were apparently an indication of heavy weather somewhere at sea on the 6th. Whether these circumstances were material in determining the course of the Typhoon over the China Sea and over Hainan towards the Gulph of Tonquin, it is impossible to say for want of more detailed information on the situation, extent and importance of that area of low pressure.

The Typhoon in the China Sea.

On the 7th, the Typhoon was in the offing crossing the latitude of Manila. On the 8th, the English steamer *Plainmeller* met with it by 15° 21′ lat. and 116° 33′ long.: wind from W. In the evening of the same day the Siamese barque *Fabius* had to bear all the brunt of the storm in the same whereabouts where last year in October she had met with rough usage. The *Fabius* encountered calms at Macclesfield Bank for four days, followed by the Typhoon in latitude 18° 40′ and longitude 113° 28′, with barometer at 29^{in}48 and wind blowing with hurricane force. The ship was hove-to from 6 p.m. on the 8th till next morning, when the wind veered to NNW. Steered west-south-west and on sounding the ship, found much water in the hold, she having sprung a leak. The pumps were all out of order. On sighting the E. & A. steamer *Catterthun*, on the 11th, some fifty miles to the SW. of the Ladrones, the Captain hoisted the distress signal. The steamer came to her assistance and took the *Fabius* in tow and arrived at Hongkong on the 12th. This was the last mishap and also the last voyage of the ill fated ship: she had to be broken up as unseaworthy.

According to this report the Typhoon seems to have got to the North-west up to near the latitude of Hainan and then to have turned due west to cross the island.

On the 10th the English steamer *Consolation* had to stand the storm at the entrance of the Gulph of Tonquin.

The Typhoon at Hainan and in the Gulph of Tonquin.

We are indebted to the kindness of Lieutenant H. Belam R. N. of H.M.S. *Magpie* for a very circumstantial report of the passage of the storm over Hainan. The steamer lay in the harbour of Manin, on the northern coast of the island, 35 or 40 miles west of Hoikow.

H. M. S. ***Magpie*** *Sounding on the Northern coast of Hainan island.*

Date	Hours	Barometer	Wind		Temper.	Humid. %	Clouds Lower	Clouds Upper	Wether	Swell		Remarks
		in			°							
July 6th	6 P. M.	29.633	ENE	1	85.8	81			b. c. m.			Anchored in Jinmel Bay.
	8	.686	SE	1	86.0	76	Cum.-str.	2	b. c. m. l.			Wind light and variable.
	Midn.	.746	SW	1	83.1	87		0	b. m. l.			
	4 A. M.	.709	E by S	1	81.9	91		0	b. m. l.			
	8	.754	ENE	1	81.0	80	Cum.-str.	2	b. c.			6 a.m. — Weighed and proceeded sounding.
,, 7th	Noon	.754	NNE	1	86.0	80	Cumuli	3 Cirri N	b. c.			
	4 P. M.	.688	ENE	3	86.2	79	Cum.-str.	3	c. b.			5.40 p.m. — Anchored in Manin Bay.
	8	.745	ENE	1	85.8	84	Cum.-str.	4	b. c. m.			
	Midn.	.772	ENE	1	83.5	85	Cum.-str.	2	b. c. m. l.			
	4 A. M.	.727	ENE	1	83.0	87	Str.	1	b. m. l.			5.45 a.m. — Weighed and proceeded sounding.
	8	.775	NE	4-5	85.0	83	Nimb.-cum.	9	c. b. m.			7.30 — A heavy Cum. SE passed clear of ship to westward —
,, 8th	Noon	.767	NNE	3	86.0	80	Cum.-str.	4 Cirri	b. c.			Wind increased.
	4 P. M.	.701	E	3-4	86.3	81	Cum.-str.	6	c- b. m.			5.45 p.m. — Anchored in Manin harbour.
	8	.770	SE by E	1	83.0	85	Nimbi	10	o. l. SSE			7.30 — Heavy rain and squalls — 8.10 rain ceased.
	Midn.	.766	ENE	3-4	83.2	87		5 Ac	b. c. q. l. E			
	2 A. M.	.736	E	2								4.45 a.m. — Lightn. ceased — lower clouds rapidly from E. —
	4	.720	E	1	82.8	88	Str.	3	b. c. m. l. SW	calm		Swell from NE.; apparently heavy clear of harbour.
	6	.724	E	1								
	8	.738	E	1-2	85.0	79	Cum. E	9	b. c. m. q.	Slight swell	NE 1	
	10	.753	NE by E	3-4								9.20 — Wind increasing and squalls.
,, 9th	Noon	.749	NE by E	3-4	85.9	77	Cum. E	9	c. m. q.	Sea & swell	NE 2	
	2 P. M.	.676	NE by E	3-4								2.30 p.m. — Wind light.
	4	.652	NE by E	1	86.0	81	Cum.-str.	10	o. m.	id	NE 1	
	6	.644	E by N	3-4								5.45 — Squalls ENE 4-5. — 6.30 Clouds suddenly dispersed and
	8	.657	NE by N	4-5	82.0	86	Nimbi	10	o. m. q.	Swell	NE 2-3	wind fell calm. —
	10	.666	NNE	2								7.20 — A heavy cloud from ENE.
	Midn.	.616	N by E	2-4	81.2	86	Nimbi	10	o. r. q.	Swell	N 3	0.30 a.m. — Squalls N 5-6 — rain.
	2 A. M.	.558	N	4-6								
	4	.522	NNE	4-6	81.9	87	Nimbi	9	c. p. q.		N 3	
	6	.520	NNE	5-6								
	8	.511	NNE	4-6	83 0	87	Nimbi	10	o. m. q.		N 2	
	10	.501	ENE	4-6								10.0 — Wind ENE. — 10.20 — Wind E. moderat.
,, 10th	Noon	.525	SE	4-6	85.5	78	Cum.-str.	7 Cirri S SE	c. p. d. q.		ESE 2	11.15 — Wind ESE. freshening — 11.40 SE. squalls.
	2 P. M.	.503	ESE	6-7								12.15 — Wind ESE. much stronger.
	4	.491	ESE	6-7	85.1	79	Cum.-nimb.	9	c. p. q. m.		ESE 2	
	6	.493	ESE	3-4								6.0 — Wind falling — swell going down.
	8	.575	SE by E	3-4	83.0	81	Str.	7	c. p. q. m.		ESE 1	
	10	.642	ESE	3-4								
	Midn.	.662	ESE	1-2	81.3	83	Cum.-str.	5	b. c. m.		ESE 1	11.45 — Wind light and ceased to be squally.
,, 11th	2 A. M.	.664	ESE	1								
	4	.657										
	8	.753										

The foregoing observations are very instructive : they go once more to show how whirlwinds can be affected by high mountains. The centre of Hainan is occupied by the mountain chain called *Limoo Shan* or *Chi Shan*. During the passage of the Typhoon over the southern part of the island, the N. and NNE. winds which were blowing on the North-west coast at Manin where the *Magpie* lay, were evidently checked by the first spurs and ramifications of the central chain. The whirlwind could not easily expand on that side : then on the 10th about 4 a.m. the wind freshened and turned to N. and NNE. when there was a sudden interruption in the sinking of the barometer which had been well marked since noon on the 9th, particularly after 10 p.m. on that day, the wind blowing all that time from E. and ENE., consequently without any obstacle to check it. The effect of a strong wind (force 6) dashing against the mountains and being forced up their slope must naturally have

been an increase of atmospheric pressure on this side and a fall of rain consequent upon the cooling of the air on ascending up the mountain side. The Typhoon however soon came to the Gulph of Tonquin, South-west of the *Magpie*; the wind then turned to the ESE and blew in the direction of the Gulph, thus giving the depression free play again for expanding : hence, though about 5h 30^{m} p.m. the centre must have been at a good distance, the barometer sank again down to 29^{in}.477 to rise very rapidly immediately after. The barometric curve of the observations of the *Magpie*, on being corrected and completed, gives a minimum of 29^{in}.415 at 1h p.m., very likely at the moment of the passage of the centre within the shortest distance. Consequently, on July 10th about noon the centre stood on the meridian of 110°; — latitude less certainly known, being between 18° and 19°.

The same barometric variation was observed about the end of the Gulph of Tonquin, at Pakhoi, North of Manin, (latit. 21°28′ — longit : 109°4′). On the 10th, 8h a.m. the barometer had sunk to 29^{in}.59; at noon it had risen to 29^{in}.62 to fall again down to 29^{in}.59 at 4h p.m. From this it would appear that the Lien-chow peninsula, exactly north of Hainan, with its mountain chain, had acted on the Typhoon in the same way as the mountains of Hainan seem to have done. At Pakhoi, in the afternoon of the 9th, the wind blew from N. and settled in that direction; on the 10th, in the morning same wind, somewhat stronger (force 4); at noon, from NE (force 6); only turned to the E. on the next day, 11th, little before noon. No rain, Pakhoi being on the sea shore at the foot of those mountains over which the wind was blowing from N. or from NE.

Before reaching Tonquin the Typhoon must have passed very close to the port of Haiphong, fated to be laid waste by the Typhoon of October 5th. This time the town does not seem to have suffered, the Typhoon having vanished before reaching the western coast of the Gulph of Tonquin. At Manin (H. M. S. *Magpie*) the storm had entirely terminated on the 10th, between 6 and 8 p.m. (wind ESE force 3), though the barometer still read pretty low. At Pakhoi, the E. wind continued pretty strong (force 4) to the afternoon of the 11th; there even was a rather strong squall from SE. at 1h p.m., and the barometer kept still lower than on the northern coast of Hainan. The whirlwind would then seem to have continued in the bottom of the Gulph for some time yet before vanishing.

Fourth Typhoon : July 10th — 22nd.

TRACK :

				Latitude N.		Longitude E.	
				°	′ ?	°	′ ?
July	10th	Midn.		9.		127.	30 ?
		Noon		10.	20	127.	15
,,	11th	Midn.		11.	0	127.	0
		Noon	East coast	11.	45	126.	30
,,	12th	Midn.	of	12.	30	126.	0
		Noon	Philippinas	13.	15	125.	30
,,	13th	Midn.		14.	30	124.	45
		Noon		16.	0	124.	0
,,	14th	Midn.		17.	30	123.	0
		Noon		19.	0	122.	30
,,	15th	Midn.	Formosa	22.	0	121.	50
		Noon		26.	15	121.	40
,,	16th	Midn.	China	29.	45	121.	20
		Noon		32.	30	120.	0
,,	17th	Midn.	Yellow Sea	35.	0	122.	0
		Noon		36.	30	125.	0
,,	18th	Noon	Japan Sea	37.	30	135.	0
,,	19th	Noon		34.	0	140.	45
,,	20th	Nonn	East coast	33.	30	138.	30
,,	21th	Noon	of	32.	45	136.	30
,,	22th	Noon	Japan	32.	30	134.	0
,,	23th	Noon		32.	15	131.	30
,,	24th	Noon		33.	15	129.	0
,,	25th	Noon		36.	30	130.	0
,,	26th	Noon	Japan Sea	38.	15	132.	30
,,	27th	Noon		41.	30	135.	30
,,	28th	Noon		42.	0	141.	0
,,	29th	Noon	Pacific	38.	0 ?	145.	0 ?

EVENTS :

Wreck of the British barque *Aberdonian* in the Chusan archipelago on the night of 16th July : the captain and 18 of the crew were lost.

Wreck of the American barquentine *Annie S. Hall* near the Island of Soudan, coast of China latit. 28° 20′, on the night of the 16th July : captain and crew saved.

Lowest reading of the barometer duly ascertained 28in 785 on board the *S.S. Keelung* (Capt. W. Schulze) on July 15th 3h. p.m., latit. 26° 58′ — longit. 121° 0′.

Barom. 28in 68 (?) at Tamsui harbour on the 15th, 9 a.m. — calm.

Very curious track run over in 19 days, touching Philippinas, Formosa, China, Corea and Japan before disappearing in the North Pacific.

Documents relating of this Typhoon.

I think I have been supplied with all documents that could be desired for a circumstantial study of this most remarkable Typhoon. Besides a good many reports from ship captains inserted in the Shanghai and Hong-kong papers, I have been able to compare the following important documents from points near the track of the Centre, which have been graciously communicated to me.

For Luzon :-the hourly observations made at the Manila observatory.

-the three-hourly observations (from 6h a.m. up to 9h p.m.) made at Tuguegaras Cagayan.

-a brief discussion on the origin of this Typhoon by the R. F. Faura in the *Comercio* of Manila.

For Formosa : -the observations made at Tai-wan-fou, Tamsui and Twatutia.

For the Chinese continent : -the observations made at Wenchow, Ningpo, Zi-ka-wei, Chingkiang, Chefoo and Cape Shantong Light-House.

Near 40 captains favoured me with their report on the storm they had experienced on the coast of China.

For Japan : - the observations made at the Imperial observatories of Tokio, Kioto, Hiroshima and Nagazaki,

as well as those of 12 light-houses on the Empire. I cannot possibly give all those documents in full; yet I shall give all those that were of use to me for determining more or less accurately the position of the principal points of the track and particularly its remarkable deviations on that long run of 19 days comprising no less than 7100 miles run over with an average velocity of 15.5 miles an hour.

Before the Typhoon.

This Typhoon originated in the South of the Philippinas Archipelago almost simultaneously with the "Hainan" Typhoon. This "Hainan" Typhoon, formed to the west of Mindanao between the 4th and the 6th of July, made for the North-west across the China Sea; the "Shanghai" Typhoon sprang up to the East of Mindanao between July 6th and 9th under the same conditions and owing to the same causes : it also bore to NW. but kept on the Ocean. All the long stretch of the Philippinas thus lay between the centres of these two whirlwinds which however passed at a distance without causing any alarm.

After the former Centre had left the vicinity of Mindanao, the atmospheric pressure ($30^{in}.00$) was high comparatively to that on the coast of China (at Hongkong $29^{in}.70$; at Zi-ka-wei $29^{in}.70$; in the North $29^{in}.60$; in Japan $29^{in}.80$). According to the report of the barque *Marina*, the wind, to the SE. and SW. of Mindanao, blew constantly between SW. and W. from the 6th to the 12th of July; it was now moderate (force 5-7), now violent (force 8-10), with a diluvial rain all the time. North of the Archipelago the wind blew from E. and SE. In the upper regions of the air, above Luzon, there could be observed a strong polar current indicated by the cirri it carried along. From the high pressure that obtained all over the region South of the Archipelago, there could hardly be any doubt but that this upper current must bear towards that region : its coming into collision with the upper equatorial currents proper to this part of the globe must then have been the main cause of the cyclonic motion that took place below.

Herewith the principal observations made on board the "*Marina*".

	Latit.	Longit.	Barom. (noon)	Wind		
	° ′	° ′	in			
July 7th	5. 4—	129.53	30.00	SW—W	5— 8	Heavy rain
8th	3.44—	130.31	30.02	SW—W	5— 9	Diluvial rain
9th	1.45—	133.12	29 98	SW—W	5— 7	Heavy rain
10th	1.37—	131.45	29.90	W—SSW	5— 7	
11th	2.34—	130.18	29.94	SW—SSW	8— 9	
12th	3.22—	123. 0	29.96	SSW—SSE	8—10	

The Typhoon.

Luzon, Manila. — The barometer gave no indication of the approach of the whirlwind before the evening of the 11th. The lateness of the warning was owing to the first Typhoon, formed in the west, being yet within a short distance of the Archipelago. In fact, the wind, which had been blowing from SE., in the direction of that Typhoon, on the preceding days, only turned on the 11th to NE., then on the 12th to NW. and W., under the stronger influence of the new centre of depression and aspiration formed in the South-east of the island. In the morning of the 12th, the normal oscillation of the barometer was entirely suppressed and there was no more room for doubting the existence of that new foe. The following table gives the ensemble of the observations made at the Manila Observatory during the passage of the Typhoon off Luzon whose extreme North-east head it only touched on the 14th, midnight.

Observatory of the Ateneo Municipal at Manila.

DIRECTOR: R. F. FAURA S. J.

Date	Hours	Barom. at 32°	Wind Direc.	Wind Veloc. (miles)	Tempera. of the air (°)	Humid. %	Tens. of vap. (in)	Nebulosity Upp. clouds	Nebulosity Low. clouds	Rain (in)	Remarks
July 12th	8 A. M.	29.837	NW	2.2	89.3	84	0.859	5 Ks	2 C W		Cirro-strati converging to ENE. — Solar halo.
	10	.852	NW	1.1	83.5	77	.866	4 Ks	3 C		
	Noon	.837	W	7.7	85,7	71	.854	4 Ks	3 Ac		9 a.m. — a bar of fracto-cumuli from SSE to S.
	2 P. M.	.788	SW	6.6	87.3	70	.832	3 Ks	3 C		
	4	.749	SW	10.6	86.0	72	.882		8 Cn		10 a.m. — fracto-cumuli in the E. and NE. — halo fainter.
	6	.732	SW	15.4	84.2	81	.921	3 K	4 Cn		
	8	.756	W	11.0	83.7	79	.890		10 Ni		Very thick veil of Cirri. — A few Cirro-strati running S. to N., under which some loose nimbi bearing *perpendicularly to that direction.* Wind from SW. very convergent to Centre.
	10	.771	N	5.0	84.2	87	.921		8 Cn W	0.039	
July 13th	Midnight	.770	N	2.2	82.8	95	.953				
	2 A. M.	.709	WNW	8.8	81.5	95	.961				
	4	.679	W	8.4	81.5	88	.894		10 Cn NW		
	6	.682	N	2.2	81.5	92	.898		10 Ni	0.228	
	8	.692	NNW	6.6	80.6	85	.874		10 C NW		Fracto-cum. running from WNW. and W. — Storm clearly lying to the N. — Horizon overcast from E. to NW.
	10	.684	WNW	15.4	82.3	84	.914		10 C NW		
	Noon	.646	W	14.3	84.6	78	.906		10 C W		
	1 P. M.	.639	W	16.5	85.8	78	.945		9 Cn		
		.623	W	10.6	86.0	78	.921				Passing showers.
	3	.597	W	26.5	86,0	78	.945				
	4	.578	WSW	22.0	85.8	82	.969				
	5	.597	WSW	29.0	85.7	82	.957				
	6	.604	W	22.0	84.2	79	.917		8 Cn		
	7	.619	W	22.0	84.6	79	.914		9 Cn		
	8	.634	WSW	22.4	84.6	77	.898				
	9	.647	WSW	17.6	84.1	79	.894		10 Cn W		
	10	.666	W	20.5	83.7	78	.886		10 Cn W		
	11	.662	SW	18.0	82.8	83	.921				
July 14th	Midnight	.667	SW	15.8	82.4	85	.929				
	2 A. M.	.643	SW	17.6	82.0	84	.894		10 Cn W		
	4	.626	W	22.0	83.2	76	.795				
	6	.629	W	23.1	83.3	73	.795		9 Cn		
	8	.673	WSW	16.5	83 3	76	.851		8 Cn		
	10	.681	SW	29.0	85.5	80	.878		9 Cn		
	Noon	.669	SW	23.8	82.8	88	.965		10 Ni		
	2 P. M.	.661	SW	27.9	81.2	90	.996		10 Cn	0.024	
	4	.661	SW	23.1	83.2	82	.921		10 Cn W		
	6	.666	SW	24.2	82.4	89	.929				
	8	.710	SW	16.9	81.5	85	.984		10 Ni		
	10	.741	SW	19.8	82.4	85	.933		7 Cn	0.177	
July 15th	Midnight	.743	S	14.7	82.4	87	.929				
	2 A. M.	.721	SSW	1.8	82.8	92	.953				
	4	.726	SSW	15.4	82.3	88	.929		10 Ni		
	6	.746	SSW	11.0	81.8	89	.885		10 Cn		

Meteorological Station at Cuguegarao Cagayan (Luzon)

Latit. 17° 36'. 42' — Longit. 121° 40' — height 109 feet.

Observator: D. JOSÉ LOPEZ DE IRASTORZA.

Date	Hours	Barom. at s.lev. (in)	Wind Direc.	Wind veloc. (miles)	Temp. of the air (°)	Humid. %	Tens. of vap. (in)	Nebulosity Upp. clouds	Nebulosity Low. clouds	Rain (in)	Remarks
July 11th	6 A. M.	29.933	ESE	6.1	80.9	89	0.803	2 Ks	2 Cs ESE		Between Noon and 1 p.m., apparition of a sheaf of feathery Cirro-strati converging to the NW., last trace of the passed Typhoon — At 3 p.m., another one bearing SSE—NNW
	9	.947	SE	47.9	79.8	83	.851	2 Ks	4 C SE		
	Noon	.919	SE	20.1	81.5	76	.890	3 Ks	2 C SE		
	3 P. M.	.862	N	10.7	88.8	60	.811	3 Ks	2 C N		
	6	.851	N	21.4	83.8	66	.831	3 Ks	1 C		
	9	.874	N	32.1	86.2	87	.891	2 Ks	2 S		
July 12th	6 A. M.	29.861	N	10.4	80.1	86	.804	1 Ks E	7 Cs NNE		Remarkable lunar halo. Remarkable red tints in the sky at sunset. At 6.33 p.m., a slight shower from about NE. — There is a whirlwind in the ESE, that may possibly make itself felt here, as we are in the direction of its track.
	9	.852	N	6.1	81.3	85	.906	2 Ks SE	7 C N		
	Noon	.821	N	35.3	87.3	70	.898	2 Ks ESE	5 C		
	3 P. M.	.758	NW	51.4	88.7	66	.847	3 Ks	4 C		
	6	.734	NNW	57.8	86.8	76	.886	3 Ks	5 C NNE		
	9	.781	NNW	38.5	84.4	89	.898	3 Ks	3 C N	Shower	
July 13th	6 A. M.	29.664	NNW	35.1	79.5	92	.894		10 Ni	0.453	Squalls from NW. with showers all day long. — squalls getting much more violent at nightfall — diluvial rain. — the horizon overcast: whirlwind passing to the right hand of us.
	9	.650	NNW	50.3	78.2	94	.882		10 Cn NNE	0.322	
	Noon	.608	NW	78 0	80.3	86	.843		10 Ni N	0.150	
	3 P. M.	.504	NW	97.9	82.2	87	.937		10 Cn NNW	0.039	
	6	.509	NNW	78.5	81.5	92	.949		10 Ni N	0.197	
	9	.507	NW	96.0	80.2	91	.921		10 Ni NNW	0.438	
July 14th	6 A. M.	29.447	W	85.8	79.8	91	.857		10 Cn WNW	0.886	Squalls and showers abating at daybreak.
	9	.448	SW	55.4	77.2	93	.858		9 Cs SW	0.020	
	Noon	.496	S	83.4	78.0	90	.870		10 Cn SSW	0.047	Horizon clearing up to the North.
	3 P. M.	.501	S	79.3	78.2	92	.858		10 Ni S	0.071	
	6	.588	S	86.1	77.2	96	.851		10 Ni	0.256	Wind light with slight squalls.
	9	.626	SSE	72.9	76.1	94	.847		10 Ni SSE	0.197	Raining all day.

Note: I doubt whether the observations of the velocity of the wind have been correctly reduced: I have thought it necessary to multiply by 10 the numbers given in the manuscript.

These observations show that the centre of the Typhoon kept at a good distance from the eastern coast of Luzon. At Manila, the general direction of the wind was constantly from W. to E. with little variation: it first blew from NW. to SE. when the centre was to the South-east; then from W. to E. when it had reached the latitude of Manila, lastly from SW. to NE. when it had got to the straits that separate Luzon from Formosa; the convergence of the wind is therefore unquestionable. The centre got much nearer to Tuguegarao than to Manila and the wind much stronger.

An effect of the mountain chain that runs along the eastern coast of Luzon, must also be noticed. When the wind, already stronger, blew at Tuguegarao from NW., W. or SW. and struck more directly against their western slope, the rain kept falling abundantly on that side. This phenomenon we have already mentioned several times: it is easily explained by the cooling of the moist air forced up against the steep mountain slope to get over the obstacle standing in its way.

On July 10th, the Typhoon lay to the North-east of Mindanao. On the afternoon of the 13th it reached the latitude of Manila and on the 14th about 6 a.m. it passed the North-eastern head of Luzon and bore straight upon Formosa.

Formosa — Extract of the *Peking Gazette,* December 1881:

«Ho Ching reports that on the 14th and 15th of July, and 26th, 27th and 28th of August (1), Tai-wan (Formosa Island) was visited by a succession of heavy gales, which did much damage to the crops and shipping of all sorts, blew down houses and public offices, and caused, in some instances, considerable loss of life. The Governor of Fukien, Ts'ên Yü-ying, crossed over to Tai-wan to ascertain the extent of the mischief done, and set on foot measures for the relief of the sufferers. . . .»

From this official report it may be gathered what the violence of the Typhoon must have been in its passage over the great Chinese island. Herewith the most interesting observations, with the help of which the course of the centre may be followed:

Tai-wan-foo

Latitude 22°. 58′ — Longitude 120°. 13′

HARBOUR MASTER'S OFFICE.

Date	Hours	Barom.	Wind	Rain	Weather
		in		in	
July 11th.	8 A. M.	29.869	N	2 hours 0.24	Cloudy, variable weather, heavy sea on Bar — Wind, steady Nly breeze — rain squalls at intervals.
	4 P. M.	.851	N		
	8	.849	NW		
12th.	8 A. M.	.846	NE		Cloudy weather, sea on Bar — Wind, a.m. NE. light, p.m. NNE. fresh.
	4 P. M.	.766	N		
	8	.770	NW		
13th.	8 A. M.	.747	NE		Fine weather the whole day — moderate sea on Bar. — A severe shock of earthquake passed from SSW. to NNE. lasting 60 sec. motion oscillating.
	4 P. M.	.640	NW		
	8	.639	NNW		
14th.	8 A. M.	.569	SW		Fine weather until 5 p.m. then light rain, moderate sea on Bar. — Wind most of the day very light SW-NW-N.
	4 P. M.	.449	NW		
	8	.384	NNW-N		
15th.	8 A. M.	.434	NNW	6 hours 1.00	Rain at intervals first part of the day — second part overcast and threatening, heavy sea on bar. — From 6 a.m. until noon it blew half a gale from NNW, the lowest reading was at 4 a.m. 29.294.
	4 P. M.	.549	SW		
	8	.603	SW		
16th.	8 A. M.	.668	SW		Fine weather but cloudy, sea on Bar.
	4 P. M.	.672	SW		
	8	.700	SW		
17th.	8 A. M.	.758	NW		First part of the day rain squalls at intervals, second cloudy.
	4 P. M.	.789	SW	2 hours 0.31	
	8	.747	SW		

(1) A second typhoon crossed the Formosa Strait on August 26th and 27th.

We beg over and over again to call attention to the convergence of the winds. On the 14th and early on the 15th, wind NW. and NNW., the Typhoon lying South, close to Tai-wan-foo; if the wind *always* blew at right angle with the direction of the centre, it now should have been ENE. and NE. After the passage of the centre, at the time the whirlwind covered the whole of Formosa and raged at Twatutia, Tamsui and Keelung on the north coast, the wind at Tai-wan-foo was from SW., not from W. In this last case, it is clear that there was nothing in the way of W. wind coming direct from that sea on whose shore the Capital town of Formosa is situated, with an immense plain at the back, which would have supported the circular wind theory. Before the passage of the centre, the irregular direction of the wind might have been ascribed to a deviation brought about by the great mountain chain which crosses the island from North to South, rising as high as 12 800 feet (mount Morisson), though there is no apparent reason why those easterly winds, checked and deviated by the mountains, should at Tai-wan-foo have taken a NW. direction, thus assuming the same convergence as we have met in the preceding Typhoons and shall find in the following.

On the other hand, this manifest convergence cannot be laid to the score of a loss of velocity in the lower currents by friction against the soil, for the result would not be a convergence but a divergence, as may often be observed in similar cases.

Tamsui

Latitude 55° 10′ — Longitude 121° 25′

HARBOUR MASTER'S OFFICE.

Date	Hours	Barometer at sea level	Temper. of the air	Humidity	Wind		Weather	Remarks
		in	°	%				
July 12th	7 A. M.	29.85	84	75	SE	2	C. B.	
	1 P. M.	84	91	57	SW	2	C. O.	
	7	.79	85	64	SE	4	C. O.	
July 13th	7 A. M.	.76	85	64	SE	4	C. O.	
	1 P. M.	.71	92	54	SE	5	C. O.	
	7	.68	86	61	SE	3	C. O.	
July 14th	7 A. M.	.67	86	76	SE	3	C. O.	In the morning a dark threatening Bar to the Eastward.
	1 P. M.	.60	85	72	SE	2	O.	
	7	.54	86	80	E	1	M. U. R.	
	10	.49	84	87	ENE	3- 4	M. U. R.	
July 15th	Midn.	.41	81	91	NE	4- 5	M. U. R.	
	3 A. M.	.20	80	91	NE	9-10	M. Q. U. R.	
	5	.16	80	91	NE	7- 8	M. Q. U. R.	
	6	.11	80	91	NNE	7- 8	M. U. R.	
	7	28.87	77	95	N	10-11	M. R. W.	At 7.40 a.m. quite calm and Sun visible for 10 min.
	8	.69	80	89	NNE	1- 2	C. O.	
	9	.68	81	87	SE	1- 2	C. O. M.	At 9.30 the wind came with great
	10	.84	84	83	W	10-11	M. U. Q. R. W.	violence and very suddenly from
	11	29.11	78	95	SW	10-11	id id	the W. gradually changing to SW.
	Noon.	.28	78	95	SW	10-11	id id	
	1 P. M.	.38	80	82	SW	9-10	id id	
	2	.35	80	78	SW	9-10	id id	
	3	.39	80	82	SW	8- 9	M. O. R.	
	4	.42	80	78	SSW	5- 6	C. O.	Water rose to 13 feet above L. W.
	5	.45	80	78	SSW	5- 6	C. O. V.	Tides, the usual rise being 8 feet.
	7	.50	81	74	SSW	3- 4	C. O.	
	10	.53	81	78	SSW	3- 4	O. M.	
July 16th	Midn.	.55	80	74	S	2	O.	
	7 A. M.	.65	80	74	ENE	2- 3	C. O.	
	1 P. M.	.66	86	76	SW	3- 4	C. M.	
	7	.70	86	68	calm		C. O.	

At Keelung, 20 miles East of Tamsui, the calm lasted from 7h to 7h. 30^m a.m., and the barometer fell to 28^{in}.60. The wind blew NE. 8 at 5 a.m.; ENE. 9 at 7h. a.m.; S. 4 at 8h. a.m.; SW. 9 at 9h. a.m.; SW. 10 at 10h. a.m.; SW. 11 at noon; SW. 10 at 1h. p.m.; SW. 8 at 2h. p.m.; SW. 6 at 4h. p.m.

At Twatutia, 8 miles SE. from Tamsui, the calm lasted from 7h. to 8h. a.m.; the barometric minimum (28^{in}.65) seems to have taken place at 8h, after the period of calm: the wind went through the same variations as at Keelung, E. and NE. before the calm, and SW. after.

I need not here again and in the three other stations, point out the convergence of the wind : after midnight NE. instead of circular E. wind; after 10h. a.m. SW., turning to SSW. in the evening, instead of circular W. as might have been expected to the South of the centre. It appears clearly here how the strict application of the circular theory would lead into error with regard to the direction of the track. The observations at Manila and Tuguegarao (Luzon) and those made at Tai-wan-foo on the South-west coast of Formosa sufficiently prove that the Typhoon rose almost direct from south to north after passing Luzon. Now the persistency of NE. winds at Tamsui, Keelung and Twatutia, before the passage of the centre and that of the opposite SW. winds after the passage would lead an adept of the circular theory to admit that the Typhoon in passing over those three stations was running from SE. to NW., which would entail an error of 30° to 40° at least on the true direction.

A Twatutia the junks suffered badly, fourteen of these broke adrift from their moorings near Banka, and were carried down the river by wind and flood in a body, and meeting with obstruction near the *lekin* station, the steady crashing that went on is indescribable, some lost masts, others were swept clean to the decks of their topsides and the whole stern carried away square to the hull, including rudder and gear. In many cases the crews were seen with their bags and bones and leaving the vessels to their fate, seeking safety on shore, such of those as remained aground were of course quickly luted.

Another not less decisive proof of the convergence of the winds we find in the report of the SS. *Albay* sailing to Tamsui from Amoy, a port of China, opposite Formosa, at equal distance from the north and south entrances of the straits (latit. 24°. 28′ — long. 118°. 3). She left Amoy on July 15th, 5h a.m., at the moment when the centre of the Typhoon reached the eastern coast of Formosa at the same latitude. The ship's barometer marked 29^{in}.68 (at Tamsui 29^{in}.16; at Tai-wanfoo, 29^{in}.30) and the wind blew from W. (!) straight towards the centre. Shortly after leaving the coast and entering the straits, she found the wind first SW., then SSW. and next S. on getting near the coast of Formosa, its violence increasing every moment. The *Albay* cast anchor in the harbour of Tamsui at 1h a.m. on the 16th : the centre of the Typhoon must therefore have been still on the sea, close to the northern entrance of the straits of Formosa at the time when SW. and S. winds were blowing in the straits, their convergence having in no way altered.

Coast of China — I have already stated that during July there prevailed a very low atmospheric pressure over the central region of China. Thus at Hankow (latit. 30°. 34′ — longit. 114°. 20′) the mean height of the barometer (corrected for altitude) did not exceed 29^{in}.55, and the prevailing wind was from SSE.; at Chang-kia-chwang, to the South of Peking (latit. 38°. 17′ — long. 116°. 14′) the mean reading of the barometer was 29^{in}.66; at Chefoo (entrance of the Gulph of Pechili, lat. 37°. 36′ — long. 121°. 26′), 29^{in}.62; at Zi-ka-wei, 29^{in}.716; at Nagazaki (Japan) 29^{in}.828; at Tokio, 29^{in}.857. There was then really on the continent a marked minimum of pressure, which this time also was the effective cause of the direction taken by the Typhoon. But it could not move far from the sea shore without soon vanishing away, and it proceeded straight north towards Chefoo, which direction besides was already pretty well marked out by the strong equatorial aerial current which was running all along the coast to Chefoo ever since the 10th of July, the very day on which the whirlwind started on its course near Mindanao. The observations of Capt. F. W. Schulze of the *SS. Keelung* show us how that aerial current came gradually to be connected with the whirlwind, ultimately to partake of its gyrating motion. The Steamer left Chefoo on the 11th, 5h. p.m. and on the 15th 3h. p.m. got within a very short distance of the Typhoon somewhat north of Formosa.

Steamer **Keelung** — Captain F. W. Schulze

From CHEFOO to SWATOW.

Date	Hours	Position Latit.	Position Longit.	Winds		Barometer (in)	Clouds	Remarks
July 11th	5 P. M.	° Chefoo	°	SE	1	29.840	5	Left Chefoo on the 11th July at 5h p.m.
" 12th	Midn.	37. 20′	122. 50′	S	3	.782	10	Foggy weather off Shantung Peninsula and in the Yellow Sea.
	Noon	35. 58	123. 10	S by W	4	.804	10	
" 13th	Midn.	34. 34	123. 20	S by W	5	.793	9	
	Noon	33. 8	123. 21	S	3	.816	3	
" 14th	Midn.	31. 47	123. 10	S by E	3	.844	2	Hazy atmosphere.
	Noon	29. 52	122. 44	SSE	4	.808	2	5h a.m. Passed the Barren Islands — swell from SE.
	4 P. M.	29. 21	122. 27	SSE	4	.735	4	11h. 30m a.m. Haichu Isl. (Taichow group) bore NW. 2 miles distant — heavy swell from SE. — squally weather.
	8	28. 49	122. 9	SE	6	.717	9	Dense showers of rain,
" 15th	Midn.	28. 21	122. 0	SE	4	.654	9	
	2 A. M.	28. 6	121. 52	SE	5	.592	10	
	4	27. 53	121. 42	SE	5	.543	10 R	There was every indication of a Typhoon raging to the Southward.
	5			SE	6	.491	10 R	Kept ship on her course (SWly Sly) with the expectation that she
	6	27. 38	121. 32	ESE	7	.459	10 R	would pass with favourable winds though the left hand semicircle of
	7			E	7- 8	.409	10 R	the storm, under the supposition that the latter should make a north-
	8	27. 26	121. 22	ENE	8- 9	.401	10 R	easterly track. Reefed the square sails and close reefed the trysails.
	9			NE	7	.337	10 R	An enormous cross sea was now running from NE. and SE.
	10	27. 12	121. 12	NE	8	.296	10 R	At noon the rain became perfectly blinding; could not see a ship's
	11			NE	9	.245	10 R	length ahead: resolved to heave to. Secured the foresail and put the
	Noon	26. 58	121. 0	NE	9	.111	10 R	head to the wind and let the engines go dead slow — Tremendous con-
	1 P. M.			NE	10	29.000	10 R	fused sea running from SE-NE.: the waves attained an enormous
	2			NE	10	28.948	10 R	height when crests of two cross seas coincided; ship behaved splendidly.
	3			N-NNW	10	.785	10 R	3h. p.m. — Lowest reading of the barometer, the mercury oscillating
	4	Nearly stationary		W	10-11	28.847	10 R	and bumping more than one tenth of an inch up and down.
	5			WSW	11	29.090	10 R	4 p.m. — Wind shifting gradually to WSW. with furious squalls of
	7			SW	11	.336	10 R	almost hurricane like force and very heavy rain which caused a pain-
	5			WSW	10	.405	10 R	ful impression on the skin of hands and face, like hail or small peb-
" 16th	Midn.	26. 40	121. 0	WSW	8	.487	10 R	bles. The heaviest gusts of wind were from SWbyW.
	Noon	26. 29	120. 50	SSW	5	.654	6	After the last shift wind the sea became terribly confused and of an immense height: the steamer behaved exceedingly well.
								16th July, 7 a.m. — terrific sea from SW.
								8 a.m. — Sky clearing up to the southward; heavy banks of cumulo-strati to the Northward; hazy atmosphere.
								At noon, cloud banks to the northward more distant, tapering off towards the zenith to Cirro-strati and Cirri — ordinary clear sky to the Southward — A complete halo round the Sun.

Though the convergence of the winds be less marked here, it can be made out nevertheless for the winds from NE. and WSW., as the ship's position was north of the centre before the moment of shortest distance and also right south of that same centre on the evening of July 15th. The greatest violence was met with in the hinder part of the Typhoon with land winds from W. and SW., which fact may perhaps be explained by the consideration that the velocity of the SW. wind received an increase from the velocity of translation of the whirlwind, the reverse being the case with the NE. wind; it might also be said that, in point of velocity, the SW. wind had the advantage over the NE. wind in running as it were with the main equatorial current which carried the whirlwind along with it.

The british brig *Emily* (Capt. W. Crichton), sailing southward, seems to have passed through the centre of the Typhoon on the 15th, 3h. 45m p.m., by latit. 27°.0′ and long. 121°.30′. The barometer is said to have fallen only down to 28in 84, at 4h. 30m p.m. after the short period of calm, though on board the *Keelung* it fell to 28in.785; but the barometer of the *Emily* was an aneroid barometer and the correction is not given. At 3h. 45, «a sort of lull and shift of wind veering round from E. to SE., S. and SSW.: took advantage of the break and wore ship». The storm then became more and more furious.

Another sailing ship, the German brig *Peter*, sailing northward, passed close to the same spot about 3 p.m.: she found the same short calm and with her also the wind turned from E. to SE. and to SW.: the barometer, at 3 p.m., was at 28in.85.

Both these ships then touched the eastern edge of the central region of the whirlwind. Now, the *Keelung* by the same latitude and 121°.0′ long., had the wind from NE. afterwards veering to N., NW. and W., and she

passed outside of this central region somewhat to the West of it: it is therefore clear that on July 15th, between 3 and 4 p.m., the centre must have been lying by latit. 27° and longitude 121°25′, that is to say 110 miles due North of Tamsui. Since it had passed Tamsui between 8 and 9h. a.m., it had employed 7 hours to run that distance, and its velocity of translation had been 15.7 miles an hour.

Wenchow (latit. 28°2′ — long. 120°38′). — Mr. W. Stronach was so kind as to communicate to me his observations made at the British Consulate during the passage of the Typhoon. The wind had been blowing from NE. since 7h. a.m. of the 15th. As the centre of the Typhoon was then on Formosa to the South of Tamsui, it is clear that those persistent NE. winds at Wenchow were not circular, but convergent. — At 6h. 20m p.m. the wind shifted to N by W. whilst the barometer attained its minimum, 29in09: the centre thus passed to the East of Wenchow, not far from it. — At 8h. p.m. the wind veered to NW. — at 8h. 40m p.m. to W by S. — at 10h. p.m. to S. (strong) still blowing straight towards the centre which was getting near Hang-chow-foo Bay.

Ningpo (latit. 29°52′ — longit. 121°34′). — Wind: S. (force 1-3) since July 8th; turned to SE. (3-1) on the 14th afternoon, to E. (1-3) on the 15th, then SE. again and freshening rapidly in the evening of the same day. Wind S. (6-2) on the 16th; dying away on the 17th. The barometric observations made regularly every 4 hours in the Harbour-office supply data for calculating with sufficient accuracy the time and the amount of the minimum pressure: that is 29in10 at 1h 30m a.m. on the 16th. The centre of the Typhoon must then probably have been at that very moment passing somewhath to the west of Ningpo running northward, and it was on the 16th, 2h a.m. that it crossed the parallel of 30° by 121° long.

The mean velocity of the Typhoon, 3 p.m. on the 15th and 2 a.m. on the 16th, had therefore been 16.3 miles an hour, that is showing a slight increase since the centre had reached the continent.

Zi-ka-wei (latit. 31°12′ — longit. 121°26′) and **Shanghai.** — The first indication of the Typhoon's approach was not the fall of the barometer, for the passage in the North of a strong depression on the 12th had already caused the barometer to sink; on its rising again, on the 13th and 14th, the influence of the Typhoon, to be sure, made the rise be less than it would otherwise have been; yet the effect of the whirlwind which was running straight northward did not come out clearly. But there was another very frequent in such cases and more reliable sign, namely the appearance so soon as July 14th, 7 a.m., of loose vapoury low clouds, swiftly rising from the SE. horison and running to the North-west. The centre of the Typhoon was then near the North-east headland of Luzon, 660 miles South of Zi-ka-wei: at such a distance, we were evidently outside of the whirlwind properly said, but still under its influence. Now the formation of those loose swiftly running clouds may be explained by the fact of the lower currents, at the edge of the whirlwind, mixing with the descending cold currents driven from the centre in the upper regions of the air; for in a whirlwind the convergence towards the centre of the lower winds supposes necessarily the divergence of the upper ones. In the present case, the high currents which were running from the centre of the storm yet could partially reach our latitude in the shape of an inclined SW. current, and their lower temperature gave rise to condensations on meeting the lower warm moist currents.

On the next day, 15th, the higher clouds showed that there was an upper current running between SW. and W., and the strong ESE. wind that blew before noon being much inclined upwards could not fail to bring showers as it really happened. Towards evening the rain became heavy and the wind violent: the Typhoon had come.

On the 16th, 2h a.m., the rain had ceased; there blew violent squalls between E. and SE.; thinly scattered nimbi looked high and were running from SE. to NW. — At 2h 30m a.m. the wind shifted a little to the NE.

and rain began to fall again abundantly. — At 3h 30m a.m. the wind came back to ESE. — Between 4 and 5h a.m., barometric minimum; — strong oscillations of the mercury, though the mean height did not vary; — wind now from SSE. blowing with frightful violence : between 4 and 5 a.m. velocity 45 miles : the velocity during the squalls may have been 55 or 60 miles an hour — At 5h 45m a.m. clouds running to North or inclining slightly to NE.; wind abating. — Several trees were uprooted at Zi-ka-wei.

Between 9h and 10h a.m. the wind turned to SW. and about 1h p.m. to WSW. On the 17th, midnight, it shifted to W. and during the whole day oscillated between W. and WSW.

Zi-ka-wei Observatory

DIRECTOR R. F. M. DECHEVRENS S. J.

Latit. 31°.12'.30" — Longit. 120°.26'. 20"

Date	Hours	Barometer at sea level	Winds Direct.	Winds Velocity	Temperat. of the air	Humid. %	Tension of vapour	Clouds Upper	Clouds Lower	Rain
		in		miles	°		in			inch.
July 14th	1 P. M.	29.779	S	12.6	77.7	93	0.886	0		
	4 A. M.	.780	S	5.3	77.0	95	.882	0		
	7	.792	SSE	10.6	82.6	85	.953	2 C	SE	
	10	.781	SSE	13.4	88.3	72	.965	4 C	SSE	
	1 P. M.	.772	SSE	15.3	88.0	71	.933	5 C	SSE	
	4	.707	SE	18.7	85.5	78	.953	6 C	SE	
	7	.724	SE	14.4	81.1	88	.941	Ac 4 C	SE	
	10	.754	ESE	11.9	79.5	94	.957	4		
15th	1 A. M.	.706	ESE	10.6	78.8	97	.953	8		
	4	.693	ESE	5.5	78.8	96	0.949	Ac SW 10	Ni ESE	
	7	.714	E	6.6	79.3	97	1.977	10	Ni	
	10	.705	E	15.8	84.7	85	1.019	Ac W 10	Cn E	0.055
	1 P. M.	.656	E	19.0	85.3	83	0.009	10	Cn E	
	4	.608	E	23.4	81.7	90	.976	10	Ni E	
	7	.547	ENE	24.5	79.5	93	.949	10	Ni E	
	10	.461	E	28.8	78.1	100	.961	10	Ni	1.288
16th	Midnight	.408	E	28.3	78.8	94	.933	10	Ni	
	1 A. M.	.356	ESE	29.6	77.7	98	.925	10	Ni	
	2	.302	ESE	31.0	77.2	97	.902	10	Ni SE	
	3	.216	ESE	41.2	77.2	94	.878	10	Ni	
	4	.132	SSE	44.7	75.9	99	.890	10	Ni	0.559
	5	.129	S	34.6	77.0	99	.921	10	Ni S	
	6	.162	SSW	26.5	77.2	100	.933	10	Ni SSW	
	7	.220	SSW	25.0	77.0	100	.929	10	Ni SSW	
	8	.256	SSW	26.5	77.2	100	.933	10	Ni	
	9	.294	SW	28.3	77.7	100	.949	10	Ni	
	10	.325	SW	26.0	81.3	90	.965	10	Cn SW	0.740
	11	.334	SW	23.4	82.9	87	.980	10	Cn	
	Noon	.344	SW	23.4	82.9	87	0.988	10	Ni	
	1 P. M.	.357	WSW	22.3	82.4	92	1.019	10	Ni WSW	
	4	.393	W	19.6	77.9	88	0.839	10	Ni WSW	
	7	.443	WSW	18.7	76.5	87	.788	10	Ni W	
	10	.533	WSW	12.2	75.9	90	.803	10	Cn W	
17th	1 A. M.	.555	W	12.3	75.6	90	.795	10	Cn W	
	4	.614	W	8.6	74.3	89	.752	10	Cn W	
	7	.642	WSW	10.7	74.7	90	.767	9	Cn W	
	10	.654	W	15.7	78.4	88	.855	8	C Ni W	

At Zi-ka-wei, the wind veered from E. to W. through S. : consequently the centre of the Typhoon passed to the West of us.

At Shanghai the steamers in the river got up steam and the sailing vessels strengthened their moorings, and so far as these larger vessels are concerned little or no damage was done; but the damage to cargo-boats, sampans and small craft in general, must have been considerable, as the foreshore of the Bund amply showed at an early hour on the 17th morning. The loss of life amongst natives, especially amongst the junks anchored opposite the city, is thought to have been large, as several bodies have been seen floating down the river. The Bund presented a pitiable sight, trees here and there having been blown down . . . etc.

Chinkiang (latit. 32° 13′ — long. 119° 27′). — The Typhoon continued its course northwards, skirted along the great lake West of Shanghai and went to cross the Yang-tze-kiang somewhat to the East of Chinkiang,

a port of commerce situated on the right bank of the river, 110 miles North-west of Shanghai and 47 miles East of Nanking. The northerly wind there blew with a terrible violence, as may be seen on the following table.

Chinkiang

HARBOUR MASTER'S OFFICE.

Date	Hours	Barometer	Wind		Clouds	Rain	Remarks
		in					
July 15th	9 A. M.	29.59	SE	3	10		Overcast and threatening rain.
	Noon	.60	E	4	10		
	3 P. M.	.56	NE	4	10		
	6	.51	ESE	5	10		Light rain.
	9	.50	E	6	10		Very squally.
16th	Midn.	.50	E	7-8	10		At 11 p.m. suddenly commenced blowing in heavy gusts.
	3 A. M.	.55	E	7-8	8		raining from 12. 30 to 3.30 a.m.
	6	.56	N	5-6	8	in	Raining from 4.30 to 6 a.m., the wind having gone down
	9	.20	NNE	9-12	7	0.86	considerably.,
	Noon	.27	NNW	9-12	5		At 8 a.m. sudden fall in the barometer and the wind
	3 P. M.	.31	W	8-10	6		shifted round to N., NE. and NNE.
	6	.35	NNW	7-8	6		The worst of the gale was between 9 a.m. and 3 a.m.,
	9	.36	NNW	6-7	7		from the NNE and NNW. — about 4 p.m. the gale began
17th	Midn	.46	NNW	7-8	7		gradually to abate.
	3 A. M.	.46	NNW	6-7	7		From midnight to 8 a.m. raining, and then it commenced
	6	.46	NW	5-6	6		to clear up.
	9	.55	W	4-5	4	0.55	
	Noon	.52	W	4-5	7		Fine, but dull and hazy.

The stone-faced bund resisted the action of the waves admirably. One bad accident occurred. A boat, overcrowded with 20 passengers, was upset by a squall on the 17th morning, and all but three drowned. Six were Pekingese just arrived; they left four more cautious friends on the north bank, who decided to await more favourable weather. The boatmen and crew were saved by the exertions of native lifeboats of the local Humane Society, only, however, to be arrested by the Magistrate for carrying ten passengers over the legal limit allowed for boats of his size.

Chefoo. (latit. 37° 36′ — longit. 121° 26′) and **cape Shantong** (latit. 37° 24′ — long. 122° 42′).—Chefoo is a sea port on the North coast of the Shantong Peninsula. On the extreme NE. headland of that Peninsula there stands a Light-House whose light is 200^{ft} above the sea.

A chain of high peaked hills, 2 to 3 miles in breadth, rises eastward of the sandy plain of Yung-ching (longit. 120° 10′) and forms the Shantung Promontory. These hills when first seen from NW. or SE. make like a number of pointed detached islets of peculiar appearance. Five of them are very prominent: the highest, 910 feet high, called Ta-ching-shan, (which is also the Chinese name for the Promontory), is the western peak; it is very pointed and precipitous, except to the north, on which side it has a gentle slope. "Sharp" peak, 680 feet high, half-way between this and the extreme of the Promontory, is also remarkable, with deep valls on either side.

Such is the obstacle against which the Typhoon came to strike on the morning of July 17th and which it was unable to get over. And yet there is no doubt but that its course hitherto so straight and sure had been directed to this point by special atmospheric conditions. For, as stated before, there was a strong depression spreading all over the North of China from the 10th to the 15th of July and the heat had become excessive, as may be gathered from the following observations out of the *Bulletin mensuel* of the Observatory of the Jesuit Missionnaries at Chang-kia-chwang (lat. 38° 17′ — long. 116° 14′).

Chang-kia-chwang

Director: R. F. GATTELIER S. J.

Latitude 38° 17′ — Longitude 116° 14′ — height 100 feet.

Date	Barom. mean at s. l.	Temperature maxim.	Temperature mean	Humi. %	Evapor. per day	Clouds	Prevailing winds
	in	°	°		in		
July 10th	29.735	100.8	88.2	46	0.496	4 Cirri NE. N	S
11th	.628	104.5	92.3	43	0.488	3 Cirri N	S
12th	.463	111.2	97.0	43	0.591	5 Cirri N. NE dusty	S-SW-N
13th	.626	100.4	86.9	34	0.425	1 Cirri-Cumuli E	NE-E-SE
14th	.618	99.1	83.7	56	0.370	3 Cumuli E	SE
15th	.707	91.4	77.9	75	0.189	5 Cirri-Cumulo nimbi E	E-SE

It is clear that there was at that time a polar current above the surface equatorial current.

At Taku, at the mouth of the Peiho (Tientsin river) the thermometer, on the 11th, marked 102° in the shade, and on the 12th afternoon 108°.

At Chefoo, with a cloudy sky, there was 96° on the 11th, and 102° on the 12th (1).

At Si-wantze, in Mongolia, north of the Great Wall (latit. 41°.0′ — long. 114°.50′), at a height of 5360 feet, the temperature rose to 73°.9 on the 10th, 1h p.m., and to 75°.4 on the 11th.

If that northern depression together with this high temperature realized conditions such as to attract the whirlwind towards those regions of North China, the radical change in the state of the atmosphere which took place little before the arrival of the Typhoon to the Shantong Peninsula must also have been the cause of the sudden check it underwent and of its partial vanishing in the Yellow Sea. For let us consider what took place at Newchwang, on the coast of Liao-tong in the north of the Gulph of Pechili (lat. 40°.43′—long. 122°.14), on the line which, according to all probabilities, the whirlwind was to follow. We find that on July 12th, 7h. p.m., the barometer, under the influence of the above mentioned northern depression, had fallen down to its minimum, 29^{in}.28. From that moment it rose steadily till noon on the 16th (29^{in}.60) with feeble or moderate wind from SW.; it fell somewhat on the 17th and 18th (minimum on the 18th, 6h p.m.: 29^{in}.46) the wind during that interval having shifted to NW. and NE. to come back to WSW. and SW. through S., feeble all the time. On the next day, 19th at 6h a.m. the barometer had again risen to a maximum 29^{in}.55 which also was the mean pressure of the month.

At Chefoo, there was a barometric maximum on the 16th, midn. (29^{in}.75), with wind from SE., force 1. It was followed on the 17th, 4h. p.m., by a minimum (29^{in}.58) though but little marked for such a proximity of the Typhoon. The wind, since the 16th, noon, was blowing from NE., force 3 and continued in that direction till the morning of the 19th when it abated to force 1 and shifted to E. — At Cape Shantong Light-house, there was a similar barometric variation, but the E. wind which blew constantly on the 16th, 17th and till the afternoon of the 18th was stronger (force 4-6-3); it afterwards turned to SE. force 4, then on the

(1) It is not without interest to note the enormous difference of temperature then observed between two points but little distant from each other and differing but little in altitude, viz. Chefoo and the Shantong Light-house, at the North-east point of the Shantong Promontory: it is about 70 miles to the East of Chefoo; its heihgt above the sea = 270 ft. On July 18th the thermometer at Chefoo, at the sea level, rose to 102.°2: at the Light-house it only reached 69.°8. The mean temperature of the month as resulting from 4 daily observations at each station, was at Chefoo 79.°2 — at the Light-house 72.°0 (a decrease of 1° for every 38 ft of difference of level). Such a rapid lowering of the temperature at an inconsiderab'e height naturally brought about the saturation of the moist air rising from the sea; and in fact the report of the observations made at the Light-house during that month of July mentions that two days only, viz. the 3d and 4th excepted, there was a constant fog round the lantern! There was no rain at that altitude, whilst at Chefoo on the contrary it was frequent and the sky during the month was almost constantly overcast: hence the lower figure for the mean temperature of the month at Chefoo, viz. 79.°2 compared to that of Chang-kia-chwang (83.°8) and of Zi-ka-wei (81.°5).

20th, to S. force 4. — At Taku (Tientsin river) the barometer stood high on the 16th, 17th, 18th and 19th with moderate easterly wind.

All this, I think, clearly proves that the Typhoon did not cross the Shantong Peninsula and did not get to the North of Chefoo either over the plains of Shantong, West of the hills of the Peninsula (for the barometer stood high at Chang-kia-chwang and particularly at Taku), or round Cape Shantong over the northern part of the Yellow Sea, for the wind at the Light-house continued from E. and at Newchwang turned to the W. through S. Moreover, we have a document to set all doubts at rest and prove that the whirlwind did not cross the 37th parallel between China and Corea, that is the report of capt. D. Rüte of the Schooner *Faugh Ballaugh*: she was sailing from Newchwang to Amoy and turned Cape Shantong at noon on July 16th, at the moment when the Typhoon had just crossed the Yang-tze-kiang, east of Chinkiang.

Schooner **Faugh Ballaugh**

CAPTAIN D. RÜTE.

Date	Hours	Latit. Longit.	Barom.	Wind		Remarks
			in			
July 16th	Noon	36°.56,-123°.21,	29.72	ESE	4	Rain
	4 P. M.		.62	E	6	
	8		.57	E	7	
	10		.49	E	8	Squalls and heavy rain — hove to.
	11		.45	E by N	10	
17th	Midn.		.42	ENE	11	Barometer unsteady.
	2		.42	E	11	
	4		.40	E	10	6 a. m. Kept steer course.
	8		.43	E	8	
	Noon	35.48,-123.20,	.40	ESE	8	

The wind on the 17th to the 18th noon veered to SE. and moderating — barometer to 29^{in}.54.

On the 18,19,20,21 and 22, fog and moderate S by E. and SSE. breeze — barometer 29^{in}.70 very steady. On the 22nd, noon, latit. 33°.14′ — longit 123°.53′.

Thus in the middle of the Yellow Sea, the wind on the 17th and 18th continued between E. and SE., and notwithstanding the violence of the storm during the night of the 16th-17th, the barometer did not sink below 29^{in}.42, a slight fall for the season of the year and the region where the ship lay.

The course of the Typhoon northwards must then have been interrupted after it got to sea again by latit. 34°. — What became of it?.... — It is worthy of note that during that night of the 16th-17th, at cape Shantong, at the height of the Light-house, the force of the wind did not exceed 6, whilst some distance at sea there was blowing a hurricane (force 11). It was a last effort of the whirlwind in a region where the elements of its preservation and development were wanting, and though some remains of this great storm may yet be followed up eastwards in the direction of Japan, there is properly no Typhoon any more to detain us in this great inner sea of China and Corea.

Japan. — It will not be without interest to follow eastward the runaway storm so suddenly escaped out of the main Typhoon come to grief in the neighbourhood of the Shantong Peninsula. There is nothing unprecedented or uncommon in this division of a whirlwind generating secondary whirlwinds, which seem to run at random, often even getting further subdivided until the stored up energy of the storm is exhausted. A similar phenomenon may be observed in the whirlpools of a water-course, and what takes place there under our eyes will help us to understand the ways of our Typhoon in its last stage. Here our sources of information are the following:

1° — The Imperial meteorological Stations at

Nagasaki:	latitude	32.°44.′ 17″	—	longitude	129.°52.′29″	—	height	129	feet
Hiroshima:	,,	34. 20. 0	—	,,	132. 27. 0	—	,,	14	,,
Kioto:	,,	35. 1. 7	—	,,	135. 46. 10	—	,,	162	,,
Tokei: (Obser.)	,,	35. 39. 50	—	,,	139. 45. 10	—	,,	63	,,

2° — The 13 chief Light-houses on the coast of Japan, the most distant of which are

Satanomisaki:	latitude	30.°58.′ 30″	—	longitude	130.°40′	—	height	200	feet
Siriyasaki:	,,	41. 26. 10	—	,,	141. 29	—	,,	150	,,

The high pressures in the regions North of the 37th parallel were a bar against the invasion of the Typhoon. Gliding, as it were, along the foot of this obstacle, a secondary whirlwind, without any great energy, but easily known from the fall of the barometer it occasioned on its way, escaped in the middle of the Yellow Sea, making for the East : it rapidly traversed Corea and the Sea of Japan and got to the western coast of Nipon about 38° latit. On July 18th, about 10 p.m., it passed somewhat to the north of Tokei, the Capital of Japan, and got to the sea on the morning of the 19th. It then first ran SE., afterwards SW. on the 20th, 21st and 22d, with a greatly diminished velocity : its course was opposite to that of the great japanese current. On the 23th, it traversed the great island of Kiu-siu from E. to W., passing close to the South of Nagazaki, and on the 24th came back through the straits of Corea into the Sea of Japan : after running the whole length of it, it at last, on the 28th, issued into the Pacific through the strait of Sungar north of Nipon, and was finally lost sight of bearing SE.

Such, in a few words, is the curious rambling excursion of that small insignificant whirlwind : it remained for ten days in that region, maintaining a low pressure and bringing about sultry weather, thus opening the way for the Typhoon which in the last days of July was going to rage in the South of Japan.

It was at Hiroshima and Kioto that the barometric pressure was more affected, those two stations having from the 18th to the 25th been constantly within the great closed curve described by the track. Tokei and Nagazaki on the contrary lay at the two extreme NE. and SW. points of the almost triangular area enclosed within this singular track. At Tokei the barometer did not really read low except on the 18th ($29^{in}.715$ at 11 p.m.) when the whirlwind approached that town on first getting to Japan. The wind which blew from S. before the arrival of the whirlwind, turned successively to SW., to W. and N. On the 19th 3h p.m., it blew from E., then from ENE. on the following days and lastly from SE.

At Kioto there really also was but one barometric minimum, viz. on the 20th, 3h 30^{m} p.m. ($29^{in}.759$) the wind blowing from NW. feeble.

At Hiroshima, the lowest reading was $29^{in}.708$ on the 23d, 3h 30^{m} p.m.

At Nagazaki, the absolute minimum must have taken place on the morning of the 24th, about 3 or 4h. a.m., for at 9h. 30^{m} p.m. on the 23d, the barometer marked $29^{in}.740$ and at 9.30^{m} a.m. on the 24th, $29^{in}.921$, so that it must have fallen to $29^{in}.69$ at least. On the 23d, 9h p.m., the wind was NNE. (7.5 miles); on the 24th, 9h. a.m., it was ENE. (18.0 miles). It then appears that the light winds which obtained all over that region during the presence of the whirlwind, were generally convergent, that is blowing towards its centre. The approach of the whirlwind caused a slight fall of the barometer, at Zi-ka-wei on the 23d and 24th, in the north of China on the 25th and 26th.

The escape of that whirlwind to the north of Nipon through the strait of Sungar is well set off by the observations made at the Siriyasaki Light-house. On the 25th, the barometer stood at its maximum, $30^{in}.10$ wind SE. — On the 26th, and 27th, same wind, barometer sinking. — On the 28th, both at 9h. a.m. and 9h.

p.m. 29^{in}.76, wind SE. veering to W. through S. : the barometric minimum must have taken place about 3h. p.m.

The South-easterly direction apparently followed by the whirlwind on the 29th seems to have been the cause of the fall of the barometer observed in succession on that day, afternoon, at the Kinkwasan and Inuboyesaki Light-houses on the eastern coast of Nipon north of Tokei and so far as Tokei; but on the approach of the Typhoon about to follow the southern coast of the Archipelago, this secondary depression was lost and soon all trace of the "Formosa and Shanghai" Typhoon disappeared.

Extent of the Typhoon — Barometric gradient.

The Typhoon seems to have acquired its full development and the depth of the central depression not to have varied in any degree during the course of the 14th and 15th July. It was on the 14th, 6h p.m., that the steamer *Keelung* from Chefoo met with SE. winds (force 7) : she was getting into the zone of the Typhoon properly said. The barometer marked 29^{in}.724; on the next day, the ship being near the Centre, it sank to 28^{in}.785. On the 14th, 6h p.m., the ship lay by latit. 29°.9 and longit. 122°.19, whilst the Centre of the Typhoon was at latit. 21°.0′ and long. 122°.0′ : the storm therefore at that moment extended 485 miles to the North and the barometric difference was about 1^{in}.06, equal to 22 for 100 miles. On the 15th, 11th a.m., the *Keelung* was in latit. 27°.5′ and the Centre of the Typhoon in latit. 26° 43′, their distance being very nearly 22 miles : now the barometric difference being 0^{in}.607, the gradient was equal to 2,76 per 100 miles, a very high figure which accounts for the violence of the storm in this region.

The extent of the whirlwind from E. to W. was much less than from S. to N. Thus on the 14th, 6h p.m., the convergent SW. wind that was blowing at Hongkong had only force 3, that of a gentle breeze, with barometer at 29^{in}.58 : the Centre of the Typhoon was only 365 miles away to the ESE.

The steamer *Hoikow* (Capt. Th. Shaw) had left Amoy on the 15th, about 6 a.m.; with light N. wind — raining - swell from E. At 9h. p.m. had got off the White Dogs island (Light-house : latit. 26° 0′ — long. 120°.0′). The wind, from N. at starting, W. at 9h a.m., SW. at 4h p.m. now took the force 7 (moderate gale)- barometer 29^{in}.45 - position : 180 miles SSW. of the Centre.

At Tamsui, 215 miles South of the Centre, on the 15th 9h. p.m., the wind blew from SSW. (convergent), force 3-4; barometer 29^{in}.52. On that same day, between 3 and 4 p.m., the same wind got to force 7, then abated rapidly; barometer 29^{in}.40.

It is evident that the Typhoon, cramped behind and to the west, extended forward considerably. For the eastern side no document allows us in any way to determine the development of the whirlwind.

On the 16th, 3h 30^{m} p.m., the Typhoon was at the latitude of Nagasaki and entered the Yellow Sea again. At Nagasaki, wind S. light; barometer 29^{in}.782 rising : that port then was outside of the whirlwind, though its distance to the Centre did not exceed 520 miles.

On the other hand, the German barque *Juno* (Capt. Nielsen), on the 16th afternoon, being 200 miles North-east of the Centre was right in the whirlwind : wind SE. by E., heavy storm, terrific confused sea, heavy rain.

Swell. — It is important to ascertain how far from the centre that sure indication of heavy weather coming on was discernible during the period of this whirlwind.

In the report of Capt. Schulze *(SS. Keelung)* we find a swell from SE. noticed for the first time on July 14th, 4h a.m., by lat. 31°. 19′ and long. 123°. 6′, that is 800 miles North of the centre; wind S by E. force 4 —

barometer 29^{in}.843 just beginning to fall. The swell here then it was that gave the first announcement of the Typhoon. That heavy swell from SE. was also met at the very same time by the SS. *Foochow* (lat. 30°. 7′) and the SS. *Pakhoi* (lat. 28°. 10′). It might probably have been observed even sooner and farther from the Centre. For in the report of Capt. J. M. Clarke of SS. *Miramar* from Chefoo at the date of July 14th, midn., by lat. 36°, there is the following entry: "Dark cloudy weather with a heavySE. swell throughout, wind S. strong, barom. rising 29^{in}.82." — It is true however that this swell might as well have been due to those very strong Southerly winds that belonged to the depression already noticed on the 12th and 13th as extending over the North of China.

The steamer *Hoihow* in the port of Amoy on the 14th, with the wind NE. and N. abating, did not feel any swell, but as we have seen, on going to sea again on the 15th, 6h a.m., she met a swell from E. Her distance from the Centre was then about 230 miles.

The SS. *Fuh-yeu* (Capt. A. Croad) left Hongkong on the evening of the 13th, with light changeable wind; barometer high. On the 14th, 8h a.m., swell from ESE., wind NE by E. moderate breeze, barometer beginning to fall; latit. 22°. 50′ — long. 116°. 40′: the Centre was 400 miles to the ESE. — According to Capt. J. Wallace of the SS. *Glenroy*, in the afternoon of the 14th and next day there was in those whereabouts a swell from ENE. afterwards from NE. It was found less high in the Straits of Formosa; it ceased on the 15th about 6h p.m. to appear again at 8h p.m. from S. and increase rapidly under the action of the strong SSW. wind (force 5) then blowing.

Ship captains are therefore earnestly invited not to neglect taking notice of the Swell : the observation is of the easiest and gives an almost infallible indication of the weather likely to be met with. The existence of a swell, its direction and intensity should always be carefully noted down in the Logbook and never omitted in the reports intended to supply data for a circumstantial study of storms.

Casualties.

The passage of this Typhoon on our coast was marked by two shipwrecks.

The British barque *Aberdonian*, Captain Boig, was lost on one of the islands in the Chusan Archipelago, on the night of the 16th July. There were 25 men on board : six of the native crew saved themselves; the captain and the remainder of the crew were lost. The *Aberdonian* was reported by the survivors to have struck on a rock, and to have gone to pieces shortly afterwards. Nothing more was ever seen of her, although H. M. S. *Foxhound* went for a cruise round the islands. The *Aberdonian* was on a voyage from Newchwang to Swatow.

The American brigantine *Annie S. Hall*, owned and commanded by Captain C. H. Nelson (a grand nephew of the celebrated admiral), was lost in the same night. She was on a voyage from Newchwang to Hongkong, and after encountering the Typhoon, she anchored on the night of the 16th July, near the Island of Soudan (latit. 28°. 10′ - long. 121°. 30′). The ship lay on her beam-ends, and was completely disabled, so much so that next morning the captain and crew abandoned her, and reached Fung-me Island, one of the Taichow Group, and from thence were taken in a Chinese gunboat to Ningpo. One of the crew had been killed when the deck-houses were swept away by a heavy sea. The captain reported that the vessel sank ten minutes after he left her.

Fifth Typhoon : 26th July — 2nd August 1881.

PROBABLE TRACK :

			Latitude	Longitude
July	26th Midn.		20°. 0′	126°. 0′
,,	27th Midn.	Sea	21. 30	126. 30
,,	28th Midn.	South-east	23. 30	127. 15
,,	29th Midn.	of	26. 0	128. 30
,,	30th Midn.	Japan	27. 30	129. 30
,,	31th Midn.		29. 0	130. 30
August	1st Midn.	Southern coast	31. 15	132. 30
,,	2nd Midn.	of	32. 30	136. 0
,,	3rd Midn.	Japan	33. 30	141. 0

EVENTS : Floods in southern provinces of Japan.

It was on July 18th that the preceding Typhoon, having lost much of its violence, reached the western coast of Japan, and already on the 19th there appeared in the upper regions of air at Zi-ka-wei and at Manila cirri and cirro-strati which revealed the existence of a polar current contrary to the equatorial current that swept the surface of the earth, running this time between N. and NE. and foreboding further perturbation in the region at least whence it came. For this upper current clearly indicated the existence to the NE., that is in the direction of Japan, of a centre of depression from which issued those diverging upper currents evidently fed below by the contrary S. and SE. equatorial current that was sweeping our coast and the southern coast of Japan. That centre of depression could have no other cause than the whirlwind we have mentioned after the "Shanghai" Typhoon and which took a ramble all over the great Japanese Archipelago. No wonder then under such circumstances, with two opposite currents lying one above the other and sometimes coming into collision, that a new Typhoon should have originated and been carried along with the lower current.

First indication of the Typhoon.

At Manila the upper NE. current made its appearance so early as the 19th, but the barometer did not take to sinking before the 24th : it attained its minimum $29^{in}.725$ on the 26th. The centre of the depression seems to have remained to the North-east of Luzon.

On the island of Formosa, both at Tai-wan-foo in the South and at Tamsui in the North, the barometer kept low on the 28th, 29th and 30th; the absolute minimum ($29^{in}.55$) was observed in the evening of the 28th.

At Ningpo, below Shanghai, minimum $29^{in}.53$ on the 30th, evening.

At Zi-ka-wei, minimum $29^{in}.519$ on the 31st, 4 p.m.

At all these stations the wind kept blowing light between S. and SW. The centre of the depression must therefore have been somewhere to the North-east. It kept far from the coast of China and bore from South to North.

The Typhoon in Japan.

Nagasaki. — The barometer, on the 27th, 9h a.m., had risen to $29^{in}.903$. Wind light from SW. It continued in that direction till the 30th when it shifted to NW., keeping light all the time. On the 31st, it veered to N. rather increasing in force (16 miles); the barometer had its minimum $29^{in}.525$ on the same day, about 3 p.m.

The wind came back to WNW. on August 1st, to WSW. on the 2nd, to SW. on the 3rd, light all the time. The depression therefore still kept pretty far from Nagasaki : it passed to the South of that town (wind N. and NW.) and took an easterly direction (wind WNW. and WSW.). There fell no rain.

Satanomisaki Light-house on the southernmost cape of Japan (latit. 30°.58′ - longit 130°.40′) — The barometric minimum 29in.48 must have taken place on July 31st afternoon. The wind that since July 25th was blowing from E., turned to NE. on the 30th, then on the 31st to NNW. and W. freshening, and continued in this last direction to the 9th of August. There fell some little rain of July 31st. The Typhoon on its eastwardly course must then have passed pretty near Satanomisaki.

Siwomisaki Light-house (latit. 33°.26′ - longit. 135°.45′). Southernmost point of the Province of Kii. This is probably the point of the southern coast of Japan to which the Typhoon came nearest, on the morning of August 1st, and also the only one where the wind seems to have attained a hurricane violence. The wind varied from E. to SE. on July 31st, came back to ENE. on August 1st and then turned to W. The lowest reading of the barometer recorded is 29in.05 on August 1st 9h a.m. On that day there fell 5in.6 of rain : altogether 8in since July 30th. Local floods are reported in the provinces nearest to the track of the Typhoon.

Hiroshima. (latit. 34°.20 - longit. 132°.27′) — Barometric minimum 29in.426 on August 1st., 3h 30m p.m. Wind moderate from E., NE., NNE. and lastly from SW. on the 3rd.

Omaisaki Light-house (latit. 34°.36′ — longit. 138°.13′). Southernmost point of the Province of Totomi, to the West of Suruga Gulph. Only moderate wind from E., SE. and W. The barometric minimum must have been 29in.42 between 2h and 3h. p.m. on August 2nd.

Tokei Observatory (latit. 35°.40′ - longit. 139°.45′ — There was no heavy weather experienced in the Gulph of Yeddo; the barometric minimum, 29in.554, was observed at 1h a.m. on August 3rd. On the 2nd, the wind was ENE. (9 miles); on the 3rd it turned, before noon, to NNW. (10 miles) and in evening to NNE. (3 miles); lastly on the 4th to ESE. (4 miles). The Typhoon then kept at a good distance from the capital of Japan; it must have proceeded straight E. or ENE. into the Pacific; its velocity was comparatively very slow.

The foregoing extracts show that there was no great notice taken of this storm. As for its being truly a Typhoon, the report of the captain of the German barque *Annie* leaves no room for doubt.

«The *Annie* left Shanghai on the 21st ult., and experienced fine weather to Van Diemen's straits; but when off the Bungo Channel on the 30th, the weather changed, and the wind blew hard from the NE. with a heavy cross swell from SE. All sail was taken in, but the vessel laboured heavily and sprung her jibboom; the barometer at noon reading, 29in.85 (with the wind and sea increasing), which by midnight had fallen to 29in.76, a tremendous cross sea running. Next morning at 6 o'clock the wind had shifted eastwards, bar. at noon 29in.67, blowing a fearful gale accompanied by blinding squalls, which shut in all around. In the afternoon the wind hauled to ENE. and at 10 p.m. veered to E., bar. 29in.60. On the 1st inst., morning, the typhoon had reached its height, the glass reading from that to 10 a.m., 29in.10; the wind chopping to the E. and N., ship straining heavily. At 11 a.m., the glass rose to 29in.30, and the weather gradually moderated. After the storm, four and a half feet of water were found to be in the hold, and the position of the vessel ascertained to be 240 miles eastward of her course, with a current still setting east, so it was judged advisable to bear up for Yokohama, and, having taken a pilot off Vries Island, that port was safely reached on the night of the 6th of August.

"KIANG-SI" TYPHOON

Sixth Typhoon: 10th — 14th August 1881.

TRACK :

				Latitude	Longitude
August	9th	Midn.	South of Japan	27° 0′	133° 30′
		Noon		27. 30	133. 0
,,	10th	Midn.		28. 30	132. 30
		Noon		29. 0	132. 0
,,	11th	Midn.		30. 0	131. 15
		Noon		31. 0	130. 0
,,	12th	Midn.	Eastern Sea	31. 0	127. 30
		Noon		30. 0	125. 0
,,	13th	Midn.		28. 30	120. 30
		Noon		27. 45	117. 30
,,	14th	Midn.	China	27. 15	115. 0
		Noon		26. 30	112. 30
,,	15th	Midn.		26. 0	110. 30
		Noon		25. 30	108. 0
,,	16th	Midn.		24. 0	109. 0
		Noon		24 45	109. 0 ?
,,	17th	Midn.		26. 0	109. 0 ?

EVENTS :

Terrific Storm on the coast of China.

Great floods in the Province of Kiang-si. — Great loss of life and destruction of property.

Direction of the Typhoon.

This Typhoon is remarkable both on account of its proceeding from East to West at a latitude where the usual run of storms is the opposite direction, and of the frightful havoc it carried into densely populated region of China.

Typhoons have been observed coming from the Philippinas, reaching China through the Gulph of Tonkin or about Amoy and issuing into the Eastern Sea (Tong-hai); others, like that of the 15th of July, touched the Chinese coast still higher, but they rose from South to North and soon left the continent to come to sea again. Piddington gives the track of two Typhoons, in September 1843 and in July 1848, both of which seem to have come to Shanghai from the South-east. Another one, whose date is not given, appears to have penetrated into the continent almost to the same point as our present Typhoon, running also from South-east to North-west. I am inclined to think that the directions given for those Typhoons are somewhat wrong, by the simple reason that Piddington clung fast to his theory of circular winds blowing round the centre of the whirlwind; whereas according to all my investigations of the Typhoons within the last three years and of the common storms since 1877, this view does not hold good along the coast of China where the winds have constantly been found more or less converging to the Centre; the three Typhoons of Piddington, properly investigated, not from one single captain's report, however carefully drawn up, but from observations at various points pretty distant from each other, would probably have been found to have come to the coast of China from the same quarter as the Typhoons of July 1879, 1880 and 1881, that is rising direct from South to North.

The present Typhoon is then as yet unique with regard to direction : it ran from East to West at a comparatively high latitude, and what is rather strange, far from abating in violence on alighting on the continent, it seems to have gathered new strength and become more furious.

And yet there was nothing very uncommon in the causes of its formation and of its subsequent course. In the East there was a Typhoon moving away, viz. that of the Southern coast of Japan (August 1st-3rd), and leaving behind on the Archipelago a secondary whirlwind that followed in its wake. Here was a new cause of

low pressures that lasted till the 8th, at once to give room to high pressures (Nagasaki : 29^{in}.93 on the 8th and on the 9th, 9h. a.m. — Kioto : 29^{in}.98 on the 10th, 10h. a.m. — Tokei: 30^{in}.06, on the 10th, 9h. p.m. A whirlwind taking rise on the ocean under such circumstances must first be attracted towards Japan, then thrust aside: it is precisely what happened. — In the West, on the Chinese continent, the temperature kept high (mean of the maxima from the 1st to the 11th = 92°), and at the same time the atmospheric pressure, compared with that of Japan, was very low; thus when at Nagasaki the mean reading of the barometer at 9h. a.m. for the first ten days of August was 29^{in}.825, from the 1st to the 11th it was 29^{in}.76 at Zi-ka-wei and Foochow on the coast of China, 29^{in}.68 at Chang-kia-chwang (Tchili), and 29^{in}.62 at Hankow, 600 miles west of Shanghai: it is therefore towards that quarter that the whirlwind must have been driven by the high pressures which on the 10th settled over Japan.

First signs of the Typhoon.

Whether this Typhoon was in close connection with the preceding one of August 1st-3rd; whether it was not that very same Typhoon turning westward again, though when last seen it seemed to be making for the Pacific Ocean, or whether it was not a new distinct whirlwind due to those peculiar atmospheric conditions the preceding Typhoon had contributed to establish in Japan : — these are questions it is imposible to answer for want of information with regard to the whereabouts of the whirlwinds in the interval between the 3rd and 8th of August.

The first stations where, as early of the 9th, the sinking of the barometer announced the approach of the whirlwind, were Satanomisaki on the Southermost headland of Japan, and Nagasaki. At Zi-ka-wei there was no marked sinking before the 10th about noon.

At Satanomisaki and Nagasaki, the wind since the beginning of the month, had kept steady from W., under the influence of the two easterly depressions already mentioned; it now suddenly turned to NE. (at Satanomisaki on the 9th before noon; at Nagasaki on the 10th afternoon), then to E. and lastly to SE. after the Typhoon had taken to run towards China. The Typhoon at those two stations was then felt as coming from S. or SE.

			Satanomisaki (Light-house : 200 feet)				**Nagasaki Observ.** (Height: 189 feet)			
Date		Hours	Barometer	Wind.		Rain	Barometer	Wind.		Rain
			in			in	in		miles	nt
August	9th	9 A. M.	29.94	NE	moderate		29.929	N	4.8	
		9 P. M.	.92	E			.898	SSW	0.6	
,,	10th	9 A. M.	.90	E	breeze		.903	SW	2.6	0.50
		9 P. M.	.87	E			.839	ENE	16.2	
,,	11th	9 A. M.	.78?	E	gale		.749	ENE	11.6	
		9 P. M.	.75	SE		0.30	.745	N	2.1	
,,	12th	9 A. M.	.78	S	gale		.775	E	8.6	0.29
		9 P. M.	.84	S			.839	SE	5.6	
,,	13th	9 A. M.	.87	S	moderate		.838	ESE	7.1	
		9 P. M.	.89	S			.879	SSE	4.0	

At Satanomisaki the barometer fell 0^{in}.30 from the 9th 9h. a.m. to the 11th between 4 and 5h.a.m. when it reached its minimum = 29^{in}.66. The barometer sank rapidly for 20 hours before the minimum; its rising again was slower. — At Nagasaki minimum 29^{in}.70 on 11th, about 3h. p.m. (fall : 0^{in}.23). Rising again still more slowly that at Satanomisaki Light-house. — The indications of the barometer show that the whirlwind, after drawing towards the Light-house, left it on its right and went some way on to the North-west (latit. 31°-longit. 128°)

before it turned due West. The wind never was very strong, except at Satanomisaki where on the 11th there blew a strong gale of E. and ESE.

At Zi-ka-wei, during the whole of the 11th the sky was almost entirely clear; only a few isolated cumuli appeared now and then coming from the NE. On the evening, between 8 or 9h., all the horizon to the East overspread, first with Cirri, then with Cumuli also from NE. and very high vapours soon taking up the whole sky. On the 12th, 4h. a.m., vapory low cumuli could be seen running very swiftly from NNE. to SSW., whilst Cirrostrati rose up from the ESE. The barometer was sinking rapidly: the Typhoon then was approaching the coast of China. Our principal observations made during the passage of the Storm to the South of Zi-ka-wei are as follows.

Zi-ka-wei Observatory.

Date	Hours	Barometer at sea level	Wind Direc.	Wind veloc.	Therm	Humid. %	Clouds Upper	Clouds Lower	Rain	Remarks
		in		miles	°				in	
August 10th	4 A. M.	22.819	S	1.3	80.2	98		0 C		2h — 3h p.m. Squally in the NW. and W., thunder and light shower.
	10	.862	SE	4.9	95.1	64		3 C ESE		
	4 P. M.	.803	variab.	2.1	87.1	86		8 C		
	10	.816	SE	5.0	81.3	92		0		
11th	4 A. M.	.765	SE	6.0	79.2	98		0		Barometer falling — Typhoon in the South.
	10	.770	NE	6.0	90.3	67		1 C NE		
	4 P. M.	.723	NE	3.1	88.0	69		2 C NE		
	10	.728	NNE	4.3	80.1	94	K. Br	4 C NE		9h p.m. Horizon E. overcast.
12th	4 A. M.	.648	N	6.4	79.7	96	Ks ENE	6 C NNE	nil	
	10	.648	NE	18.3	85.6	81	Ac ENE	10 C NE		
	4 P. M.	.579	NE	20.1	85.8	81	Ks	10 C NE		
	10	.604	E	16.0	81.7	87		10 C		
13th	4 A. M.	.577	ESE	18.3	79.0	89	Ks ESE / Ac SE	7 C SE		5h 30m a.m. Rainbow on clouds.
	10	.627	ESE	23.5	90.0	71	Ks SE	6 C SE		
	4 P. M.	.601	ESE	23.0	86.5	79		9 C ESE		
	10	.673	ESE	15.0	80.6	93		2		8h 15m p.m. Meteor in the Scorpion.
14th	4 A. M.	.652	ESE	12.8	79.2	95		0		
	10	.696	SSE	15.5	87.4	76	K	7 C SE		10h a.m. Light shower.
	4 P. M.	.693	SE	21.4	86.7	77		8 C SE		Barometer rising.
	10	.765	SE	15.0	80.4	93		0		
15th	4 A. M.	.774	ESE	15.0	79.3	93		2 C SE		
	10	.847	SE	21.3	87.4	72		7 C SE		

Such a variation of the wind from NE. to E. and SE., coupled with a real atmosperic depression is exceedingly rare at Zi-ka-wei, since the fact of a depression moving from E. to W. within a short distance is almost unheard of at this latitude.

The Typhoon at Sea.

There is no notice of any ship having met the Typhoon in the open sea; all the best and most detailed information is supplied by ships that were sailing along the coast visited by the storm on the evening of July 12th. Having then seen the Typhoon leave the neighbourhood of Japan, we shall take it again at the moment of its alighting on the continent to carry havoc and death on its path.

Ships at the North of the Centre

Steamer **Pecheli,** CAPTAIN W. H. JACKSON.

Date	Hours	Latit.	Longit.	Barom.	Wind		Remarks
		° ′	° ′	in			
July 12th	Midnight	30. 50′	122. 20′	29.74	NE	4–5	Hazy.
	4 A. M.			.63	NE	4	Heavy swell from the Eastward.
	8	29. 52	122. 36	.51	N by E	5	
	10. 30	29. 25	122. 31	.38	N	6–7	
	11 30			.28	N	9	Slowed engines and put ship's head to the
	Noon	29. 10	122. 35	.16	N	9–10	sea: terrific sea running from the ENE.
	2. 30 P. M.			.06	NNE	9–10	Hazy and cloudy: atmosphere full of spray.
	4	28. 50	122. 40	29.00	NE by N	10	Hard storm — tremendously heavy sea run-
	4. 30			28.96	NE	10–11	ning.
	5			.94	NE by E	11	
	6. 30			.90	ENE	12	Full hurricane force.
	6. 50			.91	ENE	12	
	7. 30			28.95	E	12–11	
	9			29.12	ESE	12–11	Terrific sea struck the ship.
	10. 10			.25	SE	9	
	11. 10			.34	SSE	8	Experienced rain squalls.
July 13th	Midnight	28. 38	122. 30	.41	SE–SSE	8–7	
	5. 15 A. M.			.56	S	6–5	Heavy showers of rain.
	8			.62	S	4	
	Noon	27. 51	121. 42	.61	S	3	

The Typhoon is perfectly set out by these observations and, with such a frightful wind so near the coast, one may well imagine what heart-rending disasters must have taken place in populous districts where the harvest was standing ready for the sickle. The minimum of the barometer took place on the 12th, 6h 30m p.m., with the wind ENE. force 12. Since it may be admitted that strong winds near the centre are circular, it follows that the course of the Typhoon at that time bore from ENE. to WSW. : the centre lay then 65 or 70 miles from the coast.

The steamer *Swatow* (Capt. J. Hutchison), from Shanghai to Swatow had stopped for shelter under the lee of Pootoo Island (latit. 29° 58′ — longit. 122° 22′), where she remained till the 13th 8h a.m. — At 8h a.m. on the 11th, the wind was N. force 5-6. At 2h. p.m. on the 12th, it still blew from N. force 7-8; - at 4h p.m. NNE. force 7; - at 6 p.m. NE. force 6-7; - at 8 p.m. NE by E. force 8-9; - at 10h p.m. ENE. force 7-8. At midnight on the 13th it had veered to ESE. force 8-9 and finally settled SE. force 5-6 at 2h a.m. Rain began to fall on the 12th, noon, and continued till 4 a.m. on the following day. The barometric minimum seems to have been observed on board the steamer between 4 and 6 p.m. on the 12th : wind then between NNE. and NE. The winds were evidently convergent, not circular; but those met by the steamer *Pecheli* much nearer to the Centre, if still convergent, were very much less so.

Ships at the South of the Centre

Chinese Steamer **Hwai-Yuen,** CAPTAIN OSCAR WILSON.

Date	Hours	Latit.	Longit.	Barom.	Wind		Course	Remarks
		° ′	° ′	in				
August 12th	8 A. M.	26. 23′	120. 34′	29.80	WSW	4	N	Heavy swell from E. — Rain.
	Noon	26. 59	120. 50	.70	WSW	5	NE by E	
	4 P. M.	27. 30	121. 0	.55	WbyS	8	N	Terrible squalls of wind and rain.
	6	28. 5	121. 5	.48	WbyS	10	NE by N	Anchored in Bullock harbour
	7	anchored		.30	WSW	10		—squalls and rain increasing.
	8			.20	WSW	11		
	9			.10	WSW	12		
	10			.05	WSW	12		
	11			.05	WSW	12		Very heavy rain.
August 13th	Midnight			.15	SW	11		Squalls terribly strong.
	1 A. M.			.20	SSW	11		Heavy rain.
	2			.40	S	10		Rainy — heavy squalls.
	3			.50	SW	11		
	4			.60	SW	9		Rain moderating.
	6			.65	SW	7		Showers with frequent lulls.
	7			.70	SSW	6		Proceeded on our voyage.
	8			.80	S	6		

This report brings out the same fact of moderate winds (WSW. force 4 at 8 a.m. and noon on the 12th, latit. 26°30′ - longit. 120°40′) at a good distance from the Centre being more or less convergent, whereas the convergence disappears almost entirely for furious winds in the zone nearest to the Centre (WSW. force 11 and 12 from 8 to 11 p.m. on the 12th at the moment of the barometric minimum).

At 6h 30m p.m. the Centre lay by 122°40′ long.; between 10 and 11h p.m., by 121°, bearing all the time from ENE. to WSW. The distance run over being 95 miles, the velocity of translation must have been near 24 miles an hour, — The steamer *Hwai-yuen* got within 36 miles of the Centre which lay to the NNW. of her.

At Wenchow (English Consulate) lat. 28°0′ - long. 120°40, the barometric minimum 29in07 took place on the 12th, between 11h and 11h 30m p.m.

The Storm at Sea.

The barque *Omega* (Captain Ch. Bruce), from Chifoo to Amoy, must have passed very near the Centre of the Typhoon on the 12th about noon: for the ship's barometer fell down to 28in50 (correction?): wind hurricane force turning from N. to WNW. (latit. 28°27′ — longit. 122°41′). In the afternoon furious Typhoon, the wind veering from W. to SW. hardest at W., the sea running very high filling the vessel fore and aft, lurching herself half up the port rigging into the sea. Deck swept by the sea every moment, masts broken, boats carried away, one man lost. — At 4h, the force of the wind was such as to lay the vessel dipping her top sail yard in the water. — At 10h sounded the well, 4 feet after pumping five hours, pumped all night...etc.

The Japanese Steamer *Niigita Maru* (Captain Wynn), from Kobe to Hongkong was, on the 12th, 10h a.m., in latitude 28°35′ and longit. 122°58′: the lowest reading of the barometer was 28in40, at 5 p.m. The sea, which was fearfully high, swept the deck continually from every side, and had it not been for the ship's splendid qualities as a sea-boat, she must inevitably have gone to the bottom. Captain Wynn is of opinion that the Typhoon exceeded in power any he had ever seen or heard of.

Steamer *Europe* (Captain T. Davies) from Shanghai to Foochow:

— "Left Shanghai 11th August; had light variable winds and overcast weather going down the river; Bar. steady at 29in80. At 2.45 a.m. of the 12th passed through Steep Island Pass; swell setting in from ESE. and SE.; Bar. steady at 29in80, wind being at the time N. At 9.30 a.m. came on thick rainy weather with heavy squalls of wind from N., N by E. and NE. At 9.45 very heavy squalls with blinding torrents of rain from N. and NE.; Bar 29in60; put ship's head NE.; lat. by D. R. 29°9′ N. - long. 122°15′ E. At 10 a.m. blowing a hard gale, and high sea running from SE. and NE.; slowed the engines, ship burying herself and flooding the decks fore and aft. At noon a hurricane from N. with a tremendous high cross sea from NE. and ESE., making complete breaches over the vessel; Bar. falling 29in22. At 2 p.m. terrific cross sea and ship burying herself, becoming almost unmanageable, with blinding torrents of rain. At 3 p.m. a heavy SE. sea boarded carrying away the two quarter boats, after wheel, awnings, spars, ice chest, bath tank, taking away rails, &c., and stove in saloon skylight, windows, and part of the after part of deck saloon, partly filling the lower saloon, damaging all apparel contained; at the same time staving in the engine room skylight, partly filling the engine room with water and putting the fires out in stoke hole, rendering the ship helpless. At 3.30 p.m. another heavy sea broke on board, tearing off part of main hatch tarpaulin; headed ship off to NW by N., seas making breaches over the vessel fore and aft, taking away steam pipe covers, ventilators, hen coops and several packages of deck cargo. All hands baling, pumping, battening down, and every effort made to save

property. Bar. at 4.30 p.m. 28^{in}.80. Gale raged to 5 p.m.; drifting to SW. At 5.15 p.m. gale lulled, wind NE.; ship's head NNW. Sounded in 13 fathoms, and kept lead going. At 9 p.m. gale and sea going down, Bar. 28^{in}.83. 10 p.m. being in 9 fathoms let go starboard anchor, and gradually veered chain to 95 fathoms, and vessel rolling and plunging heavily. Pumping, baling and repairing damages. Midnight, gale moderating, vessel labouring heavily, 3 feet of water in lower saloon. 13th at daylight found ship to be in Taichow Bay. Barometer rising, and moderate NE. wind, but ship rolling heavily at times. At 3 p.m. having got water in stoke hole and engine room partly under, got steam and proceeded, but heavy easterly swell caused ship to roll so much that it was impossible to keep fires going, washing the stoke hole plates up with remaining water and choking bilge pipes with coals. Proceeded under Sanshi Island in smooth water and anchored at 7 p.m., and again started baling. At midnight 14th, Bar. 29^{in}.20; 7 a.m. lit fires; at 0.30 p.m. proceeded towards Foochow and arrived there at 10.50 a.m. of 15th. Strong NE. wind and rainy on arrival.

The Typhoon on the continent.

The *Amoy Gazette* says: "The storm of yesterday (12th of August) may be regarded as one of the most terrific ones experienced in Amoy for some years. We hear that the lightning struck the ground in a garden close to the Club, fortunately causing no loss of life. The barometer is still low."

Amoy is a port on the coast of China in the Straits of Formosa : Latit. 24° 28′ — longit. 118° 3′.

The direction of the Typhoon on reaching the continent was ENE.-WSW.; it follows that it could not prove very destructive on the banks of the Yang-tze-kiang. And yet at Wuhu on the 13th and 14th, the E. wind was uncommonly strong. At Hankow likewise that same wind on the 14th and 15th evidently belonged to the terrible storm that was raging in the region South of the river. The barometric minimum at Hankow was 29^{in}.27, it took place on the 13th between 10 and 11 p.m. (Hankow: lat. 30° 34′ - long. 114°20′).

At Kiukiang (latit. 29° 43′ — longit. 116° 8′), on the 14th, 2 p.m., heavy squall passing over, lasting for three hours blowing a gale of wind with heavy rain.

At Hongkong and Macao the barometer was low on the 14th and 15th of August : the lowest reading, 29^{in}.53, took place on the 14th afternoon. The wind, since the 12th afternoon, was keeping SW. force 2; it only changed on the 19th, passing to SE. and E. It was therefore convergent all the time during the storm. But the atmospheric pressure was very slow in getting up to its level again, an indication apparently of the Typhoon having remained for some time in these Southern regions.

At Pakhoi, on the north coast of the Gulph of Tonkin, the wind was very feeble between SW. and W., on the 13th, 14th and 15th with the barometer steady at 29^{in}.55 up to the 19th, when it rose higher.

Our Typhoon therefore seems to have been brought to a stand by an insuperable barrier of relatively high pressures along the Southern coast of China; its dispersion probably took place somewhere in the region comprised within latit. 24° and 27° by longit. 106° and 109°.

Devastation in Kiang-si.—Failing precise meteorological observations, the track of the Typhoon may be followed through China by the sight of the ruins and of the frightful distress that have marked its passage. We give two documents of very different origin which check and complete each other: the first is a letter from the Rev. — Rougé, catholic missionary, inserted in the *Missions catholiques* (N° for 25th November 1881); the other is an extract from the Peking official Gazette for December 28th 1881. The principal towns mentioned in these documents are comprised between 26° and 28° latitude N. and 114° and 116° longitude E.

1/. Letter of the Rev. Rougé :

« *A frightful disaster has befallen this poor country of Kiang-si, already so wretched. On the 13th and 14th August a terrible storm followed by diluvian rains caused a sudden freshet worse than any within the memory of the oldest inhabitants, particularly at this season of the dog days. In a few moments, the smallest water-courses became torrents, torrents became wide impetuous rivers, and rivers again swollen by the influx of so many streams, rose to a prodigious height, and burst forth over the country, carrying away not only the harvest, but even the very soil of the rice fields. Alas! how many dead bodies were swept along close by us in that great Kan-chou river, at the foot of the city of Ki-ngan! Hundreds there were either carried away by the flood or crushed to death under the ruins of their houses, and most distressing for my heart, numbers of our christians were involved in that calamity. Some few miles from my residence there was the christian congregation of Pi-teou-shu comprising 86 people. It is no more : not a single house, not even the house of the mission could stand. The head cathechist with an old man were killed on the spot; several others got broken limbs or were left without shelter, even without clothing. Ten leagues from here, in the district of T'ai-ho, the congregation of Chou-san numbering 40 or 50 people has likewise been swept away by the flood with all the villages and markets situated near the river. We are at a loss how to provide for the most pressing wants. There is just now in the courtyard a troup of poor christians hunger-stricken and moaning : they only depend upon my purchasing some rice to relieve them with their wives and children.* »

2/. Abstract of *Peking Gazette*, December 28th :

Memorial from Wang Pang-hsi, Tutor of the Imperial Academy, who represents that he is a native of Ngan-fou Hsien in Kiang-si, and has received from private sources further particulars of the terrible floods that have recently desolated that neighbourhood. It appears that on the 12th of August and following days the rain throughout the four districts of Lu-ling, Che-shouei, T'ai-ho and Yung-feng was continuous and heavy, causing several hundred landslips in different parts of the surrounding hills. Through the openings thus made the Dragon *waters (蛟水) rushed forth in torrents, descending upon the astonished population and sweeping them away before they had time to bethink them of means of escape. Memorialist is familiar with some of the scenes of the disaster. At Pi-t'ou, out of something like a thousand dwelling-houses only three or four were left standing, and over 180 of their inmates were drowned. At Shuei-nan, about ten* chien *(houses) withstood the force of the flood out of several hundred houses, and between sixty and seventy of the inhabitants lost their lives. Memorialist mentions these two places merely as illustrations of the terrible nature of the visitation, which left numerous other villages and hamlets in the same state as Pi-t'ou and Shuei-nan. The neighbourhood in question is drained by the river that runs through Ki-ngan-fou and in that direction the waters carried down in rapid succession the corpses of those who had attempted to save themselves by clinging to boards and beams, mothers with children at their breast, and old men holding the hands of their grandchildren; all tossing about on the surface of the river, now sinking and now rising for three days before they finally disappeared. The disaster is without parallel in the history of the Ki-ngan Prefecture, and Memorialist has assured himself of the truth of the facts he relates both by correspondence with his family and by conversation with such of his fellow-provincials as have arrived at Peking since the occurrence of the inundation. He therefore prays His Majesty to direct the Kiang-si Provincial Government to do all in their power to*

provide temporarily for the homeless and destitute survivors in the villages in question. (*Anoted by the N.-C. Daily News*, 17 *February* 1882).

Extent of the Typhoon.

The observations of Japan lead to think that by the 10th and 11th of August the Typhoon was of a small size and of moderate violence. Not so however when it had approached the chinese coast: in both respects it had taken a wonderful increase. At Zi-ka-wei during the night of August 12th-13th, the anemograph of the Observatory registered a velocity of 26 miles, wind ESE. The barometer fell down to $29^{in}.572$, whilst at the centre of the whirlwind, 155 miles to the South, it marked $28^{in}.40$.

At Chinkiang, to the North-west of Shanghai, in the afternoon of the 13th, the wind blew steadily from NE., force 6; the Centre lay 250 miles to the SSE. and the Typhoon was then raging in Kiang-si.

On the other hand, in the China Sea the SSW. monsoon continued to blow with the greatest regularity, but with an increasing force as the Centre of the Typhoon was moving Southward; on board H.M.S. *Magpie* sounding on Macclesfield Bank (latit. 15°-long. 114°), the barometer fell slowly from the 11th to the 15th whilst the wind blew strong from SSW. (force 5-6). Owing to the persistency of the wind from SSW. and to its increasing force, there arose a swell in the same direction the intensity of which gradually increased: on the 11th, force 2; on the 12th, force 3; on the 13th and 14th, force 4; on the 15th, and 16th force 5-6; on the 17th, force 4; on the 18th, force 3; on the 19th, force 2.

The following fact related by the Manila papers may likely have been due to the same cause. "During the night of the 12th August, there was a very high sea in Manila harbour with scarecly a breath of wind at the time. The damage caused by this heavy sea was chiefly confined to the junks and was trifling in nature."

We may also mention the barque *Star of India:* she on the 10th left Manila for Hong-kong where she arrived on the 19th, having met all the time with a succession of W. squalls with hurricane force.

Here then is a Typhoon to be remembered.

Secondary whirlwind

In the same direction as the "Kiang-si" Typhoon, and following close upon it.

It cannot but be both interesting and useful to note the passage in the same direction, that is frow ENE. to WSW. of a small secondary whirlwind following in the wake of the great Kiang-si Typhoon, but without any of its devastating fury. Here is then a short account of it.

At Zi-ka-wei after the passage of the Typhoon, on August 16th, 10 a.m., the barometer had reached a maximum = $29^{in}.869$; in the evening it began to fall again. The upper clouds came from the SE., an anomalous direction which pointed to a centre of depression in the East; the wind blew very strong all day from ESE.: there was still the influence of the great whirlwind then running towards the SW. (From the 13th to the 18th the mean velocity of the wind at Zi-ka-wei was 409 miles per day, equal to an average of 17 miles an hour). On the 17th, 4 a.m. the Cirri were still bearing from SE. to NW., but there appeared some of those low swift vapoury cumuli, forerunners of storms: they ran from ESE. to WNW. At 2 p.m., the barometer had reached its minimum, $29^{in}.724$ - wind veered from ENE. to E. and ESE. — On the 18th, 7h. a.m., the vapoury swift

running cumuli appeared again rising from the SE., that is with the wind, whilst the Cirri bore SSE. to NNW. The maximum velocity was registered on the 17th, between 4 and 5 p.m., viz. 25.5 miles. The depression evidently was proceeding from E. to W.; it must have passed very close to the South of Zi-ka-wei, for at Ningpo the wind turned to S. at the moment of the barometric minimum, 29^{in}.84, which took place about the same hour as at Zi-ka-wei.

The barometric minimum and the wind observed at Wuhu, on the Yang-tze-kiang, (latit. 31°.23′ - longit. 118°.22′) prove that the Centre of the depression passed South of that port in the night of the 17th - 18th; in the afternoon of the 18th, it lay below Hankow. At those two stations the wind kept from E. At Hankow the barometric minimum 29^{in}.490 took place at 4 a.m.

This insignificant secondary whirlwind was evidently brought to central China by the low pressures which had already attracted the great and destructive Kiang-si Typhoon and which had only been partially levelled after its passage. — On the track of the secondary whirlwind the wind, south of the centre, blew from W. as at Foochow.

Thus in the interval of few days, there occurred two well defined whirlwinds bearing at a comparatively high latitude from E. to W., a direction which I had hitherto considered as against the rule in those regions.

Seventh Typhoon: 18th — 23rd August 1881.

TRACK :

			Latitude	Longitude
August 18th	Midn.		14° 0′?	125° 0′?
	Noon		14. 15 ?	124. 0 ?
19th	Midn.	Luzon	14. 30	123. 0
	Noon		14. 45	121. 40
20th	Midn.		15. 15	120. 10
	Noon		16. 0	119. 0
21st	Midn.	China	17. 0	118. 0
	Noon	Sea	18. 0	116. 45
22nd	Midn.		19. 30	115. 45
	Noon		21. 0	114. 15
23rd	Midn.	China	22. 0	112. 30
	Noon		22. 15	109. 30

EVENTS :

Great violence of the storm at Manila: the velocity of the wind reached sometimes 100 miles an hour.
Fall and destruction of St Nicholas Light-house (Luzon).
Immense destruction among the small craft in the harbour at Manila.
Storm at Macao and Hongkong.

Before the Typhoon.

I have no information fram Luzon with regard to this Typhoon begond the telegrams sent from Manila to Hongkong on the 19th and an abstract of the Manila papers, published by the *China Mail* of Hongkong. I am therefore unable to say under what peculiar circumstances it originated. Besides, even fuller observations from Manila and any other places in the Philippine Archipelago would not supply any information in that respect, since it was from the depths of the Pacific, East of the Archipelago, that the Typhoon came as also did the next, through it followed a different route. But we can inquire into the reasons for which it took such a direction from East to West towards the Philippine and the South of China. In our description of Typhoons there has already been occasion to notice how those impetuous whirlwinds seem as it were to seek each other. Let a whirlwind, after dying away, leave behind a comparatively low pressure, the first whirlwind that springs up afterwards within a moderate distance is not unlikely to take its course towards the point where the former vanished.

We have seen above how one of the grandest and most terrible China sea Typhoons on record bore from ENE. to WSW. to the continent, spread havoc over provinces and finally went to die away probably in Kuang-si, to the North of the Gulph of Tonkin. It is precisely towards this same region that we shall now see the Typhoon to run, which crossed Luzon on August 19th at the moment when the "Kiang-si" Typhoon was vanishing.

The Typhoon.

Manila. — On August 19th, 11h 10m a.m., a first telegram was despatched to the Governor of Hongkong by the Director of the Manila Observatory. It ran thus : "A Typhoon is raging in the ESE. of Luzon and it will probably pass over Manila. Its direction seems to be SE. to NW., although it is rather doubtful." This telegram did not reach Hongkong before the next day, 20th. All that day and following night, the weather kept fine with no appearance of a storm shortly to come on.

At the date of August 19th, 3h 10m p.m., another telegram was sent from Manila. By an unaccountable

delay, very surprising at least in such a momentous circumstance when life and property were at stake, it was not received before the evening of the 21st. It contained the following significant words: "A Typhoon is now raging in Manila and its direction is WNW.: it is passing to the North."

From the first telegram it appears that the Typhoon differed from several of its forerunners which had originated somewhere to the SE. or SSE., of Luzon and followed up the eastern coast of the Philippine: it came from the ESE., that is from those regions of the Pacific Ocean whence most of the Typhoons of the summer of 1880 seem to have issued.

The Manila papers supply some details about the storm that raged there and about the passage of the Typhoon across the island of Luzon.

It began to blow on the afternoon of the 19th, and lasted till three o'clock the next morning. The vortex was calculated to be about forty miles to the North of Manila. The destruction among the small craft was immense. The British ship *Titania* (Capt. Townsend), which arrived on the 18th from Cardiff with a cargo of coal, went ashore near the Malecod, where she is probably stranded on sand. The *Masonic* also, it is said, went ashore in Cavite, where she had been anchored for some time. On shore the destruction was also great, especially to houses of light coustruction.

According te the estimate of the Director of the Observatory of Manila, the force of wind reached sometimes the velocity of 100 miles per hour, though an exact account cannot be given, owing to the destruction by the wind of the two anemometers possessed by the Observatory. The direction of the gale appeared to be WNW., but it cannot be said then in manila whether it has shifted or not before reaching the China coasts.

The Light-house at St Nicholas has disappeared altogether and 11 lives were lost. During the night of the gale, the steamer *Reina Mercedes* was near colliding with the British barque *W. H. Corsar*, and to avoid this the steamer had to keep the engines at full speed from the direction of the barque until the weather changed.

A destructive whirlwind (a tornado or a secundary whirlwind accompanying the Typhoon) was reported to have occurred in the village of Polo, near Bulacan (some 20 miles north of Manila) on the afternoon of the 19th, causing great destruction to a place named Mabolo. Nearly the whole of the houses of light construction were razed to the ground and two of stone suffered a like fate: but no loss of life was reported. This phenomenon was also reported to have crossed the parish of Pineda, where it caused a great noise, it carried away one man, one woman and one bullock; the last named, on being found, had one of his horns knocked off. One house disappeared under the force of the tornado. (*China Mail*).

China Sea — We find some interesting observations on the passage of the storm from Luzon to the coast of China.

And first from H. M. S. *Magpie*. She was on surveying duty on the Macclesfield Bank to the East of the Paracels, in the middlle of the China Sea (latit. 15° 45′ — longit. 114° 15′). The wind had then been blowing steadily strong SSW.: in the evening of the 19th of August it fell entirely as well as the SW. swell it had been raising and keeping on; the barometer had risen again after the passage of the «Kiang-si» Typhoon and reached its maximum, 29^{in}.81, on that same day 19th about 10 a.m. — On the next day, August 20th, blowing again with swell from W. and WNW. But whilst the wind settled in this last direction and freshened rapidly, the swell turned to N. and then to ENE., from which direction it came strong at 8h p.m. At the same time all over the horizon the sky looked stormy with bright flashes of lightning. There was evidently a centre of perturbation in the East-north-east. — On the 21st, the wind was WbyS. force 3-5: minimum of the barometer 29^{in}.58 at

4 a.m. Swell: at 4h a.m., NE.; at 6h a.m. NNE., but chopped up by a heavy sea coming with the wind from NW. and from W.; at 4 p.m., great undulations bearing from North to South, showing plainly in what direction lay the Centre of the Typhoon. As early as the 22nd, the wind came to blow from SW. and SSW. again and brought about a swell from the same quarter. On the 23rd, 10 p.m., the barometer had risen and reached a maximum = 29^{in}.79.

The shortest distance of the *Magpie* to the mean Centre of the Typhoon was about 240 miles; the wind was then WSW. force 3-5 and the Centre lay to the NE.; the wind then, far from being circular, was strongly convergent.

The curve of the half hourly barometric observations made on board the *Magpie* at that time stationary on Macclesfield Bank, shows an uncommon feature in having two perfectly distinct minimums, viz. at 4h a.m. = 29^{in}.581 and at 6h a.m. = 29^{in}.589. We subjoin that interesting series of observations.

H. M. S. Magpie.

Latitude 15°. 27′ — Longitude 114°. 4′

Date	Hours	Barometer	Wind		Thermom.	Clouds	Weather	Remarks
		in			in			
August 20th	9 P. M.	29.678	NW by W	3-4	84.3	8 C St	O. M. L.	
	10	.678	id	id			O. M. L. Q.	
	11	.656	WNW	4-5			id	11h. 10^{m} p.m. Looking very dark to WNW.
21st	Midn.	.646	id	id	83.8	10 St	id	Stars shining through the Stratus over head.
	1 A. M.	.630	W by N	3-5			id	
	1.40	.618	id	id			id	
	2	.605	id	id			id	Midn. to 4 a.m. — Vivid sheet lightning all
	2.30	.597	W by S	3-5			id	around.
	3	.591	id	id			id	
	3.30	.591	WSW	3-5			id	
	4	.581	id	id	83.5	10 St	id	
	4.30	.596	W	3-5			id	
	5	.604	id	id			O. M. Q.	5h. — Lightning ceased.
	5.30	.607	id	id			id	
	6	.589	id	id			id	Very cloudy and misty.
	6.30	.609	id	id			id	
	7	.623	id	id			C. M. Q.	7h. Clouds broke a little to WNW.
	7.30	.658	id	id			id	
	8	.657	id	id	84.0	5 St	id	
	8.30	.650	id	id			id	
	9	.684	W by S	3-5			id	
	9.30	.678	id	id			C. M. Q. P.	9h. 30^{m}— A squall and passing shower.
	10	.690	id	id			id	
	10.30	.666	id	id			id	10h. 20^{m} — A squall with heavy pass. shower.
	11	.680	id	4-6			id	10. 45 — id id
	11.30	.652	id	id			id	11. 15 — id id
	Noon	.636	id	id	83.3	5 St	id	

It will be remembered that the Typhoon, in its passage across Luzon by the latitude of Manila, was not single, but had the company of a secondary whirlwind which followed close upon it keeping somewhat to the north of the main track. It is evidently this same whirlwind, which had constantly kept attendance on the Typhoon, that we find again in the middle of the China Sea making itself felt by the *Magpie* and still traceable on the coast of China, at Hongkong and Macao. — The presence of this second whirlwind had the effect to keep the wind bloving W. after the pasage of the first Centre: the same happened at Hongkong and Macao for the E. and NE. winds.

Farther north than the *Magpie*, the German Schooner *Wagren* (Capt. Dibbern) had the ill-luck to stand almost right upon the track of the Centre by latit. 19°.42′ and long. 116°.32. The latitude is given for the date of the 21st 3h a.m. when from the violence of the wind (NNE. 9) they had to heave to. The barometer, after reading 29^{in}.27 at 2h a.m., had only sunk by 0^{in}.15 at 3h p.m., viz. to 29^{in}.12, this being the last reading reported. The influence of the two Centres is again evident in this case, the wind still blowing NNE. force 10-12; at 4h

p.m., it veered to N., then on the 22nd midn. to NNW., abating. The fury of the storm may be imagined from the following few notes.

«On the 21st, 3 a.m.-Hove to under close reefed main sail. — 2h p.m.-Blew away main sail. — 3 p.m. -Set close reefed main stay-sail. — 3.30 p.m.-Ship hove on beam ends,-cut away fore topmast to right her, — lost foremast head and bowsprit and jibboom with main sail, fore lower and upper topsail topgallant sails Royal: fore topmast topgallant and royal staysails fore topmast staysails jib and flying jib.»

This report gives us the means of determining with a fair approximation the position of the centre of the Typhoon at noon on August 21st.

We find an interesting circumstance noted down in the report of capt. A Gulland of the SS. *Glencoe*. Sailing from Singapore to Hongkong, kept within a certain distance, first to SW., then to S., and lastly on the 21st, 22nd and 23rd to the E. of the Centre. In the evening of the 21st, frequent flashes of lightning. — On the 22nd after midnight, sudden periods of calm alternating with violent squalls from SW. (force 8); St. Helen's fire gleaming on yard arms.-At 2h a.m., the sky all in a blaze. The steamer then lay by 17°.15′ latit. and 113°.0′ longit., consequently about 240 miles south-west of the Centre. The wind, blowing a strong gale (force 8) from SW., far from being circular, showed a marked convergence to the Centre, which fact is set off by the observations of the *Magpie* we have transcribed and some others we shall give below. Nearer to the Centre on the contrary, as for instance on board the *Wagren*, the wind was more furious and also more circular (NNE. force 10-11 before noon, N. force 10-12 after noon at the moment of the shortest distance to the Centre; lastly NNW. in the evening).

Hongkong and Macao. — The telegrams announced the course of the Typhoon as running much farther to the west than Hongkong; fortunately there was nevertheless no neglect in making provision against a blow. And the precaution was justified by the event, since the track followed by the Typhoon on emerging from Luzon deviated to the North-west and came to pass very near, though below the English and the Portuguese colonies.

"On the 20th, we said, there were no appearances of bad weather and the night was tranquil. About eleven o'clock on the 21st morning, however, puffs of NE. wind commenced and these became stronger and more frequent as the day wore on, while the barometer, which at 10 o'clock stood at $29^{in}.70$, fell rapidly and at 1 p.m. marked $29^{in}.64$. The signs of coming bad weather increased in the afternoon and the cargo-boats and other Chinese craft were seen moving eastward in tow of steam-launches, and by 5 p.m. there was scarcely a boat to be seen. About to half-past 6 p.m. the Typhoon gun was fired and some of the more timid householders began to make sundry preparations for the expected storm. Most of the steamers in port also got up steam and several sought safer anchorage at the back of the Stone-cutter's Island. On the 22nd morning the wind kept steady from the NE. After 7 p.m. ($29^{in}.34$), the mercury oscillated and at 10 o'clock had risen a little, but this was succeeded by a steady fall and at 3h. 30^{m} p.m. the glass stood at $29^{in}.07$ the lowest reading, wind E. 11. Thereafter it rose slowly, but steadily until 6 p.m. and all fear of a typhoon was dissipated; by 6 p.m. the wind E. had died down and after that hour there were only occasional gusts. After 6h there was another fall, but at 8.15 p.m. the mercury made a very sudden jump upwards of over one tenth ($29^{in}.31$) and continued to rise (wind SE. and S. hard). The sea was running high in the harbour and the waves beat against the Praya wall with great violence. In the morning (22nd), when the tide was at its height, the Praya was in parts several inches under water and some of the Chinese shops to the westward were flooded. Owing to the length of the warning

given of the storm and the precautions taken, very little damage has been done either ashore or afloat and we have heard of no loss of life *(Daily Press.)*

From Macao we have no information about the storm beyond the good observations of Mr. Cinatti, which we give by the side of those from Hongkong. The way of observing the wind at this latter station must be noted. The observation is made, not at the harbour where the exposure is unfavorable, but on the top of Victoria Peak at a height of 1823 feet, where the wind has free play, so that its variations give a more correct notion of any atmospheric whirlwinds that may come near Hongkong.

Macao

Latit. 22.° 11′ 24″ — Longit. 113.° 33′ 32″

Barometer	Wind		Nebul.	Weather		Date — Hours	Barometer	Wind Vict. Peak		Weather	Rain
in						August	in				
29.695	NNW	3	6	C. U. W.		21st 9 A. M.	29.731	N	5	C. M.	
.645	N	3	6	id		Noon	.680	NE	7	C. M. Q.	
.568	NNE	3-4	8	id	T. D.	3 P. M.	.650	NE	7	O. C. Q. R.	
.538	NE	3-4	9	id	D.	6	.580	NE	8	O. C. Q.	
.538	NE	4	10	id		9	—	—		—	in
.500	NE	4-5	10	U. O. G. L. W. R. Q.		22nd Midnight	—	—		—	3.46
.413	NE	4-6	10	id	id	3 A. M.	—	—		—	
.371	NE	5	10	id	id	6	.347	E	11	O. C. Q. R.	
.362	NNE	7	10	id	id	9	.374	E	11	id	
.342	NNE	5-6	10	id	id	Noon	.355	E	10	id	
.310	NNE	5-6	10	id	id	1 P. M.	.275	E	10	id	
.236	NNE	5-6	10	id	id	2	.225	NE	9	id	
.185	NNE	5-7	10	id	id	3	.165	E	11	id	
.161	NNE	7-8	10	id	id	4	.175	E	11	id	
.161	NNE	7-9	10	id	id	5	.208	E	11	id	
.168	NNE	8-9	10	id	id	6	.208	E	11	id	
.167	NNE	8	10	id	id	7	.195	lull		id	
.167	NNE	7	10	id	id	8	.295	SE	10	id	
.174	E	5-8	10	id	id	9	.364	SE	10	id	3.30
.174	E	4-8	10	G. O. U. W. Q.		10	.394	SE	10	id	
.258	E	4-6	10	id		11	.424	SE	10	id	
.311	E	4-6	10	id		23rd Midnight	.484	S	9	id	
.372	ESE	4-6	10	id		2 A. M.	—	—		id	
.427	S	3-5	10	id		4	—	—		id	
.442	SSE	4-6	10	id		6	.584	S	7	id	
.506	SSE	4	10	id		8	.641	S	7	id	
.547	SSE	3	10	G. O. W. R.		10	.663	S	6	O. C. Q.	
.577	SSE	3	10	id		Noon	.672	S	6	id	

Hongkong

Latit. 22.° 16′ 23″ — Longit. 114.° 10′ 2″

The two centres of depression and whirlwinds which ran side by side across Luzon and in the long stretch over the China Sea, are brought out clearly in the foregoing observations, particularly in those of Hongkong. One of the two centres of depression seems to have been deeper and was the first to pass Hongkong. But they probably did not follow the same course, and the first, and lowest minimum observed here must have been identical with the second minimum observed on board the *Magpie*, belonging to the secondary whirlwind which did some damage to the North of Manila. For the *Magpie* lay South of the track (wind from W.) whilst Hongkong kept North of it (wind from E.). It is therefore very difficult to say of these two Typhoons which was principal and which secondary, both appearing as true Typhoons, observed, the one on its Southern, the other on its Northern side.

At Macao the barometer, instead of falling twice as at Hongkong, kept low from 4h to 10 p.m.: the reason of that difference it is impossible to make out. Higher up on the coast of China, at Swatow, capt. Schulze on board the SS. *Keelung* at anchor in the harbour observed a minimum = $29^{in}.584$ on the 22d, 4h a.m., the wind blowing NEbyE. force 5, also evidently convergent. At 4h 30^{m} a.m. it blew ENE. force 6; at 6h a.m. EbyN. force 5; at 7h a.m. E. force 4; at 10h 45^{m} a.m., veered to SEbyE. force 5. At the moment only of this last observation could the wind be taken as very nearly circular, but as it settled about that quarter, it soon became convergent again. The barometer, after the minimum of 4 a.m., kept low till 7h. 30^{m} a.m. when it

took to rising slowly. The wind at Swatow had only force 5, as the Centre was passing within 200 miles of it in the South-west; the *Magpie* as we have seen, at an equal distance of the Centre on the other side of the track, did not experience any stronger wind: the radius of the storm therefore did not exceed 150 or 160 miles.

At Macao the wind never attained to force 7 except about noon on the 22nd, that is when the Centre was about 60 miles distant. But on Victoria Peak (1823ft. above sea-level) the aerial currents met with no check, and it was 24 hours sooner, viz. on the 21st, noon, that they attained that force 7, the Centre yet being 190 miles from Hongkong in the South-east.

Pakhoi, Gulph of Tonquin (latit. 21°29′ - longit. 109°6′), about 250 miles to the East of Macao. - On the 22nd before noon, bright flashes of lightning in the North-east, East and South-east; no thunder heard on account of the great distance; — from 10 a.m. till noon, a diluvian rain, but no wind. — On the 23rd, midnight, thunder- 3 a.m., a squall from WSW. force 7 with rain. At daybreak, wind moderating and turning to NW; in the afternoon keeping from the same quarter, but freshening, - heavy rain. At 7 p.m. blowing from SW. All night squally with rain. — On the 24th, wind S; squalls and rain. — There was a minimum of the barometer in the afternoon of the 23rd, but there is some uncertainty with regard to its amount: the fall since the 21st seems to have been about $^{in}.20$.

The foregoing data are rather deficient in precision and completeness. As far as can be made out, the Typhoon after passing Macao, ran westward and passed to the North of Pakhoi in the evening of August 23rd. Its last traces on the coast of China were however soon lost in presence of the new Typhoon then approaching in the North of Luzon.

Velocity — Gradient — Attendant whirlwind.

The Typhoon travelled from Luzon to Macao a distance of 920 miles in 72 hours (August 20th - 23d): average speed = 8.5 miles an hour. Its velocity had been rather less, previous to its entering the China Sea; on the 18th and 19th it probably did not exceed 7 miles per hour.

As for the barometric gradient and the slope of the atmospheric depression, the fact of there being, as we have seen, two centres within a short distance of each other makes it imposible to calculate this important element of a Typhoon with any degree of accuracy.

It would be interesting to know the relative positions of the two centres at any moment during that period of four days, but we have no data for such a determination, our information with regard to the passage of the Typhoon across Luzon being confined to the note in the Manila *El Comercio,* according to which, a tornado or secondary whirlwind seems to have be doing great havoc in the north of Manila about 3h p.m. on August 19th, at the time that town was experiencing all the fury of the main Typhoon. Now on the morning of the 22nd, in the middle of the China Sea, lieutenant H. Belam of H. M. S. *Magpie* was able to observe the passage of the two centres at an interval of two hours. The difference was of 4 hours at Hongkong and 5 hours at Macao, nearer to the track, showing a variation in the relative position of the centres. The *Wagren* seems to have passed between the two centres and the report of the captain might be very instructive, if more detailed and more explicit about the metereological observations.

The barometric variation, on the approach of the first centre, was more rapid at Hongkong than on board the *Magpie* in the proportion of $3^1/_2$ to 1, the fall in 4 hours being $^{in}.210$ at the former station and only $^{in}.065$

at the latter in the offing. It is of course difficult to say precisely how far from each of those two stations the Centre passed.

The action of the second Centre on the barometer was relatively more considerable on board the *Magpie* than at Hongkong: the two minima of the *Magpie* ($29^{in}.581$ and $29^{in}.589$) only differ by $^{in}.008$ whilst those of Hongkong ($29^{in}.158$ and $29^{in}.192$) show a difference of $^{in}.034$. This would give to think that the second Centre turned round the other from East to West through South or inversely to the motion of the hands of a watch; or perhaps was the displacement shared between the two centres; but we repeat that on this interesting subject we cannot go beyond more or less likely surmises.

Let us by the way note another fact: south of the track, with SW. and W. wind, there was a great display of electric phonomena; whilst on its northern side we find no notice of any lightning or thunder. With rain again there was the same difference; though at Hongkong there fell $12^{in}.4$ of water during the 22nd, 23rd and 24th of August.

Eighth Typhoon: 22nd — 31st August 1881.

TRACK :

Date			Latitude	Longitude	1st Centre	2nd Centre
August 22nd	Noon		17° 30′	129° 30′		
,, 23rd	Midn.		17. 30	128. 30		
	Noon		18. 0	127. 0		
,, 24th	Midn.	Pacific	18. 45	126. 30		
	Noon		19. 30	125. 0		
,, 25th	Midn.		20. 0	124. 0		
	Noon		21. 0	122. 20		
,, 26th	Midn.	Formosa	22° 30′	121° 30′	21° 50′ — 121° 0′	
	Noon		24. 25	121. 30	23. 15	120. 20
,, 27th	Midn.		26. 0	120. 30	24. 45	129. 40
	Noon		28. 0	120. 20	26. 15	120. 40
,, 28th	Midn.		29. 25	121. 30	27. 20	121. 50
	Noon	Eastern	30. 30	122. 30	28 40	123. 0
,, 29th	Midn.	Sea	31. 40	123. 35	30. 0	123. 25
	Noon	and	32. 43	124. 50	31. 40	123. 5
,, 30th	Midn.	Yellow	35. 0	125. 30		
	Noon	Sea	37. 0	125. 50		
,, 31st	Midn.		39. 30	125. 0		
	Noon		42. 0	125. 30		

EVENTS:

The British ship *Bolton Abbey* dimasted on the 23rd August in latit. 17.° 35′ — longit. 127.° 56′.

The barque *Crimea* dimasted in the Chusan Archipelago on the 28th.

The barque *Pallas* dimasted near Shanghai on the 28th.

The Danish barque *Flensborg* lost on Table Island on the 27th.

Floods and great destruction of life and property in Formosa Island, Foochow, Ningpo and Shanghai, besides immense loss of native craft.

Curious splitting of the Typhoon in the Formosa Strait on the 27th.

Preliminary remarks.

I call this Typhoon the «Pescadores and Chusan» Typhoon on account of its splitting at the entrance of the Formosa strait and the two centres respectively going over those two groups of islands; also to recall the peculiarities of its track along the coast of China, for we find the following in the *China Sea Directory* (vol III) on the subject of Typhoons :

«They do not extend into the Formosa strait, the high mountain chain of Formosa, of 5 000 to 12 000 feet elevation, appearing to interpose a barrier to their progress. There is only one case on record of their having reached Amoy (August 1864 (1)); and northward of Formosa they are also of rare occurrence, one having visited the Chusan Archipelago in 1843, much to the astonishment of the inhabitants, who stated that no such thing had occurred for 50 years. Some violent storms have also visited Shanghai, but it is doubtful whether they are true Typhoons.»

We now positively know that the different places here mentioned as being very seldom visited by Typhoons, are in fact more favoured in this respect, if we may speak thus on such a mournful subject; Shanghai in particular may well depend upon getting a Typhoon every year. The one we are going to investigate is the second for 1881.

(1) In August 1864 Amoy experienced the rare occurrence of two Typhoons in the space of five days. The path of the first was from SE. to NW.; its Centre passing a little northwards of Amoy; the second travelled down the coast to the WSW. or SW by W., its vortex passing to the southward of Amoy. The year 1864 was marked by an unusual number of Typhoons. Even Shanghai experienced one in July of that year. A very violent one also occurred near the Paracels in the same month. *(The China Sea Directory, vol. III page 275).*

There are persons who find it difficult to admit the splitting of an atmospheric whirlwind. And yet there is nothing impossible or even extraordinary: the division and subdivision of vortices in water-courses or in the wake of a ship is a fact of constant occurrence under our own eyes. Now the air is endowed with an extreme mobility, thanks to which an aerial current can easily split into two or more on meeting an obstacle such as a high mountain, and there is no doubt that the same cause often must occasion the division of large whirlwinds. We have had several instances in the China Seas of Typhoons originating almost at the same time in the same region and then following different directions: thus the two Typhoons of July 1881, which I called the "Hainan" and the "Swatow" Typhoons, sprung up under the same circumstances to the North of Mindanao. In 1880 also two terrific whirlwinds seem to have issued almost simultaneously from the same region of the Pacific, to run, the one towards Formosa (September 25th-28th) and the other towards Japan (Sept. 28th-Octob. 4th). H. Piddington in his *Sailor's Horn-book* "says: there is no doubt that violent cyclones sometimes divide into two or more, each following a track somewhat divergent from the other. The case in which the dividing of cyclones has been most clearly and unequivocally traced, is that of the Calcutta Cyclone of June 1842, which, after passing that town, divided into perfect Cyclones of smaller diameter, but of less violence."

M. Hébert, in a recent publication (1), sums up his conclusions on this point as follows: "A whirlwind, which is a simple and exactly circular phenomenon becomes transformed into a depression, that is into a more complex system consisting of an aggregate of whirlwinds all originating from a single whirlwind whose energy they preserve and increase." The subdivision of whirlwinds is then far from being objected to by Meteorologists of high standing. Moreover we have just seen how the furious "Macao" Typhoon (August 19th-23d), on reaching the eastern coast of Luzon by the latitude of Manila, gave birth to a tornado which sprung up on its northern side and gradually increased so as to become equal to the main whirlwind in the China Sea, near Hongkong and Macao: in fact it was hard to say which in point of violence had the advantage over the other.

These preliminary remarks are not out of place, since all the circumstantial information I have received in regard to the "Pescadores" and "Chusan" Typhoon leads me to consider it as having split into two whirlwinds in the Formosa Strait on August 27th.

The Typhoon — Its track.

Under what atmospheric conditions this Typhoon was formed, it is impossible to say, as it issued from the depths of the Pacific Ocean, East of the Philippine islands, which it did not touch. The direction it first followed was, as it were, imposed by the low pressures the "Macao" Typhoon on its passage had brought about in the China Sea and on the Southern coast of the continent: it was from East to West that it set out on its long progress. But from the 25th, the atmospheric pressure rose again on the coast (on the 25th: at Macao, $29^{in}.78$; at Hongkong, $29^{in}.80$), and the Typhoon, having reached the vicinity of the Bashee islands, between Luzon and Formosa turned towards the North-west, in which direction there was in central China an area of low pressures (Hankow, from the 22nd to the 25th, mean pressure $= 29^{in}.58$); it was bearing towards the Formosa Strait when it met an insuperable barrier in the chain of mountains rising as high at 12000ft., which runs from North to South across the island. It split into two segments forming two more or less regularly constituted whirlwinds in the first instance, which had no help but to rise up parallel to the mountain chain, the one on the

(1) Études sur les lois des grands mouvements de l'atmosphère et sur la formation et la translation des tourbillons aériens, par Mr. F.F. Hébert — Moulins 1880-1881.

East, the other on the West of it. They were connected by a real though invisible bond, as they yet probably for a long time made but one body or vortex in the upper regions of air; below, they several times appeared, as it were, to seek each other in order to coalesce again; but the western one had taken some advance from the first start, its velocity besides found no check from want of space, and, in spite of its following a roundabout path, it constantly kept a good distance ahead of its fellow. It can be followed northward beyond the 40th parallel, whilst the other seems to have spent and vanished somewhat to the North of Shanghai, between 32° and 34° latit. Such in short is the curious history of an ever memorable whirlwind.

1st Period. — August 22nd — 26th.

The Typhoon which on August 23rd brought the Liverpool Ship *Bolton Abbey* within a hair breadth of being lost, certainly could not be said to be just forming: it was second to none for violence of wind or depth of atmospheric depression. There is then every reason to think it came from far distant regions when so early as the 22nd, by lat. 17°.35′ N. and long. 127°.56′ E., the officers of the *Bolton Abbey* began to suspect its presence in the East. We cannot do better than to give Capt. Williams's own account of his struggle againt the fury of storms, which only came to an end on the 30th September on the breakers of Pratas Reef, after sailing about 900 miles under the most trying circumstances and with the loss of five lives. The ship was bound for Manila with a cargo of coal from Newcastle, New South-Wales.

"Monday, 22nd August, set in with fresh breeze from NW., furled top gallant sails, spanker and outer jib—At 10 a.m., furled main sail—At noon, barometer 29^{in}.57: latitude 17°.35′; longit. 127° 56′—At 5 p.m., fresh breeze and showery; furled upper top-sails and jib — At 6 p.m., weather looking very threatening, and squalls very strong; put the ship under lower main top sails; fore top mast stay sail and main trysail. — At 8 p.m., heavy squalls, accompanied with thunder and lightning."

"23rd August, at midnight, wind NW., barometer 29^{in}.00; very heavy gale with high sea running, and vessel making very bad weather, putting the lee rail completely under water; wind steady at NW. At 1 a.m., washed away pig-sty, gutted out lee side of forecastle head and took everything moveable off the deck.—At 1.30 a m. blowing a typhoon; blew away fore topmast stay sail and washed top gallant bulkwark away. Called all hands aft on the poop. Ship making terrible weather of it, and lurching heavily. Washed away the side of forward house and all men's effects, including carpenter's tools: barometer 28^{in}.80. — At 2.30 a.m., barometer still falling, 28^{in}.60, wind WNW. blowing with terrific force. Cargo shifted to leeward, throwing the vessel on her beem ends, gutted lee side of the cabin; put the helm up to pay her off before it, but as she would not answer her helm we cut away mizzen mast, which did not seem to have the least effect on her. By this time the lee boats had been washed away on side poop and forward house, and the water was up to the weather side of the main hatch. The vessel still going over the captain gave orders to cut away the two remaining masts so as to save life. This being done relieved her considerably, but the water still washed over the main hatch. — At 4 a.m., the barometer showed 28^{in}.45 (lowest reading), the gale was blowing terrifically: the gale sounded as if voices were in the air all round the vessel. Wind from W. The ship was making terrible weather of it".

"At daylight at great risk of life, started to get clear of the wreck as much as possible. Found life-boat broken across her keel, leaving us only one small 18 feet boat on weather side of the poop, with slight damage to the keel; we were unable to sound the pumps, they being under the water and broken. — At noon, barometer 28^{in}.70, washed away covering of the main-hatch, which was secured at the great risk of life, the wind still

blowing with frightful force and deck constantly under water. — At 8 p.m., glass was still rising 29^{in}.00; but wind still blowing with hurricane force. Found large iron spar (crossjack yard) had gone overboard during the course of the day, and the main bulwarks, from break of forecastle head to centre of main-rigging completely washed away. The lee side of the vessel was then very low in the water."

"24th August, at 8 a.m., the barometer was 29^{in}.30, the wind SW.; the weather moderating, the glass was rising rapidly, but a heavy sea continued washing over the ship and it was impossible to stand before it. — At noon, the barometer was 29^{in}.50, and there was a moderate gale with heavy sea and rain squalls..... — At 8 p.m., moderating fast and weather improving."

"25th August, moderate SW. wind and cloudy. Passed about 200 tons of coal overboard and started to rig jury masts with what small spars we had left."

Though the report have not a word about the position of the ship on August 23rd and 24th, we may well suppose her to have drifted considerably with the NW. and W. wind, that is in a direction opposite to that she was following, up to the 22nd, towards the North-eastern extremity of Luzon, and we consequently infer the situation of the Centre in all likelihood to have been by lat. 17°.30′ and long. 128°.15′ on the morning of the 23rd of August, at the moment when the ship was nearest to it, and the distance, considering the extreme violence of the W. wind and the indication of the barometer (28^{in}.45) cannot have been more than a few miles. The velocity of translation then did not exceed 6 miles an hour. The fact of the ship having constantly met with Westerly winds shows that she kept all the time to the South of the track, first West of the Centre, later East of it. The fresh NW. breeze that sprang up on the morning of the 22nd and continued to blow with rapidly increasing violence till next day, showed a rather marked convergence to the Centre, which diminished as the Typhoon drew nearer: that same wind at its greatest violence, that is in the night of the 22nd-23rd, was perfectly circular, blowing at right angle with a line drawn to the Centre. The wind afterwards veered to WNW., then to W. at the moment of the passage of the Centre. On the 24th and 25th it blew steady from SW., almost circular. At the time when the ship approached nearest to the Centre and the fury of the storm reached its highest pitch, there was sometning startling in the sound of the wind not unlike that of a multitude of human voices all crying, screaming and hissing. That peculiar sound was noticed again and again in similar cases; it cannot but increase the horror of a desperate situation and the secret terror of men worn out with fatigne and expecting death every moment.

We now shall go over a second section of the track of the Typhoon, our starting point being the British ship *Hindostan* on her meeting with the storm, some 60 or 80 miles North of Luzon.— Herewith the captain's report.

British Ship **Hindostan** (1547 tons)

CAPTAIN BELYEA.

Date	Latit.	Longit.	Bar.	Wind		Weather	Under what Sail	Remarks
			in					
Aug. 24th 8 p. m.			29.92	WNW	6	Threatening	Top gallant sail's	Very threatening appearance in the NE.
10	19°.47′	120°.56′	.82	W by N	8	id	Lower Top sail	
25th Midnight			.72	W by N	9	Heavy rain	*Running to Eastward*	Heavy lightning-heavy NE sea.
3 a. m.			.52	W by N	10	id	Rounded to on Startack	Lower top sails and reef spanker blown away.
8			.32	W by N	10	id		Ship dimasted.
10			.27	W by N	10-12	Trem. squalls		
11			.17	W by N	10-12	id	Laying to under a tarpaulin in mizen rigging	Very high and confused sea.
Noon			.12	W by N	10-12	id		
4 p. m.			.32	W by N	10		Set fore top staysail on mizan	Weather slightly moderatiug.
26th Midnight	20. 16	122. 17	.42	W	10			
4 a. m.			.47	WSW	9		Made sail	
8			.52	WSW	9			

The *Hindostan* did not get so near to the Centre as the *Bolton* (*Hindostan*, 29^{in}.12;-*Bolton*28, ^{in}.45), but she also kept South of the track, here running almost straight SE.-NW. The wind observed before the passage of the Centre is likewise convergent, though not so much as with the *Bolton Abbey* on account of the greater distance to the Centre.

There is a circumstance that must not be left to pass unnoticed as it is fraught with instructive caution for mariners, viz. how the captain of the *Hindostan* seems to have made light of the warnings given by the rapid falling of the barometer coupled with a remarkable persistency of the wind in the same direction (WbyN.) though rapidly increasing in force. On the 25th morning the course was still E. or even NE., that is towards the storm. No wonder therefore if at 10h a.m. the ship, exposed to all the fury of the westerly wind and beaten by a tremendous cross sea, lost her masts.

On that day August 25th, noon, the Centre of the Typhoon then lay close to lat. 21°.0'. by long. 122°.30'. Its velocity of translation was increasing and it seemed to be making straight for the Southern headland of Formosa.

2nd Period — August 26th — 28th.

This second period is particularly interesting and deserves a circumstantial investigation. We have before us two quite distinct Typhoons, evidently the result of the splitting of the whirlwind that on the 23rd and 25th handled the *Bolton Abbey* and the *Hindostan* so roughly, which strange occurrence cannot be ascribed to any other cause than the action of the enormous mountain chain which runs all through the island of Formosa from North to South.

Formosa Island, 210 miles in length and 80 miles wide at its broadest part, is high and mountainous throughout its whole extent, except at the central part of the west coast, where a broad alluvial plain stretches from the mountains to the sea, and on which is situate the Chinese Capital of Tai-wan-foo. The highest peak, mount Morrison, is 12 880 feet above the sea; this mountain is in latitude 23°.17'. N., longitude 120°.58'E., the general height of the mountain range varies from 9 000 to 12 000 feet, and at its north extreme is a remarkable hat-shaped peak of 11 300 feet, to which the name of mount Sylvia has been given (1).

Let us now imagine a whirlwind to come from the offing and to meet, right in its path and parallel to it, that enormous mountain chain set there as an insuperable barrier. The effect is that of a wedge driving into the body of the whirlwind and dividing it into two large segments which, thrust aside right and left, now will form two separate and independent whirlwinds. It is evidently what happened on this occasion, thanks to the peculiar direction of the Typhoon arriving from the north-west of Luzon.

We are going now to follow closely those two whirlwinds whose tracks, though not very distant from each other, yet are quite distinct.

This second period, from the 26th to the 28th, is the most eventful in the course of the Storm; it begins with the splitting of the Typhoon on the Southern part of Formosa to terminate at the moment when the two Centres, having got as far as the latitude of Chusan, find free play to dash into the Yellow Sea.

We first meet with the report of the captain of the steamer *Abbay* who sailed from Tai-wan-foo Roads on the 25th 7h 30^{m} a.m. for Pescadores: he had to run before the wind and experienced all the fury of the storm to the South of Formosa.

(1) The China Sea Directory, vol. III.

Steamer **Abbay**: CAPTAIN H. LIGHTWOOD.

Date	Hours	Barom. in	Wind		Remarks
August 25th	7 A. M.	29.70	N	2	Lying in Taiwanfoo Roads — light breeze from N. — 7.30, a squall from N.; left for Pescadores
	8	.65	N	5	
	9	.60	N	6	During day of 25th wind increasing into very hard squalls from N. and N by W.
	10	.55	N	6	
	11	.48	N	7	
	Noon	.48	N	7	
	1 P. M.	.44	N	8	
	2	.43	N by W	8	
	3	.43	N by W	8	
	4	.43	NNW	8	
	5	.43	NNW	9	5 p.m. — Being unable to make the Pescadores hove to to watch the wind — found wind hauling to W^{d} turned round and ran South.
	6	.39	NNW	9	
	7	.39	NNW	9	
	8	.34	NW by N	9	
	9	.34	NW by N	9-10	
	10	.34	NW by N	9-10	
	11	.33	NW by N	9-10	
,,	26th Midnight	.32	NW	9-10	
	1 A. M.	.30	NW	9-10	
	2	.22	WNW	9-10	
	3	.18	W by N	9-10	
	4	.16	W	9-10	
	5	.17	WSW	10-11	5 a.m. — Hove ship to: latit. 21°. 38′ — longit. 119°. 44′ by D.R. — terrific typhoon squalls.
	6	.20	SW	10-11	
	8	.24	SSW	10-11	
	10	.29	SSW	10-11	
	Noon	.25	S by W	10-11	
	4 P. M.	.34	S by W	10-11	
	8	.39	SSW	9-10	
,,	27th Midnight	.40	SSW	9-10	August 27th — Squalls still very hard with wind veering from SSW. to SW.
	4 A. M.	.40	SW	9-10	
	Noon	.44	SW	9	Noon — wind settled into hard gale from SW.
	4 P. M.	.44	SW	7-8	

August 28th, arrived in Makung harbour (Pescadores: latit. 23°. 33′ — longit. 119°. 30′) at 3 p.m.

We have here a signifiative instance of the serious inconvenience sometimes attending too implicit a trust in the *laws of Cyclones* as they are still universally admitted among mariners. If the whirlwind that was drawing towards Formosa had been perfectly regular, the course of the captain of the *Abbay* would have been quite correct. — With the barometer sinking and a contrary wind freshening every moment, it was imposible to make way. — What to do then? — Precisely what the captain did. "Being unable to make the Pescadores, *hove to to watch the wind*". To profit of the wind and try to put back into Tai-wan-foo might have been as dangerous as any other course. Prudence made it imperative first to realize the situation, forming some idea of the probable position of the Centre and the direction of the whirlwind. — "*Hove to to watch the wind — Found wind hauling to westward, turned round and ran South.* If it had been a regular whirlwind, according to the circular winds theory, the Centre should have been in the East of the ship and bearing northward: steering southward thus was getting away from the Centre. Unfortunately the theory was again at fault; the Centre was at a good distance and the wind partly converged towards it; it lay, not to the East but to the South-east, so that in running southward there was a risk of meeting the track of the Typhoon and of getting nearer to instead of farther from it. But the ship was a good way in advance and besides the track followed a curve that was to take the Centre right upon Formosa.

After the barometric minimum, the wind at once hauled to SW. and even to SSW., that is to say, the convergence of the wind obtained in the hind part of the whirlwind as well as it had in the fore part and even at the moment of the passage of the Centre. The latitude of the *Abbay*, when the minimum of the barometer was observed, was approximatively the latitude of the Centre at 4 a.m. on the 26th August; as for the determination of its longitude we must avail ourselves of other indications: the observations made at Tai-wan-foo and at Makung (Pescadores) will supply us with the requisite data.

Tai-wan-foo

Latitude 22°. 58′ — Longitude 120°. 14′

HARBOUR MASTER'S OFFICE

Date	Hours	Barom.	Wind	Rain	Remarks
		in			
August 24th	4 P. M.	29.671	NNE		Fresh NNE. breeze — fine weather.
	8	.658	NNE		
,, 25th	8 A. M.	.502	NE	in	Fresh NE, wind increasing — 10 a.m., blowing
	4 P. M.	.320	NE	0.67	strong gale — hazy weather — heavy sea on the
	6	.260			Bar.
	8	.173	NNW		
,, 26th	Midn.	29.039			Hazy and misty weather with showers of drizzl-
	8 A. M.	28.872	NNW		ing rain at intervals.
	Noon	.823			*Heavy Sea on the Bar.*
	4 P. M.	.885	NW	0.13	
	6	28.984			
	8	29.097	W		
,, 27th	8 A. M.	.216	WSW	20 hours	Strong WSW. breeze up to 1 p.m., afterwards
	4 P. M.	.504	SSW	6.13	the wind shifted to SSW. and decreased a little
	8	.547	SSW		— Heavy sea on Bar.

Chinese Gunboat **Fei-Yuen** — CAPTAIN CHEU HONG

lying in MAKUNG HARBOUR (Pescadores)

Latitude 23°. 33′ — Longitude 119°. 30′

Date	Hours	Barom.	Wind	Remarks
		in		
August 25th	4 A. M.	29.78(1)	N by E	
	8	.73	N	
	Noon	.65	NNW	
	4 P. M.	.65	N by W	
	8	.43	N by W	
,, 26th	Midn.	.27	NNW	Both anchors down and steaming ahead.
	4 A. M.	.10	NNW	
	8	29.00	NNW	Terrific Typhoon.
	Noon	28.79	NNW	
	3 P. M.	28.89	NNW	The wind lulled down to about the force
	4	29.04	NNW (?)	5 for half an hour.
	8	.24	WNW (?)	Heaviest squalls from WSW. and SW.
,, 27th	Midn.	.	WSW	force 12 in the afternoon. (2)

(1) *Correction unknown.*

(2) The keeper of Litsitah Light-house (near Makung) also reported that the wind lulled down to about force 5.

Chinese fishermen report that a calm was experienced for a short interval a little to the Northward of Wanckan (latit. 23°. 30′ — longit. 120°. 0′) on the western coast of Formosa.

There is no doubt of it: the Centre of the Typhoon passed in the East of Tai-wan-foo on the 26th about noon; then about 3 p.m. between the coast of the island and Pescadores, from which we immediately infer the general direction it followed since the 25th noon; it now bore to NNW. and about midnight on the 26th, must have touched the southernmost headland of Formosa on its eastern side. That headland is not very high, the great mountain chain only beginning to rise some 30 miles further north. It is at the foot of that chain that the Centre of the Typhoon, now evidently altered in shape, passed on the morning of the 26th. The distance of the *Abbay* to the track of the Typhoon on that morning (4h a.m.) then must have been some 60 or 70 miles.

The Centre was not upon Formosa longer than 12 hours during which it travelled 72 miles with a velocity of 6 miles an hour. The central region of the whirlvind seems to have been from 20 to 25 miles in diameter near Pescadores.

Steamer Glencoe between Swatow and Foochow. — Let us go somewhat further north with the S.S. *Glencoe* from Hongkong to Shanghai, and we shall find the Centre again at nightfall. That steamer had the extraordinary ill-luck, in that short voyage, twice to bear the fury of the storm, having successively met both whirlwinds as they were rising along the coast.

Steamer **Glencoe**, CAPTAIN W. A. GULLAND

from Hongkong to Shanghai.

Date	Hours	Course	Bar.	Wind		Remarks
		°	in			
Aug. 26th	Midn.	N 47 E	29.54	NW	2-3	*Latit.* 23.°35′—*longit.* 117.°45′ — Wind light — weather fine.
	3 a. m.	N 47 E	.54	N by E	7-8	Moderate — increasing gale — sea making from N.
	6	N by E	.44	N by E	9	*Latit.* 24°. 10′—*longit.* 118°. 23′— Wind and sea increasing.
	8	N by E	.39	N by E	10	Heavy gale — tremendous sea — weather dry with passing clouds.
	10	ENE	.30	N by E	10-12	Gale still increasing.
	Noon	ENE	.26	N by E	12	*Latit.* 24°. 23′—*longit.* 118°. 39′—Wind hurricane force — sea mountainous-heavy
	4 p. m.	NE by E	.14	N by E	12	No change in force of Wind — continuous rain. [rain squalls.
	8	NE	.10	N by E	12	Gale continuing in strength — sea high, decks flooded.
	10	NE	.10	NW — W	6-7	8. 30 p.m. — Wind NW and hauling to W. — 10 p.m.-sky clear — wind moderating
27th	Midn.	NE by E	.10	W	1-2	11. 30 p.m. — Calm — overcast — sea confused and decreasing. [fast.
	4 a. m.	NE by E	.25	NE—SW	2-4	Wind very unsteady — continuous rain.
	6	N 32 E	.28	SSW	4	Wind increasing slightly — very heavy rain.
	8	N 32 E	.32	S	4	Moderate wind — much rain — sea moderate.
	Noon	N by E	.35	S by E	3	Latit. 25°. 54′ — longit. 120°. 33′ — light winds — drizzling rain — sea falling.

During the storm, from 8 to 12 p.m., on the 26th, another Barometer indicated $28^{in}95$.

This report is most interesting and we shall take it up again. For the present we have only to do with the storm. — We may first wonder at the boldness of the captain who, on seeing the barometer to fall and the wind steady NbyE. to blow into a hurricane, did not seek for shelter, but unhesitatingly went on his course NbyE (Aug. 26th, 8 a.m.) and even turned still more to E. (after 10h a.m., route ENE.); it may have been for better resisting to the wind and sea, but it was rushing in the way of the Centre, which indeed was got into between 11 p.m. and midnight. The position of the ship at that moment can be put down at lat. 24°.50′ by long. 119°.25′. The Centre must have passed the Ockseu light-house about midnight, Aug. 27th *(see further on the observations taken at the light-houses)*.

That the position of the Centre, on the 27th midn. was by lat. 25°.0′-long. 119°.25′, is, I think, unquestionable.

Let us now return to Formosa and take our station at Tamsui to note what has happened and what is now taking place there.

Tamsui (lat. 25°.10′-long. 121°.25′). — Mr. W. P. Patterson, Custom house officer, has been kind enough to communicate to me his own observations than which there are none more carefully made and more complete.

Tamsui (Formosa)

Latitude 25.° 10′ — Longitude 121.° 25′

HARBOUR MASTER'S OFFICE

Date	Hours	Barom. at sea level	Therm. Wet	Therm. Dry	Winds Direction	Winds Force	Weather	Remarks
		in	°	°				
Aug. 23rd	1 p, m.	29.796	78	90	SE	2	c. o.	
24th	1 p. m.	.743	81	92	NE	3	c.	
25th	7 a. m.	.658	79	82	NE	2-4	o. m. q. *u.*	
	1 p. m.	.588	80	84	,,	4-6		
	5	.523	79	83	,,	5-7	c. o. q. p.	Very peculiar looking sky at Sunset with one flash of lightning.
	7	.526	76	80	,,	5-7		
	9	.501	76	79	,,	5-7	o. q. d. p. r.	
26th	Midnight	.405	76	78	,,	7-8	,,	
	3 a. m.	.315	75	80	NE	8-10	o. m. *r.* q. u.	in
	5	.228	76	78	NE *to* ENE	,, ,,		Rain fall during 24h 2.40 from
	6	.208	76	79	,, ,,	8	o. m. *r.*	Aug. 25th 8. a.m. to 26th 8 a.m.
	7	.149	77	79	NE	8-10	o. m. r. q.	
	8	.129	78	80	,,	7-9		
	9	.126	75	80	NE *to* ENE	8-10	c. o. m. r. *q.*	Sun visible at times.
	10	.085	76	82	,, ,,	,, ,,		
	11	.065	76	82	East	9-11		
	Noon	29.055	76	82	,,	,, ,,		
	1 p. m.	28.998	75	80	,,	,, ,,		
	2	.960	75	80	ESE	,, ,,	o. m. *r.* q. u.	
	3	.940	75	80	,,	11-12		
	4	.928	75	80	,,	10-11	o. m. r.	
	5	.898	75	81	,,	,, ,,	c. m. *q.* d.	
	6	.900	75	80	,,	9-11	c. m. d.	
	7	.900	74	79	,,	8-9	c. m. *q.* d.	
	8	28.968	75	80	ESE to SE	9-10	o. m. *q.* d.	
	9	29.008	75	80	,,	91-1	o. m. *q.* r.	
	20	.028	75	80	,,	9-10	o. m. *q.* r.	
27th	Midnight	.085	76	81	SE to SSE	3-5	o. m. r. p.	in
	3 a. m.	.180	77	83	SW	2-3	o. m. d.	Rain fall during 24h 2. 40 from
	7	.269	76	80	SE	2-3	o. m. d.	Aug. 26th 8 a.m. to 27th 8 a.m.
	1 p. m.	.388	74	79	SW	4	o. m. r.	
	3	.388	74	79	,,	2-6		
	7	.408	74	78	,,	8-9	o. m. r. q. q.	
28th	Midnight	.424	74	76	,,	7-8		
	8 a. m.	.421	75	77	SW	7-8	o. m. r. *q.*	in
	1 p. m.	.398	76	78	,,	7-8	o. m. r. *q.*	Rain fall 24 hours 3.40.
	3	.418	75	78	,,	7-9	o. m. r. *q.*	

We previously found a Centre of depression that passed close to Tai-wan-foo and left the coast of Formosa to get into the strait to the East of Pescadores. That same Centre we found again on the 27th midn., close to the coast of China, 120 miles West of that harbour, at a latitude little inferior to that of Tamsui: its direction hitherto bore to NNW. or N. Now the observations made at Tamsui clearly show that a Centre of depression or of a violent whirlwind had already, at 6h p.m., passed within a short distance on the South-west and that it came from SE. or S., since the wind had kept NE. till noon to turn afterwards successively E., SE., SSE. and lastly SW., blowing all through the 24 hours with an unheard of violence. These two Centres of depression cannot possibly be made out as being one and the same whirlwind; for a wirlwind in the narrow Formosa Strait naturally gets contracted, whereas on the contrary, inthe supposition of a single Typhoon, we should find it to have taken an uncommon development and its central region alone would have extended at least from Tamsui to the SS. *Glencoe* when, about 6h p.m., some 150 miles to the SW. of that port, she also had a barometric minimum near the central region, the wind blowing furiously at the time.

We have therefore to do with a second whirlwind which must have followed up the eastern coast of Formosa from the evening of the 25th till next day noon. It had then got North abreast of the highest summits of the great mountain chain that runs all through the island; as it was some way ahead of its fellow on the other side, it went, as it were, to meet it and unite with it again, a proof of the existence of a common bond between them in the upper regions, which is confirmed by the fact of its turning sharp to the left as soon it found a free passage

to the Strait beyond the mountain chain, instead of continuing to rise straight northward as it had begun to do and eventually did after a few oscillations right and left.

We beg here by way of anticipation to call attention to the strangeness of the motions of these two whirlwinds, meandering along the coast of China, crossing and recrossing each other's track, seeking each other, as if to unite and increase their energy and always shooting beyond the point where a meeting might have taken place. It looks as if they exercised a mutual attraction which tended incessantly to bring them to the same direction again, but they cannot keep to it as the velocity which their common cause of attraction communicates to them makes them each time shoot beyond the mean position, so that theirs is an oscillatory motion right and left of the mean of the two tracks. Such seems to be the only likely explanation of those curious small sinuosities in the track of the main whirlwind, which shall cease as soon as the attendant whirlwind itself had vanished.

That there was a whirlwind to the East of Formosa in the evening of the 25th and during the 26th, is confirmed by the captain of the Australian steamer *Menmuir* who also considers that to have been the direction of the Centre of the storm he experienced North of Formosa, on August 26th. I subjoin a few lines from his report.—Left Foochow on the 25th August, and when approaching the north end of Formosa bad weather set in from NE., aud soon it became apparent that the ship was on the NW. quadrant of a Typhoon, the centre of which bore SE., and distant probably 150 miles. Everything was made secure, but the storm came down with such rapidity that all things movable about the decks were washed overboard, and only half a dozen sheep and a few fowls were saved by being put in the bathroom. All the officers' cabin were flooded, and much water found its way into the saloon, through the window in the captain's cabin being stove in, two boats were stove in, also the ventilator on the main hatch. It was with much difficulty the lead was hove, the situation being rather unpleasant, owing to the narrow waters the ship was in. After 6 p.m., the 26th, the weather moderated a little, the high land of Formosa probably interrupting it, but on the 27th it blew a heavy gale from the S.W., with a slowly rising barometer. The *Menmuir* proved herself to be a splendid sea-boat.

The direction followed by the eastern whirlwind or "*Chusan*" Typhoon when passing near Tamsui is manifest from the variation of the wind which turned to ESE. and SE. and blew from that quarter with extreme violence (force 9 to 11) till the 27th midnight. Now, the western whirlwind or "*Pescadores*" Typhoon was not far; from the 26th 6h p.m. to the 27th midnight it lay in the South-west of Tamsui, where itt ended to keep the wind blowing from SE.: there can then be nothing against admitting the track of the "*Chusan*" Typhoon to have been at that time bearing from SE. to NW. At midnight it crossed the 26th parallel off Foochow where a frightful storm was raging.

Light-houses of the Formosa Strait.

Fisher Island

Latit. 23.° 33′ — Longit. 119.° 28′

Height: 205 feet.

Date	Hours	Barom.	Wind		Weather
		in			
August 24th	Midn.	29.80	Calm		B. C. M.
	6 A.M.	.75	Calm		B. C.
	Noon	.73	N	2	id
	6 P.M.	.67	N	3	B. C. M.
,, 25th	Midn.	.62	N	5	id
	6 A.M.	.54	N	6	O. M.
	Noon	.46	N	8	id
	6 P.M.	.32	N	10	id
,, 26th	Midn.	.16	N	10	id
	3 A.M.	29.01	N by W	11	id
	6	28.92	N by W	11	id
	9	.90	N by W	11	O. M. D.
	Noon	.80	NW by N	12	id
	3 P.M.	.77	NW by N	12	id
	6	.77	NW by N	11	id
	9	28.96	NW by N	10	O. G. R. R.
,, 27th	Midn.	29.13	W	6	id
	3 A.M.	.16	W	6	id
	6	.24	WSW	9	id
	9	.43	WSW	9	id
	Noon	.39	SSW	8	O. G. M. P.
	3 P.M.	.39	SSW	8	O. G. M R. Q.
	6	.39	SSW	9	id
	9	.44	SSW	9	id
,, 28th	Midn.	.47	SSW	7	id
	6 A.M.	.48	SSW	6	O. G. R.
	Noon	.52	SW	5	O. G. M.
	6 P.M.	.58	SW	3	id
,, 29th	Midn.	.63	SW	1	B. C. M.

Lantern washed, on the 25th, at 7h, 8h, 10h p.m. — on the 26th, at 2h, 4h and 5h a.m.

Heavy rain from 9 p.m. on the 26th till 6 a.m. on the 28th.

Ockseu Island

Latit. 24.° 59′ — Longit. 119.° 28′

Height: 286 feet.

Barom.	Wind		Weather
in			
29.95	NE	3	B. C. L.
.92	NE	4	B. C.
.91	NE	5	id
.85	NE	5	id
.84	NNE	7	id
.77	NNE	8	id
.67	NNE	9	B. C. M. D.
.52	NNE	9	C M. U.
.42	NNE	10	id
.21	NNE	11	id
29.11	NNE	11	id
28.91	NNE	12	id
.74	NNE	12	O. M. R. U.
.53	NNE	12	id
.73	NNE	12	O. G. M R.
28.71	NNE	11	O. M. R.
29.02	NNE	8	id
28.98	NNE	5	id
29.15	SW	5	id
.23	SW	7	C. M. R.
.23	SW	8	id
.23	SW	9	O. M. R.
.31	SW	10	O. G. M. R.
.37	SW	10	id
.42	SW	10	id
.45	SW	8	O. M. D.
.59	SW	6	B. C. P.
.64	NW	4	B. C. V.
.71	NW	4	B. C.

Turnabout Island

Latit. 25.° 26′ — Longit. 119° 59′

Height: 257 feet.

Barom.	Wind		Weather
in			
29.88	NNE	2	B. C. M.
.84	N	3	id
.84	N	3	id
.79	NNE	4	id
.79	N	6	id
.70	N	6	O. M.
.60	N	6	B. C. M.
.53	N	7	id
.46	N	8	O. M. G.
.34	N	9	B. C. M.
.24	NNE	9	C. Q. M.
29.16	NNE	10	O. M. R. Q. Q.
28.92	NNE	11	O. N. R, R. Q.
.77	NNE	11	id
.70	ENE	11-12	id
.86	ENE	10- 9	id
.94	E	9- 8	id
28.97	SSE	8- 7	id
29.04	SSE	6	id
.19	S	7	O. M. R. R.
.18	SSW	7- 8	id
.15	SW	8- 9	O. M. R. R. Q.
.19	SW	8- 9	id
.27	SW	8	id
.32	SSW	8	id
.37	WSW	7	O. M. Q.
.49	WSW	5	C. G. M.
.56	WSW	2	B. C. V.
.64	W	3	B. C.

Lowest reading of the barometer 28in68, on the 26th 7 p.m.

Middle Dog Island

Latit. 25.° 58′ — Longit. 120°. 2′

Height: 257 feet.

Barom.	Wind		Weather
in			
29.80	NE	2	O. M.
.78	NE	2	B. C. M.
.79	NE	3	id
.76	NE	3	id
.76	NE	3	id
.70	NE	4	id
.68	NE	5	id
.59	NE	6	id
.53	NE	9	O. P. Q.
.48	NE	9	O. G. P. Q.
.40	ENE	9	O. G. Q.
.38	ENE	10	O. G. P. Q.
.24	ENE	10	id
.15	ENE	10	O. G. R. Q.
.15	ENE	11	id
.06	E	12	id
.03	ESE	11-12	id
.09	ESE	11	id
.08	SE	10	id
.21	SE	7	O. G. R. M.
.23	SSE	5	id
.23	SSE	2	id
.23	WSW	3	id
.28	WSW	4	id
.33	WSW	4	O. D. M.
.45	WSW	3	O. M.
.46	WSW	3	B. C. M.
.53	WNW	3	B. C. V.
.62	WNW	3	B. V.

Rain began at 1h p.m., on the 27th
Rain ceased at 11h 20m p.m., on the 27th.

Light-houses of the Formosa Strait. — Both whirlwinds are perfectly distinct in the foregoing observations: the first, which skirted Formosa on the side of the open sea, and is going to take to the continent, gives the barometer its minimum, even when the second Centre be nearer to the station; but everywhere else it is the passage of the second Centre that commands the variation of the wind. If the track of the Typhoon from Tai-wan-foo and Pescadores did not pass over the land, it must at least have razed it very close when going to pass on the left of Turnabout, which is only separated from the Chinese coast by Haitan island. Lastly it appears that it was at Ockseu Light-house that the total variation of the barometer was greatest, viz. 1in 42 from the 24th midn. to the 26th 3 p.m.; the minimum very nearly coincided with the moment when the two Centres entered together into Formosa Strait, the one to the North near Tamsui, the other in the middle near

Pescadores. The storm is likely to have been in that point of a terrific violence: as the wind blew NNE., that is in the regular direction there common to both whirlwinds, they must have united their energies, and this is probably what contributed momentarily to increase the depression in that particular spot, even at a good distance from the two Centres. It must also be noticed how the farther South in Formosa Strait, the more violent and of longer duration was the second storm, which followed the moment when the two tracks crossed each other. At Middle Dog, which lay above that crossing, the storm came to an end immediately after the passage of the last Centre, that is on the 27th about 10h a.m., whereas at Ockseu and at Fisher Island it was still holding on the next morning. A glance at the diagram of the two tracks at once gives the reason of this seeming paradox. From Middle Dog both whirlwinds moved away, one to the North-west, the other to the North-east; the former tended to produce SW., the latter NW., winds, that is winds blowing in two directions at right angle, the result of which must be a wind of less intensity and intermediate direction (WSW. 4-7). Behind on the contrary, in the South, the winds met with still belong to both Typhoon, but the farther South, the less they differ in direction, since the angle comprised between the lines drawn towards the two Centres diminishes as the distance increases: hence a greater violence and duration of the winds which here do not neutralize one another. We thus find in this interesting fact a signal proof of the simultaneous existence of two Typhoons produced by the splitting of a single whirlwind.

Foochow. (Pagoda anchorage: latit. 26° 8′-longit. 119° 38′) — The storm commenced with gusts and squalls (wind NE.) together with a rapidly falling barometer, at about 8 a.m., on the 26th. This, combined with a sharp cutting rain, tended to make the weather thoroughly *bad* in every respect. The wind blew with such force as had not been known in Foochow for a great number of years, and the rage and violence of the elements can only be roughly estimated by the damages done to life and property, and we regret to chronicle the death of a number of people, amongst whom were three Europeans. The wind blew from NE. before the minimum of the barometer and from NW. afterwards.

Some readings of the barometer at Pagoda Anchorage.

		in			in
August 26th	2 P. M.	29.31	August 27th	Midn.	29.06
	3	.28		1 A. M.	.04
	4	.29		2	.04
	5	.27		3	.02
	6	.25		4	.02
	7	.23		5	.02
	8	.19		6	.04
	9	.14		7	.07
	10	.09		8	.11
	11	.04		9	.13

I call attention to the North-easterly direction of the wind so persistent during the first period of the storm, and to the uncommonly slow falling of the barometer. The reason of these facts it is easy to make out. There were two centres of depression rising up from the South-east, which passed off Foochow at an interval of 4 or 5 hours of each other; there even was a mutual *crossing* of their tracks some 50 miles East of that port, for the "Pescadores" Typhoon in its turn had swerved from its path, about midnight on the 27th, in chase of the "Chusan" Typhoon and was now bearing North-eastwards. If, following up its previous direction, it had passed to the South-west of Foochow, the variation of the wind would have been essentially different: it would have veered through E., SE. S. and SW., whereas in fact it veered from NE. to NW. through N., a clear proof that the Centre or rather the Centres passed to the East of the harbour.

In the course of the morning of the 27th, the route of the SS. *Glencoe (See observations above)* intersected

the line of the two Centres, then about 85 miles apart. It is most interesting to study the behaviour of the wind in that intermediate region which belonged exclusively to neither of the whirlwinds. On the 26th 10 p.m., the ship being near the Centre of the "Pescadores" Typhoon, the wind varied between NW. and W., abating considerably. — At 11h 30m, perfect calm, barometer at its lowest point; ship standing in the central region of the whirlwind; sky overcast; sea high but no so much as before. — On the 27th, midnight, a light westerly wind blowing at intervals; direction not steady; rain pouring. — At 4h a.m., ship lying fairly between the two Centres; rain pouring on; barometer rising again very slowly; wind shifting from NE. to SW., now light, now stronger. The NE. wind belongs to the "Pescadores" Typhoon which is coming behind; the SW. wind belongs to the "Chusan" Typhoon, that is making away for the continent. At 6h a.m., wind getting stronger and more steady, from SSW. The "Pescadores" Typhoon had outstripped the Steamer: both Typhoons lay North of her but separating more and more as they went on. From that moment the *Glencoe* was able to proceed with moderate winds of S. and SE. strongly convergent.

All this time since the 25th 6h p.m., the Steamer *Hwai-yuen* lay at anchor under the lee of Lamyit island (lat. 25°.7' - long. 119°.26'), and the very circumstantial report of capt. O. Wilson is full of useful information. We first see that a barometric minimum (29^{in}.38) was registered on the 26th, 4h a.m., the wind blowing steady from NE. (force 10); the pressure then rose again and oscillated several times, being 29^{in}.72 at 8h a.m., 29^{in}.06 between 2h and 4h p.m., 29^{in}.20 from 7h to 8h p.m., and lastly 29^{in}.05 at 11h p.m. Wind steady NNE. 11 till 5 p.m. and abating gradually till 2h a.m. of the 27th, when it turned N. 4; then at 4h a.m., NW. 2; at 5h a.m., W. 1; at 6h a.m., SW. 3 in which direction it continued to blow, freshening again. Raining all the time, sometimes very hard, after the 26th midnight.

Everything in this report confirms what has been said above of the existence and of the course of the two Centres of depression. Moreover, besides the passage of a small precursory whirlwind in the morning of the 26th, we see the depression belonging to the two main whirlwinds spreading to a considerable distance in their common direction (in the afternoon, between 2h and 4h, barometric minimum: 29^{in}.06); then the two Centres drawing nearer to each other in the East of the ship (barom. maximum 29^{in}.20 between 7h and 8h p.m.); and lastly the "Pescadores" Typhoon performing its passage near the Lamyit island (barom. minimum at 11h p.m.: 29^{in}.05). The convergence of the SW. wind after that passage is manifest since we know, from the Foochow observations, that the Typhoon was moving away in the direction of the North-east.

3rd Period.—August 27th—29th.

During this period, the two tracks together form the second loop of the figure 8 begun on the 25th about noon, to the South of Formosa.

We left the two Centres to the East of Foochow: we are now going to follow them in their new positions. The "Pescadores" Typhoon, which is the western one, is going to pass to the East of the mean track, and the "Chusan" Typhoon, come from the eastern coast of Formosa, is going to pass to the West and take a run upon the coast of China, to came to sea again, on the 28th, about the Chusan archipelago. Let us follow them one after the other.

Bullock Harbour (latit. 27°.55'-long. 121°.0') and **Wenchow** (latit. 28°.0' - long. 120°.38'). — The Chinese steamer *Mee-foo* (capt. Petersen) had put into Bullock harbour for shelter on the 26th, 5h p.m. I subjoin the observations made on board on the 26th and forenoon of the 27th.

	Wind			Barometer
				in — in
August 26th from 4 to 8 A. M.	ESE	5		29.90 — 29.80
8 — 4 P. M.	E	6		.80 — .70
4 — 10	NE	7	heavy rain	.70 — .60
10 — 12	ENE	10		.60 — .60
„ 27th Midn. — 4 A. M.	E	10		.60 — .60
4 — 8	SE	9		.60 — .50
8 — Noon	SE	7		.50 — .40

These indications, though short, yet are, I think, very clear with regard to the course followed by one of the Centres. The wind turns gradually from NE. to E. and SE. whilst the barometer is sinking, a reliable indication of the fact that one of the Centres tends to pass to the west of Bullock harbour and consequently has taken to the continent; and in fact we have seen from the variation of the wind at Foochow and with the two steamers *Glencoe* and *Hwai-yuen* that the "Pescadores" Typhoon had moved away to the North-west where we shall soon find it again, 75 miles from the coast: it is therefore the "Chusan" Typhoon which had left the North-eastern coast of Formosa and was bearing straight to NW. as shown by the wind observations at Tamsui during and after the passage of the Centre.

The observations made at the Wenchow British consulate supply a complement to these first data. The wind, which since the 25th was blowing strong from EbyS., abated considerably in the afternoon of the 27th and became more changeable. At last, on the 28th 9h a.m., it came to NW. through S. and W. and freshened very rapidly whilst the barometer which had sunk with excessive slowness in the morning of the 28th, rose rapidly again. A centre of depression had then passed west of Wenchow and must have moved away, not towards the North-west or the North, but towards the North-east (wind NW. fresh). As for the circumstances of the barometer falling slowly and rising rapidly after the minimum, both are easy to explain. On the 27th afternoon, when the wind, after blowing EbyS., abated and became changeable, the barometer was already low $29^{in}.54$: it was very likely the moment when the "Chusan" Typhoon was passing in the West. But in the East the "Pescadores" Typhoon was approaching, as it rose almost parallel with the coast, and must have acted on the barometer at Wenchow in depressing it. It only attained the point of shortest distance on the 28th, little after midnight. From that moment, as both whirlwinds were bearing NE., a NW. wind could and naturally must establish itself, and the barometer rose the more rapidly, as the first Centre already was far from Wenchow. As for the wind being so light and changeable in the afternoon of the 27th and the following night, it is easily accounted for by the fact that Wenchow was then under the influence of the two whirlwinds, having on the left a Centre which must bring very strong S. and SW. winds, and on the right, somewhat behind, another Centre with not less violent N. and NE. winds: there was here the same opposition as with the SS. *Glencoe* between the Easterly and Westerly winds. Lastly, the relatively high pressure, $29^{in}.40$ (?), observed at the moment of the barometric minimum on that point of the coast, must be ascribed, first to the distance between the two Centres, thanks to which neither could work its full effect on the barometer at the station which they passed one after the other; then also to the check to its development which the western Typhoon met in the nature of the ground.

Japanese Steamer Takasago Maru. —If the whirlwind which had taken to the continent found itself cramped and hindered in its progress, such was not the case with the other one which had free play in the open sea.

Let us first say a few words of the sailing of the *Takasago Maru*.—"Left Kobe (Japan) on the 23rd - cleared the Inland Sea on the morning of the 24th, fine weather till noon, 26th, when the wind at ESE. had increased to a Gale with very high sea. Continuing our course till midnight, 27th, when in lat. 26°.52'-long. 121°.34' hove

the steamer to on starboard tack, continuing this till midnight of the 28th, being then in latit. 27°.52'-longit. 123°.6', when we stood to the WSW., the wind during all that time being ESE. and blowing with Typhoon force. A very high sea and heavy rain squalls; at 3 a.m., port quarter boat was washed away; no other damage done during the gale of any consequence. The lowest reading of the barometer 29in.12, at 7 a.m., on the 28th. The gale moderated shortly afterwards. At 10 a.m. wind SW., squally with rain and fog. At 2 p.m. the wind shifted suddenly to the NW., blowing hard and dry, but gradually decreasing to a moderate breeze."

Thus, on the 28th of August 7h a.m., the steamer *Takasaga Maru* had passing close to her, only a few miles to the West, the Centre of the "Pescadores" Typhoon whilst at that moment 150 or 160 miles North farther the "Chusan" Typhoon was vindicating its appellation by spreading havoc in the Chusan Archipelago. That the Centre passed very close to the steamer, may be inferred from the barometric minimum, little different from those previously observed in the same Typhoon, from the decrease in the violence of the wind, and from that circumstance almost constantly observed whenever a ship crosses the Centre, that the sky clears up in part or entirely and that the sun comes out to shine upon the scene of wild tumult. Here also he is reported to have appeared for a few moments on the 28th, 7h 30 a.m.

The steamer *Hwai-yuen* which, as we have seen, on August 26th had taken shelter under the lee of Lam-yit island, left that refuge the next day at 6h a.m. to proceed on her voyage to Shanghai. She unawares ran on in advance of the Typhoon which had just passed near her in the morning of the 27th. But the Typhoon, after a short and rapid excussion Eastward, was making up for the ground it had lost and rose straight Northward. On the 28th, between 11 a.m. and noon, the ship's barometer sank to a new minimum, 29in.20, with wind from W., force 11. From three positions of the ship given for 1h, 4h and 9h a.m., her situation at that moment may be estimated at latit. 29°.10', longit. 122°.32'. We may fairly infer therefrom that the track of the "Pescadores" Typhoon about that region ran from South to North and must have passed near the steamer.

Steamer Fuhyeu. (Capt. A. Croad) and **Steamer Chinkiang.**—Both of these ships, during the whole passage of the two whirlwinds, stood very nearly upon the mean track, about equally far from the two Centres. The *Fuhyeu* as early as August 25th 4 p.m. had taken shelter in the lee of Taichow island (lat. 28°.28'-long. 121°.52'), and left on the 28th, 8h a.m., at the very moment when the barometer reached its minimum = 29in.42. The wind blew in succession from NE. and ENE. (fresh breeze) on the 25th (Barom. 29in.98-29in.92); from E. (strong breeze) on the 26th (Barom. 29in.90-29in.84); from ESE. (strong gale) and from SE (hard squalls) on the 27th. It abated on the 28th shortly after midnight (barom. 29in.50), then became very variable both in force and direction, blowing now hard from NNW., now light from SW., finally settling NNW. (gale) after the ship had weighed anchor to proceed southward, and the barometer then rose again very rapidly.

A reference to the track of the two whirlwinds makes this abstract of the captain's report perfectly clear. First there is the "Chusan" Typhoon to the West, commanding the NE., E. and SE. winds. But about midnight on August 28th, the Centre of the "Chusan" Typhoon, the steamer *Fuhyeu* and the Centre of the "Pescadores" Typhoon are on a straight line very nearly North and South. The SW. winds of the first whirlwind are in opposition with the E. and NE. winds of the second, thus very nearly neutralizing each other. On the 28th 4 a.m., the "Pescadores" Typhoon lies within the shortest distance, and the barometer reaches its minimum, 29in.42, though it appears so little alarming that the captain weighs anchor at once; and yet the distance to the Centre did not exceed 35 miles. Lastly, as was to be expected, the NNW. wind came to prevail.

The two whirlwinds are yet more distinctly set off by the observations made on board the *Chinkiang*, as it appears from the following table.

Steamer **Chin-kiang**

from Shanghai to Hongkong.

Date	Hours	Position	Barom.	Wind	Weather	Sails	Remarks
Aug. 27th	2 P. M.	Lat. 30°12′ Long. 122.37	in 29.79	SE 6	Cl.-heavy rain	Nil	Heavy SE swell.
	4		.76	SE 7	id		Hard squalls and heavy sea running.
	6		.74	ESE 5	id		High cross-sea, ship labouring heavily.
	8		.73	ESE 5	Fair		
	10		.70	ESE 8	Clear	Storm sails	Tremendous sea — Taking water over all fore and aft.
,, 28th	Midn.		.63	ESE 8	Heavy rain	id	
	1 A. M.		.63	calm	id	Nil	1 a.m. — Wind shifted suddenly to the South. — Ter-
	2		.58	W 6	id		1.30. — Calm with tremendous sea. [rific sea running.
	4		.48	SE 8	Cl. and fair		2.30. — Wind hauled to the West.
	6		.47	SE 7	Showery		3.30. — Wind chopped round to SE. in a terrific squall.
	8	Lat. 28.46 Long. 122.21	.40	SE 7	id		4 — Strong gale and heavy cross. sea — ship pitching
	10		.38	NW 7	Fair		8 — *id id id id* [and labouring heavily.
	Noon		.39	NW 6	id	Trysails and storm	10 — Wind shifted to NW. with hard squalls and fair
	2 P. M.		.42	NW 6	id	Stay-sails	Noon — Wind moderating with high sea. [weather.
	4		.54	NW 5	id		2 p.m. — Fresh gale — sea moderating.

The western or "Chusan" Typhoon made itself felt up to the 28th 2h a.m., after which date it was the turn of the eastern Typhoon: hence the strange variations of the wind.

Before the upper loop of the "8" described by the track be closed, we must move to Ningpo and to the Chusan Archipelago to witness the passage of the western Typhoon as it comes to sea again.

Ningpo. (latit. 29°. 53′-long. 121°. 34′). — The barometer here fell pretty rapidly and rose again but slowly, in accordance with the course ascribed to the two whirlwinds. For since the 27th 10 a.m. the "Chusan" Typhoon was rising from SSW. to NNE., going straight towards Ningpo, which it passed close to within 15 miles, the other whirlwind at the same time being far away in the South-east. There was then nothing to hinder the sinking of the barometer till the 28th 4 a.m., date of the passage of the Centre in the South-east. But, as stated before, the excursion of the whirlwind on the continent had considerably reduced the atmospheric depression and the barometric minimum here also was not under 29^{in}.45. It was only in the afternoon that the barometer began to rise again, that is after the passage of the second Typhoon. The wind blew SE. (force 4-6) during the 27th and till the 28th 4 a.m.; then NW. till the 29th noon, afterwards abating.

We give a few incidents from the letters of Ningpo correspondents to the Shanghai papers.

Considerably damage had been caused by the gale, assisted by an extraordinary high tide which rose higher than has been known for many years. The Bund was covered to the depth of 3 to 4 feet, and the main street was flooded, access being had to the houses by means of sampans.

Many of the sampans were smashed up or sunk by the violence of the wind, and a number of junks very much damaged. The destruction on shore was also very great, several houses being thrown down, and many others wholly or partially unroofed. In fact, the 28th of August was a day long to be remembered in Ningpo.

A fire broke out on the 29th, 11 a.m. when the wind was blowing a hurricane, and in spite of the diluvial rain then falling, soon spread even to the other side of the river.

The fire at the Bridge gate consumed, besides the Fruit Hong over 100 houses, and by the fire on the Quantung side two large godowns and about 30 more houses were destroyed. Happily no lives were lost.

About 25 junks all dimasted were passed at Chinhai (on the western side of entrance to the Yung river, 11 miles from Ningpo), and many more were reported lost.

Chusan Archipelago — This large assemblage of islands, of which Chusan is the principal, lies near

the mainland between the parallels of 29°.39′ and 30°.50′, and between the meridians of 121°.50′ et 122°.40′, NE. of Ningpo.

The English vessel *Ancona* had taken refuge at Pennel Point, on the western coast of Chinsan island by latit. 30°.26′ and longit. 122°.15′; she had the ill luck of meeting the very Centre of the "Chusan" Typhoon, but came out of the danger unscathed.

British Three-Masted Schooner **Ancona,**

CAPTAIN E. G. STEAD

Off Chinsan Island.

Date Hours	Barom.	Wind		Weather	Remarks
	in				
Aug. 27th 8 P. M.	29.80	E	5	Rain	Anchored at 8.20 p.m. in 12 fathoms and veered 45 fathoms
10	.85	E	5	id	on Port Bower.
28th Midn.	.78	SE	5	id	
2 A. M.	.70	ESE	5	Heavy rain	
4	.63	ESE	6	id	
6	.60	SE	7	id	
8	.52	S by E	8	id	Violent squalls force 10 — 11.
10	.52	SE	8	id	
11	.51	SE	4	id	Stifling close atmosphere.
Noon	.49	SE	4		
0.15 P. M.	—	calm			*Calm for* 1 *hour.*
1.15	.40	N	9	No rain	Wind rapidly increasing — veered chain to 75 fathoms.
2	.41	N	12	Heavy rain	Let go starboard anchor veered 40 fathoms.
3	.45	N	12	id	Ship covered with spray.
4	.47	N by E	11	id	Sea rising.
5	.49	NNE	11	id	
6	.51	NNE	10	id	
8	.59	N	11	id	Weighed starboard anchor.
10	.59	N	11	id	
29th Midn.	.59	N	8	id	
2 A. M.	.55	NW	11	id	Ship covered with spray.
4	.57	WNW	11	id	Violent squalls, sea heavy, ship pitching.
6	.59	WNW	11	id	WNW. swell.
8	.61	WNW	11	id	Weighed star anchor.
10	.64	WNW	11	id	
Noon	.68	W by N	11	Light rain	
4 P. M.	.70	WNW	7		At 3.30 p.m. weighed and proceeded with fresh NW. winds.

On the 28th, before noon, the wind blew SE. relatively moderate; it evidently belonged to the "Chusan" Typhoon coming to pass over the island, but had its strength considerably mitigated by the admixture of NE. wind from the second Typhoon, that was coming on from the South-east. After the central calm of 1h p.m., the wind turned to N. and became a furious hurricane: it was the united violence of the two whirlwinds working in concert, the direction of the wind being intermediate between NW. and NE. proper to the two whirlwinds respectively. Barometer just beginning to rise. About 4 p.m. the wind inclined to NNE. by reason of the "Pescadores" Typhoon approaching nearer and nearer; its passage took place about 2h. a.m. — barometer sinking again slightly, wind less violent. Lastly the wind settled NW. or WNW. and the barometer rose up rapidly. It was a new period of storm, not to slacken before the afternoon.

The two tracks had crossed each other again and for the second time the whirlwinds had exchanged positions on either side of their mean direction. — The place of crossing seems to have been close to the North Saddle island, 30 miles to the North-east of Chinsan.

Before having done with this third period, let us mention an interesting fact observed by capt. Gulland of the S.S. *Glencoe*. On the 28th, noon, the ship's position was by latit. 30°.21′ and longit. 122°.36′ — wind calm or light varying between SE. and E. At 1h. 20^{m} p.m., near Bonham island, about 25 miles North-east of Chinsan, the weather was calm but the sky looked threatening. A few miles to the North there could be seen distinctly a line of broken water, when all on a sudden a blow from NbyE., of the most terrific violence, came to strike the ship. That same wind continued with hurricane force (12) till 6h p.m.; the barometer attained its minimum

29^{in}.29 between 4 and 6 p.m. The wind afterwards passed to N. 10; then on the 29th after midnight, to NW. 10 and to W. 9-10, whilst the barometer rose slowly. The steamer was then at anchor near Gutzlaff light-house.

From the relative position of Bonham and Chinsan, it can be seen that the "Chusan" Typhoon was now bearing North-east; on the other hand, the sluggishness of the barometer in rising again, the delay in the normal variation of the wind, its westerly direction and extreme violence all together clearly show that the "Pescadores" Typhoon now inclined towards NNW., even perhaps towards NW.

4th and last Period: August 29th — 31st.

North Saddle Light-house (latit. 30°.50′-longit.122°.40′-height 273ft). — Close to the point where the two tracks crossed each other, about 78 miles SSE. of Shanghai, there stands the North-Saddle light-house protruding into the sea farther than any other of the light-houses which light up the entrance of the Yang-tze-kiang. Since the 13th of August, at the height of the lantern (273 ft.) the monsoon had been blowing steadily SE., force 3 to 4; on the 27th, the wind freshened a little (force 5), barometer sinking; on the 28th, rain began to fall at 6h. a.m., wind from ESE. force 7-8. At noon wind abating; also at 3h. p.m. barometer being at minimum, 29^{in}.06. Then beginning to blow strong (force 10) from N.; raining on. — On the 29th, after midnight the barometer fell again; at 6h. a.m. it marked 29^{in}.11; - the wind about 3h. a.m. had turned to WNW., blowing with the same force as before. It was only on the 30th, 6h a.m. that it came to W.

It is therefore somewhere to the North of the Light-house that the crossing of the two tracks took place.

Zi-ka-wei Observatory (latit. 31°.12′-long. 121°.26′).

The usual precursory signs of strong storms were not wanting in this case. So early as the 26th, 5h a.m., small patches of vapoury cumuli were seen to rise from the SE. horizon and to pass rapidly. At 7h 10^{m} a.m. they became more numerous; in the course of the day, there fell several showers; in the evening, vapoury swift cumuli appeared again. The barometer however sank but slowly; — wind ESE. pretty strong, steady. Everything seemed to announce heavy weather coming on. — Herewith are the principal observations made at Zi-ka-wei (*See p.* 74.)

During the passage of this storm, the registering barometers gave a curve having three minima, which also are perfectly apparent in the series of the foregoing observations; the first (29^{in}.436) on the 28th, 9h 40^{m} a.m., the second (29^{in}.425) at 3h p.m., and the third (29^{in}.483), on the 29th, 5h a.m. To the slight maximum (29^{in}.507) which took place at Zi-ka-wei, on the 28th noon, between the two minima of that day, there corresponded a minimum (29^{in}.29) at Ningpo. This was even the lowest point attained by the barometer in that town, the mercury having remained almost stationary at 29^{in}.30 since 4 a.m. The wind, from NW. 8, veered at noon to NNW. 8 to come back again to NW. 6. On board the *Ancona*, at anchor, as already stated, close to the western coast of Chinsan island, 50 miles to the North-east of Ningpo, the barometer fell suddenly by ^{in}.09 between noon and 1h p.m., and the wind, calm at noon, at 1h p.m. suddenly began to blow from N., force 9. All these facts, I think, go to prove that the Centre of the whirlwind which, on following its original course should have passed to the West of Chinsan, went back for a moment about noon and swerved somewhat to the East to continue its course towards the North-east. Such short swervings of moderate sized whirlwinds, like Typhoons, are in nowise strange or uncommon. The Typhoon which crossed this same Archipelago on July 31st 1879 seems to have gone through the same evolution at precisely the same point, and higher up again, when just reaching the

Zi-ka-wei Observatory

Latitude 31° 12′ — Longitude 121° 26′

Date	Hours	Barom.	Wind Direct.	Wind Veloc.	Temp. of the air	Nebulosity				Rain
		in		miles	°					in
Aug. 27th	4 A. M.	29.736	SE by E	15.8	79.5	K W	5	C	SE	0.016
	10	.741	SE	20.0	84.7	Ac SE	10	C	SE	
	4 P. M.	.669	SE by E	22 4	85.1	Ac SE	10	Cn	SE	
	10	.669	E by N	12.9	78.8		10	Ni	SE	
,, 28th	4 A. M.	.535	NE by N	12.2	78.1		10			0.252
	5	.499	NE	13.2	76.6					0.469
	6	.487	E	16.2	77.0					
	7	.476	ENE	17.0	77.2		10	Ni	E by S	1.414
	8	.466	NE	19.5	77.0					
	9	.471	NNE	30.6	68.0					
	9.40	.436	NNE		67.8					
	10	.468	NNE	39.0	67.6		10	Ni	NNE	1.871
	11	.494	NNE	36.8	67.5					
	Noon	.507	NNE	31.9	68.5					
	1 P. M.	.505	NNE	29.4	69.1		10	Ni	NNE	1.544
	2	.505	NNE	28.5	69.4					
	3	.425	NNE	28.3	69.6					
	4	.496	NNE	24.0	70.0		10	Ni	NNE	0.933
	5	.509	NNE	18.9	70.3					
	6	.514	N by E	15.5	70.0					
	7	.529	N by W	13.4	68.9		10	Ni	NNE	0.248
	8	.545	N by W	13.3	69.1					
	9	.553	NW by W	14.9	68.9					
	10	.531	NNW	16.4	68.2		10	Ni		0.260
	11	.529	NNW	19.7	68.0					
,, 29th	Midn.	.514	NW	20.6	66.9					
	1 A. M.	.518	NW	22.3	67.1		10	Ni		0.217
	2	.535	NW	24.5	66.2					
	3	.531	NW	27.0	66.0					
	4	.488	NW by W	28.0	64.9		10	Ni		0.059
	5	.483	NW by W	28.2	65.5					
	6	.496	NW by W	29.7	64.2					
	7	.505	NW by W	30.3	64.9		10	Ni	NW	0.252
	8	.518	W by N	28.9	65.5					
	9	.538	WNW	29.3	66.4					
	10	.539	WNW	30.0	69.3		10	Ni	WNW	0.370
	11	.542	WNW	30.7	69.4					
	Noon	.534	WNW	31.3	74.1					
	1 P. M.	.538	WNW	28.0	72.1		10	Ni	WNW	0.016
	2	.544	NW by N	23.8	73.4					
	3	.558	NW by N	23.0	70.5					
	4	.548	WNW	24.9	74.5	Ac	10	Cn	NW	0.126
	5	.567	WNW	25.1	73.4					
	6	.578	W by N	23.0	72.1					
	7	.594	W by N	21.8	71.1	Ac	10	Cn	NW	
	8	.602	W by N	20.7	70.9					
	9	.619	W by N	19.6	70.3					
	10	.634	W by N	18.0	70.5		10	Cn		
	11	.632	W by N	16.1	70.5					
,, 30th	Midn.	.632	W by N	18.7	70.2					

extremity of Shantong Promontory, it turned somewhat to the right, as if to keep at sea: in fact after turning round the Cape, it resumed the line of its first course.

The Centre of the second or "Pescadores" Typhoon then passed Shanghai on the 29th, 5 a.m. The strength of the wind was about the same for both passages. At Zi-ka-wei its velocity did not exceed 39 miles, but owing to its great duration it did as much damage as a stronger wind might have done in a shorter time. We subjoin some extracts from the Shanghai papers.

"Within the recollection of the typical "oldest inhabitant" it is but twice or thrice that Shanghai has been visited by such a hurricane and deluge as reigned here the last forty-eight hours. Storms we have heard of in Southern China far surpassing in intensity the one which forms the subject of these remarks, but as a general rule the placid latitude of Shanghai and the surrounding districts have been singularly exempt from those virulent visitations of rude Boreas, in his more blustering moods. Sometimes the fringe of a typhoon has gyrated over the mud flats of the Whangpoo and inflicted such trifling damage as usually accompanies a gale, but in the tempest of yesterday we have experienced an almost unprecedented amount of destruction by wind and rain."

"The most notable casualty was that which occurred to Bellevue. Owing to the iron shutters which were attached to the roof being loosened by the violence of the wind, the top part of the building became seriously deranged. The next gust which followed swiftly on the one that had commenced the mischief, blew off the roof of the edifice and carried it a distance of eighty yards from the building. The roof which was of iron, in its mid-aerial passage impinged upon a small Chinese house, and overturned it, injuring one of the occupants who was a Chinese."

The steamer *Peking*, from Hankow, passed a Red Buoy adrift, 3 miles above clump.

Passing Woosung observed over 70 junks high and dry some distance inland from the River, besides several dismasted and broken which were riding to anchor. Lismore light-vessel, high and dry on the Beach.

"A village named She-toa-sha situated in Kow-kan district between 30 and 40 *lis* from Shanghai has been completely swept away by the floods originated by the late gale, and all the inhabitants have been drowned. The destruction of this village was discovered by the country people of Kow-kan seeing a number of dead water buffaloes floating in the Whangpoo. This was reported to the Life Saving department of the Taotai's office, and a steam launch was despatched to the locality indicated, and dragging was at once commenced. Altogether upwards of two hundred bodies of men, women and children, were recovered and, we believe, interred; but they were not recognisable owing to the length of time they had been submerged."

"We now learn that the village at the time of its destruction was populated by some three hundred families, and that only half of these saved themselves from the floods by taking to hastily constructed rafts. Reports reach us that these rafts ultimately reached the district of Sheun-sha, where the men landed and proceeded to plunder and rob in the most systematic manner."

Chinkiang (latit. 32° 15'.-longit. 119° 34'). — Two barometric *minima*; one = 29^{in}.62 on the 28th about 3h p.m. (wind N. 8-7), the other = 29^{in}.60 on the 29th 6h p.m. (wind NW. 4-2-5). This second minimum was simultaneous with that observed at the Shaweishan Light-house (latit. 31° 25'-longit. 122° 15'- 45 miles to the ENE. of Shanghai and 40 miles to the NW. of North-Saddle), where since noon the wind was blowing from WNW. 8, in which direction it continued till the afternoon of the 31st, only slackening somewhat on the 30th. At Shaweishan also there had been observed a second minimum on the 29th, about 3h a.m.: the barometer rose quickly again on the 30th and 31st, whilst at Chinkiang it moved upwards but sluggishly on the 30th.

There is no more question of this whirlwind beyond the 33d parallel, and this appears to be the last we shall hear of the "Pescadores" Typhoon which thus came rather suddenly to an end somewhere to the NNE. of Shanghai, just when it seemed about to take to the Yellow Sea. According to the observations of the *Kersaint* which we give below, once past August 30th, there was nothing any more to indicate its presence in that sea. Such is also the case with the observations of Chefoo and of cape Shantong Light-house. We may then bid farewell to this whirlwind to follow its companion which still has a long career to run before getting spent.

German Barque "Gustav and Marie." *This vessel* will take us once more to meet the rambling whirlwind which we left near North-Saddle in the afternoon of August 28th.

German Barque **Gustav & Marie.**

Date	Hours	Bar.	Wind		Weather	Remarks
		in				
Aug. 28th	8 A. M.	29.62	E	5		Latit. 31° 34′ — longit. 123° 23′ — Hove to with head to North.
	Noon	.54	E	5		
	1 P. M.	.50	E	9	Squally	
	4	.33	NE	10		Topsail blew away — ship under bare poles.
	8	.38	NNE	10		
,, 29th	Midn.	.38	N	10		
	4 A. M.	.36	NNW	10		
	8	.32	NW	10		Ran under Fore sail East 32 miles — Hove to under bare poles.
	Noon	.44	W	9	Heavy	
	4 P. M.	.48	W	8	Rain	
	8	.46	W	7		
,, 30th	Midn.	.50	W	7		
	4 A. M.	.52	W	6		Made sail.
	8	.62	W	5		
	Noon	.71	W	4		Latit. 31° 1′ — longit. 123° 12′.

If we neglect the influence of the "Pescadores" Typhoon whose action checked the rising of the barometer, we find that it was on the 29th about midnight that the ship lay nearest to the Centre of the "Chusan" Typhoon which was in advance of the other. Now, from the position of the ship, we can infer that of the Centre at that very moment as being latit. 31°.35′ by longit. 113°.35′ or 113°.40′. The Typhoon was then really running North-eastwardly since it had come to sea again near Ningpo, and it had lost but little as yet of its previous violence.

French frigate "Kersaint" (Comm.-Rouquette).—The *Kersaint* was sailing from Nagasaki to Chefoo; on the 28th, she was following the southern coast of Quelpaert island to the South of Corea, with the wind S. and SW. 5-7; barometer sinking. In the evening the wind became variable, sometimes N. 2, then SE. 7-8, lastly SW. 7-8. On the 29th, from midnight the wind took to blowing E. 5-6, the barometer falling rapidly; at 11h a.m. it turned to N., at noon to NE. 7-8. At 2h p.m. the barometer reached its minimum, 29in.37. The ship then lay in latit. 33°.20′ by longit. 124°.37′.

It follows evidently from this that the passage of the Centre at this same latitude took place on the East of the ship, on the 29th of August, 2h p.m. At noon the Centre must have been in latit. 33°.0′ by longit. 123°.55′, its direction being straight Northward.

The frigate steered West till the 30th noon, at which time she was in latit. 33°.42′ by longit. 122°.57′. On this run, the action of the other Typhoon soon going to spend itself on the coast of China, could be perceived in the direction of the wind. It continued NE. 7 to the morning of the 30th; at 7 a.m. it turned N. and lastly NNW. 6-7 and NW., in which direction it continued whilst the frigate altered her course and bore Northward towards cape Shantong; the barometer had been rising constantly except for a few hours in the middle of the night (29th-30th), very likely in the vicinity of the other whirlwind.

Cape Shantong (latit. 37°.24′ - longit. 122°.43) and **Chefoo** (latit. 37°.34′ - longit. 121°.31′). — The northerly winds which, on the 28th, blew strong at Cape Shantong (force 6-7), and at Chefoo (force 5), together with the wind from SSW. (force 6-7) we found on that same day to the South of Corea, made up a cyclonic movement of the atmosphere eminently fit for drawing our Typhoon into that inner Sea which washes the coasts of China and Corea. On the 29th the wind turned to NE. 6-7 at Chefoo and at Cape Shantong, at which latter station it continued steady though freshening more and more during the course of the 30th, whilst at Chefoo it returned to N., even to NW. 6-4. At last on the 31st, it settled NW. 5 on all the coast of the Shantong Peninsula. The barometric minimum had been observed about midnight on the 31st, viz. 29in.49 at the Cape Light-

house and 29^{in}.58 at Chefoo. The track of the Typhoon is therefore likely to have followed up the coast of Corea.

Newchwang (latit. 40°.35′-longit. 122°.0′). — The observations made on board the Light-ship *Newchwang* at the entrance of the Newchwang river by capt. Trebing, make us to be present, as it were, at the vanishing of the whirlwind on the eastern coast of the Yellow Sea.

Newchwang Light-ship

Latitude 40.° 35′ — Longitude 122.° 0′

Date	Hours	Bar.	Wind		Nebulosity	
		in				
August 30th	Midn.	29.53	NNE	5	0	
	3 A. M.	.53	NNE	4	0	
	6	.52	NNE	5	0	
	9	.52	NNE	4	1	St.
	Noon	.51	NNE	4	1	St.
	3 P. M.	.46	NNE	4	3	Ks
	6	.42	N by E	4	2	St
	9	.43	N by E	3	0	
,,	31th Midn.	.44	N by E	4	2	St.
	3 A. M.	.43	N	4	4	C
	6	.42	N	5	10	
	9	.41	N	4	6	Ks
	Noon	.43	N	3	6	C—K
	3 P. M.	.42	NE	1	10	
	6	.43	NNE	3	6	Cn
	9	.46	N	3	3	C
Septemb. 1st	Midn.	.47	NE by N	2	5	K
	3 A. M.	.49	calm		0	
	6	.52	SE	1	0	
	9	.53	S by E	2	2	Ac
	Noon	.53	SW	2	8	Ac

These are the last observations to enlighten us about the doings of our Typhoon. We see the barometer keeping at the lowest for 24 hours at least, viz. from the 30th 6h p.m. to the 31st 6h p.m., and then rising but slowly, whilst the wind, first NNE. 4, then N. 4-5, after blowing somewhat strongly, came to die away NE. to blow suddenly again from SE. on September 1st 6h a.m. It we take all these circumstances into view, we cannot help thinking that the whirlwind once got to the North of the Yellow Sea, had no energy left to proceed over those northern lands at so late a season and vanished away on the spot. For, so early as September 1st, the atmospheric pressure already high on the Shantong Peninsula (at Chefoo: 29^{in}.82) seemed about to fill up the depression by spreading in that quarter, as we see from the springing up of winds from S. and SSE. 2-3.

Velocity of translation.

The conditions of the two whirlwinds were such that their velocity of translation must necessarily have been pretty irregular. With neither of them do we find that acceleration observed in number of other Typhoons as they rose rapidly in latitude.

Here below we give an approximate value of the hourly velocity of the two whirlwinds in the various stages of their long run along the coast of China.

		"Pescadores"	"Chusan"
August. form 22^d	to 23^d . ...6 miles		
23	— 24... ... ...6 ,,		
24	— 25... ... ...6 ,,		
25 (0)	— 25 (12)... ... ...7 ,,		
25 (12)	— 26...	8.1 miles	9.2 miles
26	— 27...	8.1 ,, ...	9.4 ,,
27	— 28...	8.1 ,, ...	9.7 ,,
28	— 29...	7.7 ,, ...	6.7 ,,
29	— 30...	6.7 ,, ...	9.4 ,,
30	— 31...	... ...	8.3 ,,
31 (0)	— 31 (12)...	... ...	6.0 ,,

The distance run over, reckoned from the common starting point at the date of August 22nd, is approximately: for the "Pescadores" Typhoon, 1344 miles; for the "Chusan" Typhoon, 1825 miles.

Extent of the atmospheric depression and remote effects of the passage of the Typhoon.

Macclesfield Bank (China Sea) and **Hainan Island**—On August 25th 5h 30m a.m., H.M.S. *Magpie* left Macclesfield Bank at noon (latit. 16°. 27′-longit. 114°. 45′) and steered towards Hainan, when at 9h a.m. there first was felt a slight long swell from NE; —barometer 29in.779, had just commenced falling at midnight. Position of the ship at that moment, about 590 miles SW. of the Centre of the Typhoon. The swell thus seems to have been in advance of the barometric variation. The wind, belonging to the SW. monsoon, had force 3; it got fresher next day and veered WSW. 4-5, whilst the barometer sank somewhat. On the 26th, numerous Cirri appeared, coming from E. and ENE.: in the higher regions of the atmosphere the air flowed away from the Centre of the whirlwind, whilst in the lower it drew towards it. The swell on that day came from NNE. At noon the ship stood in latit. 18°. 4′ by longit. 113°. 50′, that is 150 miles from the Eastern coast of Hainan. *It must* be noted that the swell observed on the 25th and 26th in the China Sea was entirely distinct from the direction of the sea and of the currents, which bore to NE. with a speed of 15 miles in 24 hours.

Macao and **Hongkong.** — On the 25th, about 10 a.m., the barometer was at a maximum: 29in.79. The wind at noon had turned to W. 2; on the 26th it oscillated between W. 4 and SW. 3; on the 27th, WSW. 3. Thus here again, more than 450 miles from the Centre of the Typhoon, the winds were convergent. It appears that in that quarter, that is in the direction of the China Sea (*Magpie* and Hongkong) the extreme limit at which the barometer began to be affected by the whirlwind did not exceed 550 or 600 miles.

Nagasaki. (Japan). — According to the observations made in Japan, the barometer began to indicate the approach of the Typhoon when the Centre yet was 600 miles distant from Nagasaki (on the 27th about midnight: bar. 30in.00). The wind took to blowing S. and continued in that quarter till the 31st afternoon. Thus on that side whither the whirlwind was tending, the winds were divergent and seemed to point out the way to be followed by the Centre, for it must not be forgotten that South of Corea, near Quelpaert, there were also then blowing strong SW. winds. Such facts it is important to note, for they will be of great help in the study of these phenomena. Already, on the occasion of the "Shanghai" Typhoon of the 16th July 1881, we established the existence in the North of Shanghai of a well defined equatorial current which seemed to have carried the whirlwind along with it. Moreover we now well know that all our Typhoons are always driving towards the areas of low pressure, which comes to say that forward, at a great distance from the Centre, the winds are more or less divergent, whilst at the back, even pretty near the Centre, they are strongly convergent. This also would supply a natural explanation of the usual elongation of the whirlwinds in the direction of their track and of the inclination of the axis forward. Thus in the present case, whilst towards Hongkong, that is back of the Centre, the Typhoon's influence did not extend beyond 600 miles, as soon as it had started in the direction of the North-east it was felt more than 1000 miles ahead (Tokei: barometer beginning to sink on August 27th about 10h a.m.)

Chang-kia-chwang Observatory (latit. 38°.17′-longit. 116°.14), belonging to the Jesuits Missionaries (Director: Rev. Fath. Gattelier), situated south of Peking, 100 miles both from that capital and from the Gulph of Pechili. — The observations made there give us the means of ascertaining another noteworthy effect of the whirlwind. The barometer first began sinking on August 28th about noon: the Centre of the perturbation then lay about 550 miles to the SSE. of Chang-kia-chwang (it was therefore not towards that station that the whirlwind was to proceed.) The minimum (29in.71) was observed on August 31st 4 p.m. Now we gather from the Monthly Bulletin of the Observatory that the mean temperature of the five last days of the month only amounted

to 71°.6, whereas the mean temperature for the whole month was 78°.8; the daily minima of the last days also were the lowest of the month. The tension of vapour also had its minima from the 27th to the 31st, viz. $0^{in}.479$ against an average of $^{in}.748$ for the month. The same happened with the relative humidity of air: 57% against 72%. The wind blew NE. (mean daily velocity for the last 5 days, 104 miles; average for the month, 90 miles), and it had been the prevailing direction of the wind during the month. It is not therefore in that direction of the wind that the reason of such atmospheric anomalies at that season and in that region is to be sought for. The explanation, I think, entirely rests upon the theory of atmospheric whirlwinds which I have brought out several times in the Bulletin of the Zi-ka-wei Observatory and in my paper upon the Typhoons of 1880. Some Meteorologists may say that Chang-kia-chwang, from the 27th to the 31st of August, lay under the influence of a *stationary Anticyclone* whose relations with our Typhoon could not be made out very clearly. As for me, the fact as I see it, is simply that, *from the 27th to the 31st noon*, Chang-kia-chwang lay within a region of the whirlwind which may be taken as having first been its outer periphery on the 27th and 28th, then the firsts inner zone on the 29th and 30th, which region moved with the whirlwind itself. In that outermost zone, the surface currents are mostly fed by the air from the higher strata of the atmosphere which flows out under an appreciable inclination, sufficient to give rise to the observed phenomena. The air which rises in a whirl in the central region of a cyclone, must, to preserve the equilibrium, descend again at the periphery; it is then cold and dry because on rising at the Centre and afterwards diverging in the upper regions it has become deprived of a great portion of its original heat and humidity. — On August 31st, the Centre of the whirlwind being nearer, Chang-kia-chwang for a short time had its share of the phenomena proper to the inner regions of the whirlwind: there fell some rain ($0^{in}.58$) at 8h 30^{m} p.m., thanks to the Southerly wind which succeeded to the North-easterly wind of the preceding days. The barometer still kept low on September 1st, afterwards rising slowly.

These special phenomena of the Anticyclone, (to use the commonly received term, though in the restricted acceptation have given to it), are perfectly well marked in the Northern regions of China, but less so elsewhere, in Japan, for instance, surrounded as it is by the sea, and on the coast of which there runs a great warm current. There a downward current of cold air, in spite of its relative dryness, will condense in the shape of fog or even of rain the masses of vapour which cannot fail to overlay this great archipelago, which rain together with the heat liberated by the condensation, will frequently cause the phenomena of the Anticyclone to pass unperceived. And yet in the present instance, notwithstanding the rain that fell at Nagasaki on August 27th, 28th, 29th and 30th, there is no mistaking for that town as well as for Chang-kia-chwang, the position close to the outer limit of the whirlwind.

Ninth Typhoon: 31st August — 3rd September.

TRACK UNKNOWN IN THE PACIFIC, EAST OF JAPAN.

This Typhoon very probably rose from SSW. to NNE. as far as somewhere in the neighbourhood of Tokei, capital of Japan, in latit. 35° by long. 141°. From thence proceeding on its course, it was lost sight of in the North Pacific. Its action was then not felt anywhere but on a spot in Japan, that is on the coast immediately close to the Gulph of Yeddo. There only can we seek its trace in the barometric observations. I subjoin whatever reliable information I was able to obtain.

Imperial Meteorological Observatory **Tokei, Japan**

Latit. 35.° 39.′ 50″ — Longit. 139.° 45.′ 10″

Communicated by I. Arai, Surveyor-in-chief.

Date	Hours	Barom.	Wind		Temp.	Humid. %	Nebulosity	Rain	Remarks
		in		miles	°			in	
Aug. 31th	3.30 A. M.	29.956	S	3.0	73.8	92	0		
	9.30	.964	NNE	4.9	81.1	73	6 Ks Ac	0.510	Thunder in ENE. 3 p.m. rain, lightning 3.30 p.m. — rain since 4.30 p.m.
	3.30 P. M.	.912	NE	7.3	84.5	69	10 Ni		
	9.30	.956	ENE	4.4	76.4	97	10 St.		
Sept. 1st	3.30 A. M.	.931	NE	5.4	76.1	98	10 Ni St.		Rain 3 & 6 a.m.
	9.30	.933	NNE	9.2	81.5	85	9 Ks Ac	0.025	Rainbow 3 – 4 p.m.
	3.30 P. M.	.851	NE	20.1	86.1	62	7 Ks Ac		Strong wind, afternoon.
	9.30	.836	N	11.2	78.5	77	10 St. Ac		
2nd	3.30 A. M.	.752	NNW	12.1	75.7	83	10 St.		Rain, morning —
	9.30	.754	NNW	11.2	86.9	58	3 Ac C	0.195	
	3.30 P. M.	.716	NW	6.3	88.0	61	4 K Ac C		Rainbow 3 — 4 p.m.
	9.30	.801	NNW	2.5	79.7	82	6 Ks Ac St.		
3rd	3.30 A. M.	.796	WNW	3.3	76.0	91	1 St.		Lightning in E. at night.
	9.30	.847	W	3.5	88.9	55	1 Ac Cs	nil	
	3.30 P. M.	.813	SSE	10.7	91.8	50	3 Ks Ac C		
	9.30	.878	W	4.0	80.2	83	6 Ks Ac C		

Light-houses.

Omaisaki

Latit. 34.° 35.′ 46″ — Longit. 138.° 13.′ 28″

Height 173 feet.

Date	Hours	Barom.	Wind		Weather
		in			
Aug. 31st	9 A. M.	29.95	ENE	light	Cloudy
	9 P. M.	.95	NE	breeze	
Sept. 1st	9 A. M.	.92	NE	light	Cloudy
	9 P. M.	.88	NW	id	
2nd	9 A. M.	.82	W	id	Cloudy
	9 P. M.	.82	S	id	
3rd	9 A. M.	.89	W	id	Cloudy
	9 P. M.	.89	W	id	

Inu-bo-ye-saki

Latit. 35.° 43.′ 30″ — Longit. 140.° 53.′ 30″

Height 168 feet.

Date	Hours	Barom.	Wind		Weather
		in			
Aug. 31st	9 A. M.	30.00	N	light	Hazy
	9 P. M.	.98	NE		
Sept. 1st	9 A. M.	.93	NNE	breeze	Hazy
	9 P. M.	.78	NE		
2nd	9 A. M.	.65	N	gale	Cloudy
	9 P. M.	.79	NW		
3rd	9 A. M.	.88	W	breeze	Hazy
	9 P. M.	.92	SW		

These observations, taking into account the relative position of the three stations, go to show that the Typhoon did not come from the W.: it must have come very near the coast on which stands the Inu-bo-ye-saki Ligth-house, East of Tokio, and have at once made for the Pacific, running North-east.

As for its violence, it must have been very strong, to judge from the annexed report of capt. Thomson of the German barque *Carl*.

"Left Nagasaki on the 15th of August, and experienced light winds and calms to near Rock Island (latit. 34°34′-longit. 138°57′, 95 miles SW. of Tokei) where, on the 1st of September, had a heavy Nly gale with a high East sea running, headed the ship to Eastward on account of the swell. On the 2nd, Cape King (45 miles South of Tokei) bearing NE., 22 miles distant, sighted two fishing boats on the lee bow evidently in distress (the wind blowing a hurricane and a tremendous sea running at the time). The boats closed with us at noon and the crews requesting to be taken on board: all hands, comprising 29 men, with their baggage, were safely hauled over the stern by lines, and the boats cast adrift, the damage done to the brig's stern during the operation being considerable. That evening at 6 o'clock the weather moderated and fell calm and this lasting for three days, the ship drifted daily to the North-east, about some 120 miles, during which period met with four more fishing boats which were blown out to sea, and gave them rice and water as far as the stock of provisions would permit of, and telling them the course to the nearest land, they sculled towards it. Sighted Inu-bo-ye, on the 7th, bearing WSW., 10 miles off. . . ."

Tenth Typhoon: 6th — 13th September 1881.

TRACK:

				Latitude		Longitude
September	6th	Midn.	Luzon	16.°40′	—	124.° 0′
		Noon		° 19. 0 °	—	° 122. 25 °
,,	7th	Midn.	China Sea	21.10′	— 120.50′	21.20′ — 121.50′
		Noon		23.10	— 118.45	22.55 — 120.35
,,	8th	Midn.	China: towards West	24.40	— 117. 0	23.35 — 118.35
		Noon		25.35	— 115.40	24.10 — 116. 0
,,	9th	Midn.		26.55	— 114.20	24.10 — 114. 0
		Noon		27.50	— 113.35	
,,	10th	Midn.		28.35	— 113.15	
		Noon	China: towards East	29.30	— 113.20	
,,	11th	Midn.		30.10	— 114.10	
		Noon		30.20	— 116. 0	
,,	12th	Midn.		30. 0	— 118.10	
		Noon		30.55	— 119.45	
,,	13th	Midn.		32.25	— 121.40	
		Noon	Eastern Sea	32.25	— 124.15	

EVENTS:

Division of the Typhoon near Formosa Island.
Backing of the chief Typhoon to the sea near Shanghai.

The last meteorological observations sent to me from the Manila observatory for the investigation of the Typhoons of the summer of 1881, were those relating to the Shanghai Typhoon of July 15th and 16th. I must then depend upon more or less accurate articles in the Manila papers and reports from ship captains to enable me to determine as accurately as practicable the course through the Philippine Archipelago of ten Typhoons which still will visit it before the close of that uncommonly fruitful season, and carry me through the work I have undertaken.

Presages of the Typhoon.

On September 6th, 11 a.m., a telegram was sent from Manila to Hongkong giving notice that a Typhoon was raging to the North-east of Luzon, close to the coast, and that it seemed bearing to NNW. (1).

If at the hour specified the Typhoon really was near the North-eastern coast of Luzon, the direction given in the telegram was true, for the Centre came next day to pass close to Tai-wan-foo, the capital town of Formosa, after which it crossed the Strait and, entering the continent between Amoy and Swatow, proceeded some distance West. It then faced about, sought the sea again near Shanghai and made off in the North-east.

The very extensive depression which originated in China from September 2nd or 3rd is not unlikely to have had a share in the formation of the Typhoon and in its direction. That depression appears to have spread mostly over the central provinces South of the Yang-tze-kiang, for it brought to our coast, at Ningpo and Shanghai, persistent winds from SE. and S. which lasted till the 11th. At Hankow, on the contrary, the depression

(1) The Hongkong *China mail*, on giving that telegram, adds:— In reference to the complaints that reach us from Manila, as to the delay in publishing weather telegrams for twenty-four hours after their receipt here, we understand that the Secretary of the Union Insurance Society wrote to the local Government, and, having called attention to the fact that some steamers had gone to sea which would have been detained had the telegram been published earlier, asked that some arrangements might be made to issue the Manila warnings immediately upon their receipt. This has, we believe, been favourably received; and arrangements have now been made for the immediate issue of such telegrams. The message of this morning, as well as the previous one, were published without delay.

brought NNE. wind, whilst at Wuhu, between Shanghai and Hankow, it was less steady and varied between E. and SE. The barometric minimum took place on the 6th successively, at 1h. p.m. at Hankow ($29^{in}.52$), and in the evening, 5h. p.m. at Shanghai (Zi-ka-wei: $29^{in}.77$).

The approach of the Typhoon, in the course of the 7th, did not affect the barometer at our latitude; both on the 7th and the 8th it continued rising, even more rapidly than it had sunk since the 3rd. The whirlwind which had been indraughted by that depression, contributed to fill it up, partially at least on the coast, with the masses of air it carried along and compressed on its periphery. When therefore it had become clear to my mind that the barometer at Zi-ka-wei would not for the nonce pass through any other minimum than that registered on the 6th, I gave up all idea of an immediate visit of the Typhoon, though a telegram sent from Amoy on the 7th 9h. 30^{m} a.m. announced it as already raging in the Formosa Strait and bearing straight northward. On that telegram being immediately sent to me at Zi-ka-wei by the editor of the *Shanghai Mercury*, who had received it from a correspondent, I deemed it proper to write a few lines in the paper to allay the alarm of the public. I even added that the Typhoon, though it might have entered the Formosa Strait, had nevertheless altered its direction and was making for the West over the continent of China. In fact it is what had happened, as we are going to see.

Let us suppose, with the Manila Telegram, that the Typhoon, on the forenoon of September 6th, was raging near the North-eastern coast of Luzon. Its velocity must consequently kave been considerable: in fact, 12.5 miles an hour, since it took only 25 hours to go to Tai-wan-foo, a distance of 315 miles. — Herewith the observations made at Tai-wan-foo.

Tai-wan-foo (Formosa)

Latitude 23°. 2′ — Longitude 120°. 15′

HARBOUR MASTER'S OFFICE.

Date	Hours	Barom.	Wind	Rain	Weather
		in			
September 5th	8 A. M.	29.848	NNE		Fresh breeze and fine weather all day — smooth water on the Bar.
	4 P. M.	.772	NNE		
	8	.792	NNE		
6th	8 A. M.	.704	variable		Light variable winds up to 11 a.m., afterwards fresh NNW breeze — Fine
	4 P. M.	.550	N		weather — moderate swell on the Bar.
	8	.509	NNW		
7th	8 A. M.	.192	NNW		Fresh NNW breeze up to 11. 45 a.m., then wind increasing and from 0. 30
	4	.061	SE		to 2. 30 p.m. it was blowing a fresh gale at short intervals — At 2.30 p.m.
	8	.240	ESE		the force of the wind decreased into a strong breeze — Hazy weather fore-
8th	8 A. M.	.575	SSE	in	noon, afternoon misty and rainy — Heavy sea on the Bar.
	4 P. M.	.658	S	1.52	Fresh breeze — Hazy weather up to 10 a.m., afterwards cloudy with occa-
	8	.700	S		sional sun-shine — Heavy sea on the Bar.
9th	8 A. M.	.792	N		Light wind and fine weather — moderate sea.

If a curve be drawn comprising the above barometric observation, it comes out perfectly regular and symmetrical on both sides of a minimum ($29^{in}.00$) obtained graphically (Sept. 7th 1 p.m.) But we shall see farther on that on the 7th about 8 a.m. there must have been some slackening in the rate of sinking of the barometer. The observations made at Tamsui in the North of Formosa, show what happened under different conditions.

Tamsui (Formosa)

Latitude 25.° 10′ — Longitude 121.° 25′

HARBOUR MASTER'S OFFICE.

Date	Hours	Barom.	Wind		Thermom	Rain	Weather
		in			°		
September 6th	1 A. M.	29.750	N	3	86		O.
	7	.699	NE	4	82		C. O. D.
7th	7 A. M.	.580	ENE to E	5-6	82		C. O. M. D.
	11	.522	E to ESE	7-9	78		C. O. M. Q. D.
	1 P. M.	.493	E to ESE	7-9	81		id
	2	.407	E to ESE	7-9	85		id
	4	.417	ESE	7-9	84		id
	6	.445	ESE	7-9	80		id
	7	.485	ESE to SE	7-10	80		O. M. R. QQ. P.
	9	.505	ESE to SE	7-10	80	in	C. O. QQ.
	10	.513	SE	7-9	82	1.40	id
8th	Midn.	.530	SE	7-8	82		C. O. M. QQ.
	3 A. M.	.540	SE to SSE	7-8	83		C. O. QQ.
	7	.590	SE to SSE	7-8	84		id
	1 P. M.	.693	calm		87		C. B.

Nota: No damage was done in the vicinity of Tamsui or Keelung.

Thus, while at Tai-wan-foo, with the barometer very low, the wind does not attain to more than blowing, a fresh gale (force 8), and that only for three hours; at Tamsui, nearly 140 miles from the Centre, the ESE. wind shows a violence of 9 and even 10 (strong and whole gale) for more than twelve hours running.

But, before pointing out the cause of these peculiarities, we must follow the Typhoon in the Formosa Strait and on the coast of China, as the phenomenon, which could not well be observed on Formosa, comes out there quite clearly.

Light-houses in the Formosa Strait.

Fisher Island

Latit. 23.° 33′ — Longit. 119.° 28′

Height: 205 feet.

Date	Hours	Barom.	Wind		Weather
		in			
September 5th	Midn.	29.83	WSW	1	B. C.
	6 A. M.	.84	NNW	1	id
	Noon	.78	NW	2	id
	6 P. M.	.78	NW	1	id
,, 6th	Midn.	.76	NW	2	id
	6 A. M.	.68	NW	3	id
	Noon	.67	N	5	O. C. M.
	6 P. M.	.53	N	7	id
,, 7th	Midn.	.44	N	7	id
	3 A. M.	.32	N	8	O. M.
	6	.23	N	9	id
	9	29.20	N	9	id
	Noon	28.98	NNE	9	id
	3 P. M.	28.96	NE	8	O. G. M.
	6	29.15	E	6	id
	9	.26	ESE	5	O. M.
,, 8th	Midn.	.30	SE	6	O. G. R.
	3 A. M.	.36	SE	7	id
	6	.51	SE	7	id
	9	.59	SE	7	id
	Noon	.59	SE	5	id
	3 P. M.	.61	SE	5	id
	6	.63	SE	4	O. M.
	9	.66	SE	4	id
,, 9th	Midn.	.69	E	3	id
	6 A. M.	.72	calm		B. C. M.
	Noon	.75	NNW	1	id
	6 P. M.	.78	NNW	1	id
,, 10th	Midn.	.78	calm		id

Lamock Island

Latit. 23.° 15′ — Longit. 117. 18′

Height: 241 feet.

Barom.	Wind		Weather	Hours	Date
in					
29.87	E	3	B. C. M.	Midn.	6th September
.84	E	3	id	6 A. M.	
.89	E	1	id	Noon	
.89	SW	1	id	6 P. M.	
.86	NW	1	id	Midn.	7th ,,
.77	N	3	id	6 A. M.	
.76	N	1	id	Noon	
.67	NE	1	id	6 P. M.	
.65	NW	4	id	Midn.	8th ,,
.59	NNE	5	id	3 A. M.	
.52	NNW	4	O. C. R.	6	
.52	NNW	4	B. C. M.	9	
.50	NNW	4	B. C. M.	Noon	
.38	N	5	B. C. M.	3 P. M.	
.34	NNW	7	O. M. R. Q.	6	
.33	NNW	7	id	9	
.27	NNW	7	id	Midn.	9th ,,
.19	W	8	id	3 A. M.	
.19	W	7	id	6	
.29	S	6	id	9	
.37	S	5	id	Noon	
.39	S	5	id	3 P. M.	
.57	S	5	id	6	
.60	SE	6	id	9	
.60	SE	6	id	Midn.	9th ,,
.60	SE	5	B. C. M.	6 A. M.	
.75	SE	4	id	Noon	
.83	E	3	id	6 P. M.	
.86	E	3	id	Midn.	10th ,,

These two first series of observations, taken almost on the same parallel, but at an interval of 120 miles, first show that the Typhoon which gave the barometric minimum (Fisher Island: Sept. 7th 1h p.m.: 28^{in}.94; Lamock, Sept. 8th, 4.30 a.m: 29^{in}.17), passed the two Light-houses successively, proceeding westward, what confirms the hypothesis which might have been grounded on the observations of Tai-wan-foo alone, where the wind blew SE. and S. after the barometric minimum. But a considerable irregularity comes out specially here: at Fisher Island, it was only 8 hours after the barometric minimum that the wind turned to ESE. and SE. and it was relatively moderate; at Lamock the storm at the time of the minimum was but slight, before and after that moment it amounted to nothing worth speaking. It is evident that there has been a perturbing cause, for a Typhoon could not of itself show such anomalies. In fact they find a plausible explanation on supposing a second Centre of depression which should have passed between the two Light-houses some hours earlier than the Centre of the "Tai-wan-foo" Typhoon, bearing about SE. to NW. If at Fisher Island the winds from ESE. and SE. were so tardy in coming out on the evening of the 7th, it was then because the first whirlvind had already got to the coast of China, in the North-west, and was commanding strong South-westerly winds.

Amoy

Latit. 24.° 28′ — Longit. 118.° 3′

S.S. *Keelung* (CAPT. F. W. SCHULZE).

Date	Hours	Barom.	Wind		Cloud.	Weather
		in				
September 7th	5 A. M.	29.574	NNE	4	4	M—Bank of clouds to Eastward
	7	.542	NNE	4	4	M.
	9	.522	NE	5	6	M.
	11	.490	NNE	4-6	9	M. Q.
	Noon	.440	NNE	4-6	9	M. Q.
	1 P. M.	.405	NNE	6	9	C. Q.
	2	.355	NE by N	6-7	9	M. Q.
	3	.318	NE by N	6-8	9	M. Q.
	4	.304	N by E	8	9	M. Q.
	5	.304	N by E	6-8	9	R. Q.
	6	.386	NE	6-7	9	R. Q.
	7	.394	ENE	6-8	9	R. Q.
	8	.404	NE	6-8	9	R. Q.
	9	.424	NE	6-8	10	R. Q.
	10	.424	NE	6-8	10	R. Q.
	11	.424	NE	6-7	10	R. Q.
	8th Midn.	.419	NE by N	5	10	R. Q. Violent squalls.
	1 A. M.	.394	NE	7-9	10	R. Q.
	2	.402	NE	7-9	10	R. Q.
	3	.402	NE	7-9	10	R. Q.
	4	.403	NE	7-9	10	R. Q.
	5	.390	ENE	6	10	D. Q.
	6	.387	E by S	6	10	D. Q.
	7	.395	E by S	7	10	D. Q.
	8	.410	ESE	7	10	D. Q.
	9	.489	SE	7	10	D. Q.
	10	.529	SE	8	10	D. Q.
	11	.571	SE by S	7-8	10	Q. R.
	Noon	.557	SE by S	7-8	10	Q. RR.
	1 P. M.	.557	SE	7-8	10	Q. RR.
	2	.569	SE	7	10	Q. R.
	4	.615	SE	4	10	D. Q.
	8	.720	SE	3	10	C. M.
	9th Midn.	.776	ESE	4	8	C. M.

Swatow

Latitude 23.° 20′ — Longitude 116.° 43′

HARBOUR MASTER'S OFFICE.

Date	Hours	Barometer	Wind	Clouds	Rain
		in			
September	6th Midn.	29.81	E 1	Cirri	
	4 A. M.	.77	Calm	Cirri	
	9	.78	WNW 1	Cum 8	
	Noon	.73	WNW 1	Ks 1	
	3 P. M.	.69	E 3	C 1	
	8	.69	Calm		
	7th Midn.	.65	Calm		
	4 A. M.	.59	NW 1		
	9	.54	NW 2	Ac 8	
	Noon	.46	NW 4	Ac 8	
	3 P. M.	.35	NNW 5	Ac 8	
	8	.37	NNW		in
	8th Midn.	.39	NNW		.004
	4 A. M.	.33	NW 6	Ni 10	
	9	.37	SSW 2	Ni 10	
	Noon	.43	S by E 4	Ni 10	
	3	.45	SE	Ni	
	8	.54	SE		.038
	9th Midn.	.62	SE		

Macao

Latitude 22.° 11.′ — Longitude 113.° 34.′

HARBOUR MASTER'S OFFICE.

Date	Hours	Barometer	Wind	Clouds	Weather
		In			
September	7th 3 A. M.	29.650	NW 3	Ac C	B. C. V. W.
	5.30	.633	NW 3	K	id
	8	.640	NW 3	K St	id
	10	.618	NW 4	Ks Ac	id
	Noon	.571	NW 3	Ks Ac	id
	2 P. M.	.513	NW 3	Ks Ac	id
	3	.489	NW 3	Ks Ac	id
	4	.471	NW 3	Ks Ac C	B. C. W.
	5	.473	NW 2	C	C. W.
	6	.480	WNW 1-2	C	C. W. W.
	7	.472	WNW 2	C	id
	8	.488	W-WNW 2-3	C	id
	9	.498	W-WNW 2-4	K	C. V. Q. W.
	10	.513	WNW 2	K C	id
	11	.505	WNW 1-2	K C	id
	8th Midn	.502	WNW 3	K C	id
	1 A. M.	.486	WNW 3	Ac C	id
	2	.491	NW-WNW 3	Ac C	id
	3	.479	NW 3	Ac	id
	4	.475	NNW 3-4	Ac C	id
	5	.485	NNW 2	K C	id
	9	.526	NNW 4-5	C	C. B. W.
	11	.535	NNW 4-6	C	id
	Noon.	.531	NNW 5-6	C	C. B. W. D.
	2 P. M.	.501	NW 4	Ni	R. O. W. G.
	5	.503	NW 3	Ni	id
	9	.540	NW 3	Ni	RR. O. G. W.

The fact is now clear: there have been at least two Typhoons or two whirlwinds belonging to the same Typhoon; what we observed before on the passage of the famous double Typhoon of August 26th-30th has taken place again, though on a smaller scale. As long as the first Centre has not passed a station, everything there seems perfectly regular as if there was but one depression on the move; but that first passage once effected, irregularities begin to appear: the wind generally loses in violence without materially altering its direction; the barometer, which had risen slightly, falls again, passes through a second minimum and at last rises readily: it is only then that the wind goes through its normal rotation if there is no third Centre yet to come, and everything resumes the usual course. The storm may rage violently at a considerable distance from the track of those Centres of depression (Tamsui, Foochow); but near and right upon the mean track, the wind may *not* have

beyond an ordinary strength owing to the winds belonging to the two whirlwinds partly neutralizing each other along that line.

Let us now return to Formosa and, since there is no question but that there has been two whirlwinds moving simultaneously in that region, let us try to make out what track each Centre followed.

And first, it may be granted that the splitting of the Typhoon was caused, in like manner as with the Typhoon of the end of August, by its meeting an insuperable obstacle viz. the mountain chain of Formosa, which runs almost the whole length of the island (210 miles) with a height averaging eight to ten thousand feet. For our chinese Typhoons whose diameter is hardly double the length of that island, this is a serious obstacle, nor is it to be wondered at if one of those whirlwinds, on coming to strike against the first spurs of such a high mountain chain, should split into two segments, both still possessed of sufficient energy to form distinct whirlwinds following the opposite sides of the chain.

In the present case, the splitting again took place when the Typhoon, coming from Luzon, met the peaks of the southern end of the mountain chain of Formosa. In the peninsula which forms the southermost part of the island, there are already peaks 2000 and 2800 high; further on the first summits of the long chain attain 9050 feet. Abreast of Tai-wan-foo there are some breaks in the chain and it is not at all improbable that the eastern segment or whirlwind may have availed itself of them to cross the island and over the Strait to join its fellow on the Chinese continent. It must have passed, East of Formosa, between Samasana and Botel Tobago and, on the island, between Tai-wan-foo on one side, and the mountains on the other, taking to sea again north of the capital, as may be inferred from the direction of the wind which on September 7th before noon, at Tai-wan-foo, blew successively NNE. and NNW., whilst at Tamsui it was NE., then ESE.

All this time the western segment or whirlwind, leaving its fellow to put itself into shape behind Formosa and to attempt scrambling over the mountain chain, had darted from the North of Luzon North-westward towards the coast of China. Between 3h. and 4h. p.m. it passed to the NNE. of Swatow (wind NNW. 6, barometric minimum $29^{in}.35$); between 4 and 5h. p.m. to the SSW. of Amoy (wind NbyE. 8 - barometric minimum $29^{in}.30$). The 8h. a.m. barometric observation at Tai-wan-foo is likely to have been a secondary minimum occasioned by the passage of this whirlwind some 60 miles SE. of the town, and the barometer must have risen somewhat or have slackened its downward movement before falling again on the passage of the second whirlwind (4h p.m.).

This easterly whirlwind was naturally behind hand, first because it had to follow a roundabout way behind Formosa to find a point where the chain could be passed; also because the scaling of those abrupt mountains could not but cramp and retard its movements. Thus was it that not before the 7th 4 p.m. could it leave Tai-wan-foo behind and have free room ahead. It then bore WbyN. to enter the chinese continent, which it also did between Amoy and Swatow, but somewhat nearer to Swatow (baromet. minimum, $29^{in}.32$ - wind NW. 6) than to Amoy (barom. minim. $29^{in}.39$ - wind EbyS. 6) inversely to what its companion had done the day before. This second passage took place on September 8th 6h a.m.

The velocity of translation of the first whirlwind had been on the average 14 miles an hour; that of the second varied a good deal and diminished gradually till the whirlwind left Formosa, but in the Strait it averaged 14.6 miles.

The foregoing explanations account, I think, for all the phenomena observed at the different stations. Let us however yet note a fact of importance. Whilst at Swatow, as well as farther North at Amoy and farther South

at Hongkong and Macao, there were two well marked minima in the barometric curve; at Lamock Island Light-house there was registered but one minimum, viz. that which belonged to the passage of the second whirlwind. I do not see any way of accounting for that difference but by supposing the two whirlwinds to have been connected in the upper regions of the atmosphere. Below, they were distinct and separated by a region of higher pressure but of a small height, so that even at the altitude of 240 feet, on Lamock Island, the separation between them was hardly marked; it is also probable that already at that moment the whirlwind coming from Formosa was spreading low pressures ahead, particularly in the middle region of air, as we know it to be the usual case, whence the apparent inclination of the axis forward.

If we return to the Hongkong and Macao observations, we find that the barometer kept low all day on September 8th and that on the 9th it rose but slowly. On the 8th, wind blowing steady SW. 5-4; on the 9th, SE. and S. 5-6. On the other hand, at Hoihow, on board H. M. S. *Magpie*, the barometric minimum $29^{in}.557$ was observed in the evening of the 8th: wind W. 2, afterwards SW., variable and light on the 9th, settling from E. on the 10th. All this seems to prove that the Typhoon which crossed Formosa proceeded westward on the continent to about the 113th meridian and that it vanished to the North-west of Hongkong.

During that time, what had become of the main whirlwind which had come direct from Luzon to Amoy? The valley of the Yang-tze-kiang with its enormous expanse of water was a favourable and naturally indicated way to effect its return to seaa nd it is probably from the Tong-ting lake (latit. 29°-longit. 113°) that it penetrated into the valley on September 10th. It then went up till near Hankow which it left on its right on the 11th; must have crossed the river twice by 115° and 117° longit., and, after a marked oscillation, went to take to sea again, on the 13th about midnight, somewhat to the North of the mouth of the Yang-tze-kiang. After backing somewhat towards the Shaweishan Light-house (6h a.m.), it finally turned to North-east and was lost sight of. The following tables will help to understand all the partitculars of that strange track.

Hankow

Latitude 30.° 34.′ — Longitude 114.° 20.′

Observator: N. TITOUSHKIN.

Date	Hours	Barom.	Wind	Clouds	Rain
		in			
September 10th	7 A. M.	29.82	ENE	9 C.	
	1 P. M.	.79	calm	10 Ni.	
	7.45	.75	calm	4	
,, 11th	7 A. M.	.78	SSE	3 K	
	1 P. M.	—	—	—	nil
	7.45	.69	NNE	10	
,, 12th	7 A. M.	.88	NNW	10 Ni.	
	1 P. M.	.87	NNW	8 Cn	
	7.45	.92	NNW	7	
,, 13th	7 A. M.	.95	NNW	6 C.	

Wuhu

Latitude 31.° 20′ — Longitude 118.° 22′

HARBOUR MASTER'S OFFICE.

Date	Hours	Barom.	Wind		Rain	Weather
		in				
September 11th	Midn.	29.95	E	2		Light clouds.
	3 A. M.	.95	E	2		id
	6	.95	E	2		id
	9	.93	E	2		id
	Noon	.89	SW	2		id
	3 P. M.	.85	SW	2		id
	6	.85	E	2		id
	9	.85	SE	3		Cloudy
,, 12th	Midn.	.83	NNW	4		id
	3 A. M.	.83	NW	5		Rainy
	6	.83	NW	5		Cloudy
	9	.86	NW	6		id
	Noon	.85	NW	6	in 0.150	id
	3 P. M.	.82	W	6		id
	6	.83	NW	7		id
	9	.85	NW	8		Rainy
,, 13th	Midn.	.87	NW	6		Cloudy
	3 A. M.	.91	NW	5		Rainy
	6	.91	N	4		Cloudy
	9	.95	NE	4		Light clouds
	Noon	.93	N	4		Cloudy
	3 P. M.	.94	NW	2		id
	6	.91	NNE	2		Clear
	9	.93	NE	2		id

Chinkiang

Latitude 32.° 13′ — Longitude 119.° 27′

HARBOUR MASTER'S OFFICE.

Date	Hours	Barom.	Wind		Nebul.	Rain	Weather
		in					
Sept. 11th	Midn.	92.87	ESE	3	2		Fine and clear.
	3 A. M.	.85	SE	2	2		id
	6	.84	SE	2	2		id
	9	.85	SE	3	2		id
	Noon	.82	SE	4	3		id
	3 P. M.	.75	SE	5	4		id
	6	.73	SE	4	10		Overcast, but fine.
	9	.73	SE	4	10		Overcast and threatening rain, thunder
,, 12th	Midn.	.73	calm		10		and lightning — slight rain.
	3 A. M.	.70	SW	1	7		Thunder storm
	6	.70	WSW	1	8	in	
	9	.72	W	2	8	0.30	Overcast and threatening weather.
	Noon	.70	W	3	8		
	3 P. M.	.69	SW	4	8		Light shower at 2 p.m.
	6	.63	NW	2	9		
	9	.68	NW	4	7		From 10 to 11.30 p.m., strong breeze.
,, 13th	Midn.	.75	NW	4	9		Breeze abating — slight rain.
	3 A. M.	.77	NW	4	8		Moderate breeze; weather clearing up.
	6	.85	NW	3	3		Fine, clear.
	9	.83	NNW	4	5	0.08	Cloudy.
	Noon	.83	N	5	5		
	3 A. M.	.80	N	4	4		
	6	.80	N	2	6		
	9	.83	N	2	6		

Zi-ka-wei Observatory

Latitude 31.° 12′ — Longitude 121.° 26′

Date	Hours	Barom.	Wind		Clouds				Rain	Remarks
		in		miles						
Sept. 11th	1 A. M.	29.932	SE	3.7			0			
	4	.908	E	1.8			0			
	7	.917	SE	3.0			0			
	10	.931	ESE	7.9			7	C		
	1 P. M.	.881	ESE	8.7			6	C		
	4	.845	ESE	10.6	K		2			Cirri bearing N — S.
	7	.836	ESE	7.5			1			
	10	.823	SE	6.6	K		1			Cirri on the NW horizon.
,, 12th	1 A. M.	.826	SE	4.3			3			
	4	.752	SE	7.8	K	NNW	9	Ac	SW	Cirri convergent to N by E.
	7	.781	SE	5.1	Ac	SW	10			halo round the moon.
	10	.779	S	5.0	K — Br		10	C	SW	
	1 P. M.	.722	W	10.0	K		9	C	W	
	4	.714	WNW	11.2	Ks	W	7	C	W	
	7	.715	W	1.3	Ac	WSW	9			
	10	.739	WSW	0.5	Ac		9			
,, 13th	Midn.	.738	W	1.9					in	
	2 A. M.	.720	WNW	3.2					0.043	
	4	.723	WNW	5.8			10	Cn	NNW	
	6	.748	NW	10.5			7	C	N	Cn. high and rapid.
	8	.783	NW	12.7				Ni	NNW	0.012
	10	.804	NNW	17.5	Ks	NNW	7	Cn	NNW	
	Noon	.783	NNW	16.1	Ac	NNW	7	C	NNW	Light showers.
	2 P. M.	.783	NW	15.4						0.016
	4	.779	NW	15.4	Ac	NNW	6	C	NNW	
	6	.804	NW	11.1						Showers.
	8	.835	NW	10.0	Ac		9	Ni		0.035
	10	.855	NW	8.6			9	Ni		

Shaweishan Light-house

Latit. 31.° 25′ — Longit. 122. 14′ — height 229 feet.

Date	Hours	Barom.	Wind		Rain
		in			
Sept. 11th	Midn.	29.94	ESE	4	
	3 A. M.	.92	ESE	4	
	6	.88	ESE	4	
	9	.94	E	3	
	Noon	.96	E	3	
	3 P. M.	.92	E	3	
	6	.89	E	3	
	9	.82	E	4	
,, 12th	Midn.	.81	ESE	4	
	3 A. M.	.78	ESE	3	
	6	.76	ESE	3	
	9	.80	ESE	3	
	Noon	.80	SE	3	
	3 P. M.	.76	S	4	Rain
	6	.71	NW	5	
	9	.70	NW	5	
,, 13th	Midn.	.66	NW	5	
	3 A. M.	.64	WNW	5	
	6	.62	NW	6	
	9	.68	NW	7	
	Noon	.70	NW	7	
	3 P. M.	.72	NW	6	
	6	.74	NNW	6	
	9	.77	NNW	5	
,, 14th	Midn.	.78	N	4	

The escape of this whirlwind towards the North-east is also indicated by the observations made in Shantong. Thus at the Cape Shantong Light-house, the barometric minimum ($29^{in}.76$) was observed on the 13th 4h p.m.; the wind blew E.4 on the 12th, NE.4 on the 13th till noon and N.4 afterwards; the next day, S. light.

At the time when the "Amoy" Typhoon thus returned to sea near Shanghai there was another one far more fearful in way of formation in the Liu-kiu Islands, 350 miles from the coast of China. It was going, on September 13th and 14th, to cross Japan, spreading havoc on its passage. It is natural then that the passage of the "Amoy" Typhoon, already much spent through a long run over the continent, should not have attracted more notice at Shanghai and on the coast.

Extent of the whirlwind.

The observations made on board H. M. S. *Magpie*, in the bay of Hoihow (Hainan), show, so early as September 6th 4 p.m., cirro-strati from NE. and ENE.; on the 7th and 8th they came from N. Those clouds then indicated an upper atmospheric current flowing, first from the Centre of the continental depression already mentioned, and afterwards from the Centre of the whirlwind. It was on the 6th about noon that the barometer began to feel the influence of the Typhoon which was yet some 735 miles away in the East. As for the lower winds, it was not before the 7th 10 p.m. that they altered their direction as they came within the zone of the whirlwind. The distance to the *Magpie* was the same as the day before; nevertheless they were late compared with the upper winds and with the barometric variation. On the 7th, after a few hours calm, about 10 a.m. the wind rose from W., blowing steady till the 8th 10h. p.m.; on the 9th, very changeable and light. The wind, convergent the whole time of the passage of the whirlwind, seldom attained to force 3. The barometric minimum, $29^{in}.559$, was observed on the 8th, 6h p.m.

Towards the North, the slight barometric variation registered at Zi-ka-wei on September 6th, belonged, as we have seen, not to the Typhoon, but to a continental depression. On the next day, about 7h a.m., there

appeared, coming from the South low vapoury swift clouds, the usual forerunners of great atmospheric perturbations: they indeed were offshoots of the Typhoon, 600 miles distant.

As for the Cirri and Alto-Cumuli seen on the 5th and 6th and proceeding from SW. to NE., they naturally belonged to the preceding continental depression, which fact is also borne out by the direction of the upper current which then at Hoihow, it may be remembered, was observed to run from NE. to SW. This continental perturbation thus made itself in the upper regions to be felt simultaneouly in places more than 870 miles apart: it was then far from being insignificant and may be pointed out as having determined the direction of the Typhoon. On September 7th, those upper currents still held on at Zi-ka-wei and at Hoihow; but then they made part of the whirlwind that was going to break upon the continent and their direction carried them both Northward to Zi-ka-wei and Southward to Hoihow.

We find in these facts a striking confirmation of the theory already brought out on several occasions. Grounded upon experience and observation, this theory of whirlwinds assumes that the aerial currents in the lower regions do not revolve round the Centre of the depression, but are inclined on the radius and converge towards the central region, round which they rise in a whirl: in the upper regions of the atmosphere, on the contrary, the air is driven from the Centre to the circumference, where it descends to feed the lower currents.

We find a new application of that theory in discussing the observations made about the same time at the Jesuit Missionaries, Observatory at Chang-kia-chwang (100 miles South of Peking.) On the 6th and 7th, the lower wind blew strongly from NE.; the upper wind from SW. As the barometer, which was on the rise since the 2nd, attained its maximum on the 7th and 8th, Chang-kia-chwang must have been very near the outer limit, first of the continental depression and next of the "Amoy" Typhoon: it was the inflow in the upper regions of those masses of air from SW. which thus increased the atmospheric pressure at about 600 miles from the Centre of the depression.

"WAKAYAMA" TYPHOON

Eleventh Typhoon: 12th — 15th September 1881.

TRACK :

				Latitude	Longitude
September 12th	Midn.	North-east		28°. 10′	127°. 30′
	Noon			28. 30	127. 40
,, 13th	Midn.	Liu-kiu group		30. 0	128. 0
	Noon			31. 15	131. 45
,, 14th	Midn.	Niphon		35. 0	136. 40
	Noon			38. 50	141. 0
,, 15th	Midn.	Pacific		41. 0	145. 45?

EVENTS :

Immense damage all over Japan.

Extreme violence of the storm at sea. — Several shipwrecks on the coast of Japan.

Lowest reading of the barometer 27^{in}95 on board the French steamer *Volga* on the afternoon of the 13th.

Before the Typhoon.

All what has been said of the last period of the *Amoy Typhoon* shows that it could have had nothing whatever to do with the originating of the Typhoon now about to rage in Japan; on the contrary, if our last Typhoon, running astray on China, was drawn towards Japan, it may well have been due to the low pressures elicited in the formation of this new whirlwind and to the very atmospheric conditions which promoted its formation.

During the first ten days of September, according to observations made mostly at Tokei and at Nagasaki, the atmospheric conditions on Japan were the most apt to prepare and bring about the great perturbation which marked the middle of the month. At Tokei, atmospheric pressure comparatively low; temperature high; much vapour in the air though far from saturation, hence no rain properly speaking; wind light and changeable: all these were as many clear indications of the existence of a strong upward draught, in consequence of which the sky showed plenty of the clouds proper to the upper strata of air, Cirri and Cirro-strati, the direction of which is unfortunately never given in the Bulletin of the Imperial Observatory (1). The same phenomena were observed at Zi-ka-wei, on the coast of China: the Cirri seen there were driving straight towards the Eastern Sea that stretches between China and Japan. If we had observations made in that sea, we should have found, for the first days of the month in particular, a comparatively high pressure, and this supposition is borne out by a comparison of the observations at Tokei and Nagasaki, this latter port being situated at the westernmost extremity of Japan. The mean pressure (reduced to sea level) for the first 8 days was found, at Tokei 29^{in}890, at Nagasaki 29^{in}960. Moreover, according to the bulletin of the Observatory, up to September 7th, Nagasaki enjoyed splendid weather by day-time, but had thick fogs both morning and evening. Now, if the air was rising upwards in the middle of Japan where the pressure was comparatively low, in the west it must have been descending on the sea and the cold currents which thus came from above to mix near the surface of the sea with the lower strata always loaded with vapour arising from the great warm marine current which washes all the Japanese coasts, could not fail to

(1) I take the liberty on this occasion to call the attention of Mr. Arai, the Surveyor-in-chief, to this great want in the bulletins which the Tokio imperial observatory publishes each month for the seven imperial observatories of Japan.

occasion those fogs at the coolest hours, whilst the absence of any ascending moist current must have caused the sky to keep clear during the rest of the day. It is also to be noted that during all this period, the prevailing winds at Nagasaki were from W. or towards the area of lower pressure, as might have been foreseen. Now that circulation from sea to land below, from land to sea above, could not fail sooner or later to bring about a collision between the two currents and the formation of an atmospheric whirlwind. It must have commenced on the 7th or 8th, for even on the 7th at Nagasaki, a first shower in the afternoon seemed to show that the descending aerial currents had been superseded by ascending currents due to the accumulation of heat during eight days of fine weather; in the evening, flashes of lightning in the North; next morning, thunder and lightning in the South-west; thunderstorm from 8h 30m to 10h a.m., rain in the evening. Wind turning to N. and NE., barometer sinking: Typhoon formed and on the march.

During that time, that is from the 8th to the 11th, the barometer was rising at Tokei, the explanation of which fact is that the whirlwind formed in the South-west of Nagasaki, but yet confined to the upper regions, already was driving back by its gyrating motion the upper currents we have seen to exist in Japan. Great masses of air were thus propelled far and wide towards the East and North-East; their rather sudden meeting with the warm and moist currents which tended to go on rising caused the condensation of their watery vapour: hence heavy rains at Tokei on the 9th, 10th and 12th; — not on the 11th however because at that date the barometer was at its maximum, and there were no more ascending but only descending currents which lowered the temperature from 84°.9 (on the 8th) to 59°.2 (on the 11th); the tension of vapour, from 0^{in}.800 on the 8th had fallen to 0^{in}.571: it was the edge of the whirlwind.

But on the 12th and 13th, Tokei had fairly penetrated into the area of the whirlwind, and the air began to ascend again carrying with it the vapour drawn from the *Kurosiwo* (the warm current of Japan); that vapour was soon brought in contact with the cold air accumulated over the station and which had not yet been driven off by the centrifugal force of the whirlwind: hence diluvial rains again, particularly along the track of the Centre. There is generally after the passage of the Centre a repetition of the same phenomena, but in the inverse order. At Tokei the barometric minimum was reproduced on the 16th, the temperature on that day was also a minimum for the reasons stated higher up, in spite of the direction of the wind (SE. light) and of a considerable solar radiation; in the sky cirri made their appearance again; — below, mist and fog in the morning.

We may then see how this theory supplies a simple and obvious explanation for every feature of those grand atmospheric movements, and in the case of this Japan Typhoon, I am happy in having been able to get observations with which to verify it in almost every particular.

Mr. Arai, Surveyor-in-chief of the meteorological observatories of Japan, has published separately the series of observations made during the passage of this Typhoon over the eight principal stations of the empire, viz. Nagasaki, Hiroshima, Wakayama, Kioto, Tokei, Niigata, Nobiru and Hakodate; he has also drawn up a map of the track of the Centre which is identical with that I had determined before with the help of only part of those observations and of some reports from ship captains. It was however hardly possible to mistake the course followed by a Typhoon, which had gone over almost all the length of such a populous country as Japan.

The Typhoon at Sea.

The following report of capt. Robinson of the SS. *Tientsin* leaves little room for doubt with regard to the place where the Typhoon originated, the phenomena observed at Nagasaki on the first days of the month

being kept in sight. The whirlwind cannot have come from a great distance and its origin, according to all probability, had nothing in common with that of the double Typhoon which followed the coast of Luzon and of Formosa on September 6th and 7th. This supposition is confirmed by the very rapid increase in the velocity of the Centre, which, after being, as a mean, of 18 or 20 miles on the 13th from midnight till noon, rose to 25-28 miles in the next 12 hours, though the Centre had in the latter case to pass over a very broken and mountainous country. On the 12th then, the velocity must have been inconsiderable, as it is indicated by the sinking of the barometer on board the *Tientsin* between noon and midnight. On the 12th, between 7 and 9 p.m., the Centre was at the shortest distance of the ship, about 60 miles to the ESE. (barom. = 29.62, wind NNE. 3 soon to veer to NNW. 3). One may well wonder at finding the wind so light within that distance, the more so as much farther away, at Satanomisaki on the southernmost point of Japan (about 150 miles from the Centre) it was already blowing full storm (SSE.), and even the steamer in the afternoon and on the next day was to meet with altogether more violent winds. This anomaly in the intensity of the winds at that time may possibly have been owing to the very elongated shape of the lines of pressure round the Centre; the depression was oval and its major axis was parallel with the line it was going to follow, as is well set off by the barometric observations and by the direction of the wind at Nagasaki, at Satanomisaki and with the Steamer *Tientsin*.

S.S. **Tientsin** (MASTER E.L.M. ROBINSON.)

from Kutchinotz (Japan) to Swatow.

Date	Hours	Latit.	Longit.	Barometer	Wind		Remarks
				in			
Sept. 11th	2 P. M.						Leff Kutchinotz.
	5			29.81	E	4	Landed pilot off Nomo saki—course set SW ¼ S.
	8	32.17'	129.29'	.82	E by S	4	
,, 12th	Midn.	31.55	129. 9	.78	ESE	4	
	3 A. M.			.75	E	4	Cross swell from ESE and E—course SW ½ W.
	4	31.36	128.47	.75	E	4	
	6			.73	ENE	4	
	8	31.15	128.25	.73	NE	4	
	10			.72	NE	4	Dark leaden sky to southward.
	Noon.	30.56	128. 0	.67	NE	4	
	1 A. M.			.66	NE	5	
	2			.65	ENE	5	Altered course W.
	3			.63	ENE	5	
	4	30,52	127·21	.63	NE	6	Heavy NE. swell—sky clouded.
	5				NNE	5	
	6			.62	NE	4	
	7			.62	E by N	4	
	8	30.51	126.48	.62	E by N	4	Heavy NE. swell—sky cloudless.
	9			.64	E by N	2	
	10			.65	NNE	3	Altered course SW by W.
	11			.65	NNE	3	Swell from NE. and ESE.
,, 13th	Midn.	30.41	126.20	.63	NNE	3	Clear sky—same swell.
	1 A. M.			.62	NNW	3	
	2			.63	NW by N	4	Heavy swell from ESE. and NE—cloudy 7.
	3			.64	NW	5	Light rain.
	4	30.23	125.55	.64	NNW	5	
	5			.65	W	3	Weather squally with heavy rain—cloudy 7.
	6			.65	W by N	3	
	7			.65	WNW	4	
	8	30. 6	125.30	.66	W by S	4	Clear sky—ESE. and NE. swell.
	9			.67	W by S	6	id —heavy swell.
	10			.67	W by S	6	
	11			.66	W	6	id —less swell.
	Noon.	29.49	125. 6	.65	W	6	Westerly sea rising—squally with rain.
	2 P. M.			.65	WNW	7	Westerly sea and NE. swell—sky clear.
	4	29.34	124.39	.65	NW	7	Heavy westerly sea—swell hardly perceptable.
	6			.67	NW	8	id id
	8	29.19	124.12	.71	WNW	8	id id
	10			.74	NW by W	7	id id
,, 14th	Midn.	29. 4	123.45	.74	NW by W	6	Clear sky and less sea.
	8 A. M.	28.33	122.51	.84	N	4	Sky overcast.

Nagasaki Observatory

Latit. 32.° 44′ — Longit. 129.° 52′ — height 189 feet.

Date	Hours	Barom.	Wind		Therm.	Hum. %	Clouds	Rain	Remarks
		in		miles	°				
Sept. 10th	9.30 A. M.	29.922	NE	7.0	82.5	58	0		Fog, dew, morning.
	9.30 P. M.	.910	NE	3.2	77.1	76	7 Cs		
,, 11th	9.30 A. M.	.868	ENE	12.8	83.5	55	0		Fog, dew, morning.
	9.30 P. M.	.845	NE	5.3	80.1	65	0		
,, 12th	9.30 A. M.	.816	NE	11.0	83.8	60	9 K, S		Fog, morning.
	9.30 P. M.	.692	ENE	6.5	80.6	66	9 Cs, C, S		Slight rain at 6 a. m.
,, 13th	Midn.	.660	NE	7.3	78.8	71	10 K, C, S		Corona and halo (moon)
	6 A. M.	.586	NE	8.4	79.1	65	10 K, S	in	
	9.30	.548	NNE	13.5	86.5	54	8 K, Cs, C	0.11	
	11	.514	NNE	18.0	88.0	50	8 K, Cs, S		
	Noon.	.499	NNE	18.3	90.0	46	6 K, Cs, C		
	1 P. M.	.483	NNE	16.3	90.2	45	6 K, C		
	2	.489	NNE	14.3	87.9	58	6 K, C		
	3	.484	N	15.3	86.7	61	7 K, Ks, C		
	4	.507	N	13.1	84.9	64	1		
	5	.524	N	10.4	82.4	73	2 Cs		
	6	.554	N	8.6	80.5	75	9 Cs, S		
	9.30	.614	N	6.1	78.4	76	3 S		
,, 14th	Midn.	.626	NE	5.2	77.7	77	8 K, S		
	9.30 A. M.	.759	N	8.5	75.5	87	10 Ni		Raining.
	9.30 P. M.	.852	NE	4.0	73.0	79	0		

Satanomisaki Light-house

Latitude 30.° 58′ — Longitude 130.° 40′ — height 200 feet.

Date	Hours	Barometer	Wind	Rain	Weather
		in			
September 10th	9 A. M.	29.94	E		Light wind.
	9 P. M.	.90	E		id id
,, 11th	9 A. M.	.85	E		id id
	9 P. M.	.82	E	in	Breeze.
,, 12th	9 A. M.	.79	N	0.50	Gale.
	9 P. M.	.77	SSE		Breeze.
,, 13th	9 A. M.	29.24	NW	0.20	Gale.
	(11 A. M.	28.80)?	—		Storm.
	9 P. M.	29.65	W		Storm.
,, 14th	9 A. M.	.75	W		Gale.
	9 P. M.	.80	E		Breeze.

The Typhoon is likely to have originated somewhere to the North-west of the Liu-kiu group in the course of the 10th and 11th, and on the 12th to have started on its progress in a North-easterly direction, first very slowly, then with increased speed; the Centre to have touched the southernmost point of Kiu-siu Island on the 13th about noon or 1h p.m.

The French steamer *Volga*, of the *Messageries maritimes*, crossed the region of central calm and thus gives us another point of the track. Herewith an abstract of the captain's report.

"Left Yokohama on September 11th 9h 30m a.m. with NE. wind, raining, barom. at 30in.08. Till 13th morning, wind variable between NE. and SE., sea from E., frequent squalls from SE., barometer sinking. Got awnings off and prepared for a blow. On the 13th 9h a.m. violent squall from SE., heavy sea, wind freshening more and more, barometer sinking rapidly. A Typhoon right ahead; 25 miles S. of cape Isa by dead reckoning, that is latit. 32°.30′, by longit. 133°.0′. Impossible to steer out of the storm; though the barometer announced a very violent storm, made up my mind to keep on route which bore straight to the Centre, and prepared every way to meet it. — 10 a.m. barometer at 29in.55, strong wind from SE., sea rising from the same quarter; — 11h a.m., barom. = 29in.53, sea higher, squalls unceasing.—Noon, blowing a hurricane and still increasing from SE.; barom. 29in.17; at 0h 30m p.m. 28in.94; 1h p.m., 28in.74; 1h 30m p.m., 28in.50; 2h p.m., 28in.31, oscillating as low as 28in.00 during the squalls. Sea frightfully high.—2h 30 p.m. barom. still at 28in.31, a sudden

calm for a quarter of an hour: sun shining, bit of blue sky at zenith. Wind SE. very light, veered to N. through E. Lying upon the practicable edge of the central zone; engine worked at 18 revolutions to allow of steering.

2h. 45m p.m. wind again blowing furiously from N.; sea frightfully high; a boat torn away. — 3h p.m. barometer at 28in.50; sea mountainous from N.; wind of unheard of violence, soon abating. Barom.: at 4h p.m., 29in.09; at 5h p.m., 29in.27; at 6h p.m., 29in.61. — Shipping an enormous sea on starboard side; water in the cabins and in the engine-room; starboard gun torn from its fastenings and lost; seats and tables in 1st class saloon torn off in a lurch. — At 6h 30m p.m. weather improving; land (Kiu-siu) seen on starboard side about 40 miles off: from present position it appears that the route had not been deviated from, going on all the time to NE. with a speed of 2 miles an hour.»

The *Volga* then had met the Centre of the Typhoon on September 13th between 2h 30m and 2h 45 p.m.; the position of the ship at the time may be taken at latit. 31.° 50' by longit. 132.° 0°. The perfect steadiness of the wind (SE.) gives the true direction of the storm in that region: it ran straight North-east. We are going to follow it on shore with the help of the observations made in the principal imperial observatories of Japan.

The Typhoon on land.

Hiroshima

Latit. 34.° 20.' — Longit. 132.° 27' — height 14 feet.

Date	Hours	Barom.	Wind		Therm.	Humid. %	Clouds	Rain	Remarks
		in		miles	°				
Sept. 12th	9 A. M.	29.869	NNE	8.0	76.4	79	10 Ac K E		5 a.m. — fine rain.
	3 P. M.	.776	NNE	4.0	80.2	73	10 Ni		Noon — id
	9	.769	NNE	2.8	74.0	92	9 K Ac	in	6 p.m. — id
,, 13th	9 A. M.	.645	NNE	6.9	78.0	78	10 Ac E	0.330	
	Noon	.594	NE	8.3	79.2	78	10 Ni		11. 20 a.m. — fine rain.
	3 P. M.	.487	NNE	11.6	78.0	81	10 Ac Ni E		
	3. 30	.466	NNE	13.0	78.0	81	10 Ac Ni E		
	4. 30	.430	NNE	11.6	78.8	76	10 Ac Ni E		5 p.m — fine rain.
	5. 30	.403	NNE	14.4	79.2	73	10 Ac S E		6.20 — double rainbow.
	9	.414	N	10.6	79.4	68	10 Ac K		6.30 — 7 — 8 p.m. rain.
	9. 30	.421	NNE	9.6	79 4	67	9 Ac Ks		
,, 14th	9 A. M.	.670	NNE	5.6	78.7	68	10 Ac Ks	0.054	6 a.m. — fog. — 7, rainbow.
	3 P. M.	.666	NNE	9.1	83.6	51	4 Ac Ks		
	9	.786	NE	2.8	72.7	79	0		Dew.

These observations are very much like those of Nagasaki. The distance of the two stations to the Centre of the Typhoon was very nearly the same, 90 miles. We call attention to those winds from NNE. almost perfectly steady. First bearing to the Centre or convergent, they become circular at the time of the passage, then divergent. Rectilinear winds can thus belong to a true whirlwind.

Wakayama

Latitude 34° 14′ — Longitude 135° 9′ — height 48 feet.

Date	Hours	Barom.	Wind		Therm.	Humid. %	Clouds		Rain	Remarks
		in		miles	°					
Sept. 12th	9.10 A. M.	29.939	ENE	3.1	77.5	77	10 Ac	SW		
	3.10 P. M	.861	NE	1.5	80.2	80	10 Ni	E		Rain.
	9.10	.854	ENE	6.7	74.6	80	10 Ac Ni			
,, 13th	6 A. M.	.779	E	6.0	71.7	92	10 Ni		in	
	9.10	.769	ESE	8.9	72.8	93	10 Ni	ESE	0.699	
	Noon	.724	ESE	6.8	73.1	95	10 Ni	ESE		
	3.10 P. M.	.612	NNE	8.3	77.0	90	10 Ni	ESE		
	4	.577	E	9.6	77.1	83	10 Ni	ESE		
	6	.471	E	8.0	75.3	94	10 Ni	S		Slight rain.
	8	.248	N	34.1	75.3	89	10 Ni			Heavy rain.
	8.30	29.160	NNE	34.1	75.7	88	10 Ni			
	9 10	28.976	NNE	43.2	73.9	98	10 Ni			
	9,30	.875	NNE	43.2	74.1	99	10 Ni			9.30 p.m. — Anemometer broken.
	10	28.778	NNE		74.1	—	10 Ni			Strong wind and heavy rain.
	11.30	29.041	N		73.8	—	10 Ni			
,, 14th	Midnight	.164	NNW		73.7	96	10 Ni			
	6 A. M.	.610	N		76.6	78	10 Ac, S	W		
	9.10	.665	NW		81.7	69	8 Ac	NW	3.755	
	Noon	.669	WSW		86.1	60	0			
	3.10 P.M.	.666	WSW		81.3	72	10 Ni			Rain.
	6	.731	WSW		75.8	90	10 Ni			
	9.10	.774	WSW		74.8	94	2 Ac			

Here we have a well marked gyration of the wind (E., N., W.), but we find it again first convergent when the Centre is far off in the South-west, circular when the Centre is within 20 or 25 miles in the East, lastly convergent again when the Typhoon lies in the North-east.

At Kobe Observatory (latit. 34° 42′ - longit. 135° 11′) the wind varied from NE. to N. and NW. Lowest reading of the barometer 29^{in}.09 at 11h p.m. on the 13th. From this time the wind which had been blowing in violent squalls accompanied by heavy rain, decreased in violence.

Kioto

Latit. 35.° 1′ — Longit. 135.° 46′ — height 162 feet.

Date	Hours	Barom.	Wind		Therm.	Humid. %	Rain	Clouds			Remarks
		in		miles	°						
Sept. 12th	9.15 A. M.	29.986	N	2.0	72.5	83		10 Ni			Slight rain
	3.15	.926	N	4.4	73.1	83		10 Ni			
	9.15	.925	ESE	2.6	70.7	87		10 Ni			
,, 13th	Midnight	.882	WNW	1.3	70.1	94		10 Ni			
	3 A. M.	.831	NW	0.3	71.1	90		10 Ac	St		
	6	.816	NW	2.2	71.2	90	in	10 Ni			
	9.15	.802	N	3.8	74.8	88	0.350	10 Ni		SE	Slight rain
	Noon	.750	NNW	1.7	75.4	89		10 Ni		SE	
	3.15 P. M.	.661	NNW	2.7	77.1	84		10 Ks	Ni	E	
	6	.575	NNW	4.1	75.0	90		10 Ni		E	Rain
	9.15	.373	NNE	13.5	77.1	86		10 Ni			
	10	.278	NNE		77.0	87		10 Ni			
	11	29.089	NE	18.9	74.4	97		10 Ni			
,, 14th	Midnight	28.918	N	18.9	72.9	99		10 Ni			
	1 A. M.	28 974	NW	34.7	72.1	98		10 Ni			
	2	29.158	NW		75.6	81		10 Ni			
	3.15	.393	WSW	5.0	74.9	84		10 Ni			
	4	.471	W	7.1	74.1	88		10 Ni			Fine rain
	5	.519	SW	3 7	73.0	93		10 Ks	St	NW	
	9.15	.633	SW	4.9	79.5	79	4.255	3 Kc	Ac	SW	
	Noon	.638	W	8.5	84.1	64		9 Ni			Fine rain
	3.15 P.M.	.661	NW	2.7	77.9	80		10 Ni			Slight rain
	6	.714	SW	1.5	75.1	93		8 Ks	Ac	SW	
	9	.767	NW	0.7	71.4	93		4 Ks	Ac		

The difference of ^{in}.17 between the two barometric minima observed at Kobe and at Kioto is probably the reason why at the Tokei observatory the track of the Typhoon was drawn up with a bend from Wakayama to the West so as to make it come nearer to Kioto. It was found necessary a little higher up to bring it towards

Tokei again; the result is that the track looks rather undulating. In fact there was no ground for giving this shape to the track: for, on the one hand, there was no reason why the Typhoon should have avoided the Gulph of Owari over which its direction led it, and on the other, the fall of the mercury, more considerable at Kioto, may be laid to the score of the height of this station, whereas Kobe lies on the Sea: the Typhoon may then have crossed Niphon without any irregular deviation in its course.

Among the special observations made in the various Observatories and published at Tokei, we notice the direction SE. and E. given for the clouds at Kioto about the middle of September 13th. We suppose it is through a mistake that this direction is given as that of the lower clouds which, according to the bulletin, were nimbi and gave some slight rain. Since the wind was then blowing from NNW., though it was light, it cannot be admitted that the strata of air at such an inconsiderable height as to carry nimbi, should have had a movement of translation directly opposite to that of the wind at the station. There may in reality have been in the sky at Kioto together with the nimbi, alto-cumuli (cirro-cumuli) or cirri running from SE. to NW., of which the observator only noted the direction; or perhaps those nimbi, taking the whole of the sky, were such as I very often observed at Zi-ka-wei some time before heavy rains and during the passage of atmospheric depressions, that is greyish alto-cumuli of a moderate altitude and giving out slight showers, but certainly belonging to upper currents. However that may be, that North-westerly direction in a stratum of air superimposed upon another one bearing SSE. affords a striking confirmation of what I stated when speaking of the formation and constitution of this whirlwind: there was truly a circulation: the air of the lower regions indraughted towards the Centre (at Kioto, wind from NNW. and NNE. whilst the Typhoon lies in the South-west and in the South) rises there in a whirl, to be soon forcibly propelled out and returns above towards its starting point (upper wind from SE., then from E.) to descend and go on the same circulation again. Such facts are too full of instruction to be passed over in silence.

Tokei

Latit. 35.° 40′ — Longit. 139. 45′ — height 63 feet.

Date	Hours	Barom.	Wind		Therm.	Humid. %	Clouds		Rain	Remarks
		in		miles						
Sept. 12th	9.30 A. M.	30.082	N	6.3	72.°6	76	7 Ks, Ac C	NE		Upper clouds from SE., 6 a.m.—misty.
	3.30 P. M.	29.997	NE	5.4	76.0	76	10 Ks, Ac			
	9.30	30.039	ENE	4.4	69.2	94	10 Ni			Raining.
,, 13th	3.30 A. M.	20.962	NNE	6.8	67.4	96	10 Ni	NE	in	
	9.30	.949	N	7.3	67.4	99	10 Ni		1.020	
	3.30 P. M.	.858	NNW	4.0	68.9	98	10 Ni	N		
	9.30	.804	N	2.5	68.7	97	10 Ni			Slight rain.
,, 14th	Midn.	.682	N	2.5	68.4	99	10 Ni			
	3 A. M.	.464	SSE	30.1	76.3	89	10 Ni	S		Few large drops of rain.
	4.30	.318	SSE	41.6	77.6	85	10 Ni	SSE		Wind veered, 1.40 a.m.
	5.30	.262	S	39 6	76.6	92	10 Ni	S		Heavy rain and vivid lightning.
	6	.222	—	—	77.6	83	10 Ks, Cs	S		Rain ceesed at 5.50 a.m.
	6.15	.171	—	—	78.2	81	——			
	6.30	.220	SSW	41.1	78.7	78	10 Ks, Cs	S		
	7	.234			79.5	72	10 Cs	SSW		
	7.30	.255	SSW	40.1	80.0	66	10 Cs	SSW		
	8.30	.343	SSW	36.1	79.7	67	10 Cs	SW		
	9.30	.430	SSW	24.1	80.9	66	9 Ac, Cs	SW	1 075	
,, 15th	Midn.	.446	SSW	22.6	85.4	58	7 C	SW		
	3.30 A. M.	.471	SSW	19.1	86.6	58	2 Ac. Cs			
	9.30	.629	SSW	4.4	75.0	86	0			

On September 12th and 13th, we have light winds from NE. and N. evidently converging to the Centre of the whirlwind: the theory of circular winds would at that time call for South-easterly wind. The winds from SE. and S. will come in their turn on the 14th about 2h a.m. and soon got considerable force, but then the Centre is near: it will pass in the west of Tokei at 6h 15m a.m. After that passage the wind continuing strong,

settled SSW. again strongly convergent. The Centre of the Typhoon lay in the middle of the island about 6h a.m. and pursuing its course, soon came to pass between the two stations of Niigata on the western, and of Nobiru on the eastern coast.

Niigata

Latitude 37.° 55′ — Longitude 139.° 3′ — height 32 feet.

Date	Hours	Barom.	Wind	Therm.	Humid. %	Rain	Remarks
		in	miles	°			
September 12th	9.30 A. M.	29.995	SE 6.7	75.3	59		Halo.
	3.30 P. M.	.919	SE 6.7	78.4	61	in	Slight rain.
,, 13th	9.30 A. M.	.882	SE 11.0	66.7	94	0.310	id
	3.30 P. M.	.749	SE 12.7	73.0	75		id
,, 14th	6 A. M.	.196	NE 14.9	71.3	88		id
	6	.171	NNE 18.8	72.3	93		id
	8	.147	NNE 19.5	73.2	94		id
	9	.265	N 17.3	72.1	100	1.065	Raining.
	10	.396	NW 7.1	73.4	97		Slight rain.
	Noon	.467	WNW 6.4	76.8	85		
	3.30 P. M.	.539	W 9.6	77.0	80		
	6	.582	N 5.6	75.4	88		
	9.30	.628	SW 7.5	72.6	93		Raining.

Nobiru

Latitude 38.° 23′ — Longitude 141.° 12′ — height 15 feet.

Date	Hours	Barom.	Wind	Therm.	Humid. %	Rain	Remarks
		in	miles	°			
September 12th	9.30 A. M.	30.086	NNW 5.6	68.1	94		
	3.30 P. M.	.020	E 9.1	74.5	64	in	7 a.m. fog.
13th	9.30 A. M.	30.003	SW 11.6	66.4	96	0.290	Slight rain, 0.46
	3.30 P. M.	29.907	SSE 23.3	69.1	85		p.m.
14th	6 A. M.	.498	SE 43.8 ?	73.3	—		
	8	.307	SE 65.1 ?	73.3	—		
	10	.082	SSE 57.5 ?	73.6	—	3.170	
	11	.035	SE 41.0 ?	77.0	—		
	Noon	.097	WSW 21.5 ?	80.0	—		Nearly calm at
	1 P. M.	.232	W 15.0 ?	79.0	—		0.30 p.m.
	3	.351	NNW 15.0 ?	82.2	58		
	5	.502	NNW 25.0 ?	75.4	—		
	9.30	.624	NE 10.6	68.8	82	0.110	

At Hakodate (Yesso Island) latit. 41.° 46′ — longit. 140.° 44′, minimum of the barometer 29.302 5 p.m. on the 14th. The wind veered from ESE. to E. — NNE. at 5 p.m — afterwards N. and NNW.

The Typhoon evidently passed nearer to Nobiru than to Niigata. The pretty strong NNW. wind which blew on the eastern coast in the afternoon of September 14th shows the track to have left the great island a short distance to the North of Nobiru and to have bent towards ENE., in which direction we lose sight of it.

The storm and disasters.

The captain of the *Volga* made us witness a true storm near Kiusiu. In the bay of Yeddo, at Yokohama, there was considerable loss of life and property occasioned by the drifting and wreckage of three of the Pacific M. S. C's cargo barges. These barges had been engaged in the landing of cargo from the S. *Belgic* which arrived here from San Francisco and were anchored for the night ontside the English hatoba. The force of the wind made two of them drag their anchors and drift on the beach near the fort at Kanagawa and the other was sunk near the steamer. Some twelve sendoes were drowned or killed by violence, and about three hundred packages of merchandize were lost.

The *Choya Shinbun* (native newspaper) says, that according to an official enquiry into damages in Tokei made by the gale, 36 houses and shades were blown down and 14 damaged. Four fishing boats were wrecked off Shinagawa.

A French traveller was on September 14th and 15th on his way from Tokei to Osaka: he reports having met thousands of trees, hundred years old cryptomerias, blown down and stopping the main road every moment.

Navy Captain Dubrot, commanding the *Champlain* which arrived at Yakohama on September 18th, reported that on the day before, the weather being fine and calm, he met for a distance of 40 miles floating timber and tree trunks of all sizes in sufficient quantity to hinder navigation a good deal. There must have been considerable wrecks of timber laden ships.

The British barque *Wellington*, Captain Rick, from Newcastle, N.S.W., with a cargo of coal for Yokohama, went ashore at daylight on the morning of the 14th September, at Sajima mura, Jokasima, at the entrance of the Yeddo Gulf, during the height of the Typhoon. On the 13th, had a light N. wind and fine weather, but at midnight of the 14th, the wind came from S. in fierce gusts, accompanied by thunder and lightning, with other indications of an approaching Typhoon. Soon after 3 a.m., near Cape Sagami, during a violent squall, the port lower fore-top-sail sheet carried away, and wrenched the quarter block off the fore yard, making it impossible to reeve it anew. The sail was picked up however, but as the vessel was being rapidly blown landward, efforts were made to set the fore and aft canvas, which blew out of the bolt ropes as soon as loosed. The lower main top-sail also split in the bunt; the starboard half went to ribbons, the port one holding firmly. As the ship was now at the mercy of the gale, the master had the ground tackle prepared and the lead kept going, heading the vessel to South-east, and soon after daylight, 10 fathoms were got, then shortly afterwards $7^1/_2$, when both anchors were let go and cables paid out to the clinches. The lowest barometer was $29^{in}.73$ during the height of the storm. The boats were got out and launched, but were stove in as soon as in the water. After the ship had struck the ground twice or thrice, she commenced to break up, the decks opening before the mizen mast, compelling the crew to take refuge aft and precluding all possibility of saving their effects. As the ship broke up very rapidly, all hands (eleven in number) endeavoured to reach the shore, in which attempt they were greatly assisted by the natives who reached them long bamboos through the surf, and saved them from being carried out by the undertow. In the end, some by swimming and others on the mizen mast, which going by the board lay from the stern to the beach, all hands reached the shore alive.

The Russian cruiser *Asia* which arrived at Yokohama from Wladivostok on the 17th September, when 180 miles from Yokohama and 40 from the nearest coast, in latitude 36° 30′ - longitude 141° 40′, sighted a disabled Japanese fishing boat about three miles off their course. The vessel's head was immediately turned towards the boat which, on approach, was found to be submerged with the exception of the bows. A Japanese, who was lying in the junk, sat up and shouted, but appeared to be unable to stand erect, as he fell back every time he attempted to do so; this man was the only person on board and had to be lifted and hoisted up to the steamer. He was in a bad state, having apparently had nothing to eat for several days. On arrival to Yokohama an interpreter was sent on board. The man said he was one of a crew of fifteen of the fishing boat which had been in company with another craft similarly manned. A storm coming on, his boat was damaged and water came into her. The crew, with the exception of himself, immediately got into the other boat, but he was by some accident left behind, and the sea running high, the boats could not come together again. He succeeded in crossing the masts and lay down on them. The sharks, he said, bit him about the knees and elbows, but were unable to lay hold of him. The officers on board the *Asia* report having their attention first attracted to the boat by the large number of those fish which were springing about it. When they took the man on board they found he was injured and scratched about the arms and body. The police at Yokohama report that the boat which had been in company

with the disabled one, into which the other fourteen of the crew had got, was afterwards lost with all hands. *(Japan Gazette).*

The Barque *Taihei Maru,* Captain Black, loaded with coal, was lost on the 13th September, about half a mile North of Taga, Suruga Gulf, latit. 34°.47′ - longit. 138°.45′. At 6 p.m. on the 13th, Captain Black anchored two miles from the shore, in 15 fathoms of water. At 7h it came on to blow a perfect hurricane, accompanied with blinding rain-squalls. The second anchor was let go and veered out to 30 fathoms. By 8h the full force of the Typhoon struck the vessel. At this time the vessel appeared perfectly safe and was riding beautifully. Captain Black now left the deck to look at the barometer, and just as he returned the second mate called out that he noticed something peculiar, and the Captain then realized that the vessel was either dragging, or had parted from her anchors and was fast going ashore. He at first intended to cut away the masts, but as the vessel had no list, and the lives of all on board would have been endangered, the idea was abandoned. The only thing left then was to wait the inevitable result; a few moments of intense anxiety passed, and the *Taihei Maru* struck of the reef which runs out from the rocky point north of Taga. The shock was tremendous, and after being raised and flung down violently on the rocks by the sea, which was running mountains high, the ill-fated vessel was noticed to part abaft the main-mast. The passengers and crew (about 40 souls in all) were clinging to the mizzen rigging, and managed with difficulty to reach the fore channels, as the fore-mast had by this time gone overboard. Here they remained exposed to the full violence of the rain, wind and waves until daylight, when the weather moderating, some fishing-boats put off and rescued the survivors from their perilous position, for we regret to say one midshipman and one sailor were found to be missing. *(Hiogo News).*

Gradient and velocity of translation.

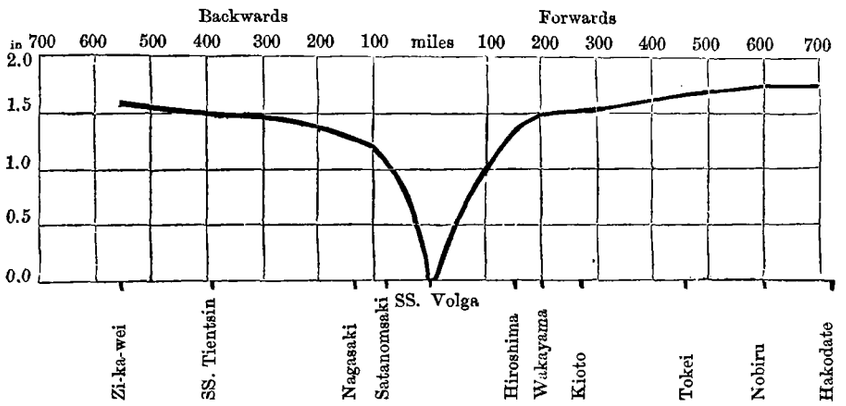
When the *Volga,* on September 13th 2h 30^m p.m., crossed the very Centre of the Typhoon, the barometer oscillated between 28^{in}.31 and 28^{in}.00. We may then take 28^{in}.20 for the pressure at the Centre of the whirlwind in the South of Japan. Between 2 and 3h p.m. there was observed: at Nagasaki 29^{in}.486, at Hiroshima 29^{in}.500, at Wakayama 29^{in}.660, at Kioto 29^{in}.690, at Tokei 29^{in}.870, at Nobiru 29^{in}.93, at Hakodate 29^{in}.93. At that time the steamer *Tientsin* was 390 miles South-west of the Centre, and her barometer read 29^{in}.700.

Let us for each of these stations compare the excess of pressure over that at the Centre, and the distance to that Centre situated in latit. 31°.50′ by longit. 132°.5′, and calculate the corresponding gradient for 100 miles.

Stations	Excess of pressure in	Distance to the Centre	Mean gradients for 100 miles	*Weight of* the mean gradients at 100 miles
SS. *Volga*	0.000	0 miles	—	—
Nagasaki :	+ 1.286	138	0.93	670
Hiroshima :	+ 1.300	150	0.87	574
Wakayama :	+ 1.460	200	0.73	365
Kioto :	+ 1.490	270	0.55	204
Tokei :	+ 1.670	460	0.36	79
Nobiru :	+ 1.730	600	0.29	49
Hakodate :	+ 1.730	720	0.24	41
Satanomisaki :	+ 1.190 ?	80	1.49	1862
SS. *Tientsin* :	+ 1.500	390	0.33	82
Zi-ka-wei :	+ 1.579	555	0.28	50

If one wanted, at a given moment, on September 13th 2h 30^m p.m. for instance, to form an idea of the shape of the depression with the help of the mean gradients calculated for 100 miles distance from the Centre, the notion thus acquired would be completely erroneous; for the figures which represent those gradients have so much less weight as they have been calculated with observations taken at greater distances (as shown in the last column: W. = mean gradient $\times \frac{100}{\text{distance}}$). The enormous diversity of those mean gradients at 100 miles from the Centre

gives an unquestionable proof of the insufficiency of that method. The best way, to my sense, is to draw the curve of the barometric variation, taking the distance itself into account, as I have done in the annexed diagram with the observations of stations taken as far as possible in the direction of the track itself. That curve is evidently the true representation of the pressure along the track at the given moment, and this construction is preferable to that which would only take the series of observations made in a single station over which the Centre would have passed, for it is known how rapidly changeable the shape of a whirlwind is in the vicinity of extensive lands and of high mountains.



The depression, though very regularly constituted, was not absolutely symmetrical before and behind the Centre; the pressure was less at the back, owing simply to the presence of the depression we have seen passing near Zi-ka-wei in the evening of September 12th, bearing towards Japan. Forward, the extreme limit of the Typhoon was between Nobiru and Hakodate, that is 700 miles from the Centre.

As for the velocity of translation of the Typhoon, I have already said that on the 12th it had varied considerably; on the 13th, from midnight till noon, it could be estimated at 16 miles; from noon to next midnight, at 27 miles; on the 14th, from midnight to noon, at $26^1/_3$ miles; from noon to the 15th midn. at about 22 or 23 miles.

"PRATAS REEF" TYPHOON

Twelfth Typhoon: 11th — 20th September 1881.

TRACK :

				Latitude	Longitude
September	11th		Is developping near Pratas Reef.	20° 30′	118° 20′
,,	12th	Midn.		20. 45	118. 0
		Noon		20. 55	117. 40
,,	13th	Midn.		21. 20	117. 30
		Noon	Formosa Strait	22. 0	117. 20
,,	14th	Midn.		22. 40	117. 15
		Noon		23. 25	118. 35
,,	15th	Midn.		24. 40	119. 10
		Noon		25. 50	118. 45
,,	16th	Midn.		27. 10	119. 20
		Noon	China	28. 30	120. 10
,,	17th	Midn.		30. 0	121. 30
		Noon	Eastern Sea	32. 0	124. 0
,,	18th	Midn.		33. 30	127. 40
		Noon	Japanese Sea	37. 30	134. 40
,,	19th	Midn.	Niphon	40. 15	142. 0
,,	20th	Midn.	Pacific	?	?

Place of origin.

The Typhoon appeared on September 14th and 15th, bearing Northward in the Strait of Formosa. On the 10th and 11th, the barometer had been high (29^{in}.71) at Hongkong and Macao; the wind had been blowing NE. (4-6) on the coast and E. (6-5) on Victoria Peak (1823 feet). On the 12th and 13th, the barometer sank and the wind turned to ENE. (3-4) at the sea level, to NE. (4) on the Peak. — At Hoihow, on the northern coast of Hainan (H. M. S. *Magpie*), on the 11th the barometer stood at maximum (29^{in}.87) - wind ENE. (2-1); on the 12th, barometer sinking - wind NE. (1) - since 2 a.m., lower clouds running rapidly from NE. On the 13th morning, low cumuli as before from NE., minimum of barometer in the afternoon (29^{in}.79) - wind very light W. (convergent), turning to SW. in the evening.

From this information it follows that the whirlwind had originated in the North of the China Sea near Pratas Reef in the course of the 12th and 13th of September; it must have set out Northward in the afternoon of the 13th.

Causes of its formation and of its direction.

The height of the barometer at Hongkong and Macao compared with that at Hoihow, as well as the divergent Easterly winds point out the existence of a maximum of pressure to the East of Hongkong on September 11th. Now it must be remembered that at this very time the two whirlwinds which on the 7th and 8th had passed between Amoy and Swatow, owing to the different directions they had taken, overspread all central China with low pressures. On September 9th, Mr. D. Cinatti, Harbour-master at Macao, observed a current from NW. in the upper regions of the atmosphere, which is in accordance with the explanations I have given over and over again with regard to the constitution of atmospheric depressions. That upper current might very well have terminated where on the 11th we find the pressure to be a maximum. In such conditions there might perfectly well be a whirlwind taking rise through the collision of that current from NW., when descending, with the lower

current from SE. or E. or better still with other upper currents, which equally issuing from secondary centres of depression situated in various directions, particularly above the Philippine Archipelago, converged towards that region and contributed to increase the pressure. If so the direction must be towards the continent, and in fact it was the direction it took in the outset. But as we have seen, on the 12th and 13th the principal area of low pressure had moved rapidly towards the East in the wake of the great "Wakayama" Typhoon of September 13th — 15th. Our new Typhoon consequently will not do more than touch the Chinese continent; also running after the depression which makes away to the North-east, it will come to pass near Shanghai and thence bear towards Japan.

The Typhoon on its course.

The wind, which at Cape d'Aguilar near Hongkong (height 170ft.) had been steady from NE. till September 13th, now turned to SW. to keep blowing in that direction till the 18th with the barometer rising. On the top of Victoria Peak the wind shifted from E. to NE. on the 13th, to NW. and WNW. on the 14th, to SSW. and S. from the 15th to the 18th. Thus the Typhoon really began to move on the 13th, and we are going to follow it in the Strait of Formosa which it entered on the 14th about midnight.

Lamock Isl. Light-house

Lat. 23.° 15′ — Long. 117.° 17′ — height 241 feet.

Date	Hours	Barom.	Wind	Weather
		in		
Sept. 12th	Noon.	29.81	NE 1	B. C. M.
	6 P. M.	.79	S 1	id
„ 13th	Midn.	.78	S 1	id
	3 A. M.	.73	SW 1	id
	6	.74	SW 1	id
	9	.78	S 2	id
	Noon.	.79	SE 2	id
	3 P. M.	.73	SE 2	O. M. R.
	6	.74	SE 2	id
	9	.71	SE 2	id
„ 14th	Midn.	.60	SE 3	id
	3 A. M.	.44	NE 5	id
	6	.49	NE 6	id
	9	.65	NE 4	B. C. M.
	Noon.	.68	NNW 3	id
	3 P. M.	.70	NW 1	id
	6	.69	SW 2	id
	9	.79	SW 3	Q. P. L. T.
„ 15th	Midn.	.70	W 2	O. M.
	3 A. M.	.69	W 2	B. C. M.
	6	.71	WSW 2	id
	9	.77	WNW 2	id
	Noon.	.78	WNW 2	id
	3 P. M.	.74	SW 2	id
	6	.74	SW 3	id
	9	.77	SW 3	id
„ 16th	Midn.	.78	W 3	id

Fisher Isl. Light-house

Lat. 23.° 33′ — Long. 119.° 28′ — height 205 feet.

Barom.	Wind	Weather
in		
29.79	calm	B. C.
.73	calm	id
.72	calm	id
.72	ESE 1	id
.72	ESE 1	id
.69	ESE 1	id
.70	S 1	id
.70	S 1	id
.68	S 1	O.
.69	S 1	O. M. D.
.70	calm	id
.66	calm	O. Q. R.
.61	SE 2	id
.60	SE 4	id
.59	SE 4	id
.58	SE 5	id
.57	SSE 5	id
.63	SSE 6	O. M. P.
.62	SSE 5	id
.61	SSW 4	id
.63	SSW 4	id
.70	SSW 4	id
.71	SSW 3	id
.72	SSW 3	B. C. M.
.73	SSW 3	id
.74	SSW 3	id
.75	SSW 3	id

Formed thus near the coast in a confined space, the whirlwind appears here irregular in shape, but it is only its commencement, and the lightness of the wind shows that it does not possess as yet all the energy it will probably bring forth hereafter.—At Lamock the wind turned from SE. to NE. and NW. and lastly to W. and SW., whilst the barometer fell by $0^{in}.40$ since September 12th noon. The Centre seems to have passed to the East of the Light-house, on the 14th, between 4h and 5h a.m.

At Fisher Island the wind turned from SE. to SSE. and SSW.; this smaller range agrees with the slight fall of the barometer ($0^{in}.22$) to set the Centre of the Typhoon a good distance from the Light-house when passing it about 6h p.m.

It must be noted that at both stations the barometric minimum was observed before the normal gyration of the wind, which might have been, at Lamock N. instead of NE., at Fisher Island S. instead of SSE.; also that

for two points situated almost upon the same parallel but on either side of the Strait, the interval between the minimum seems very great, being upwards of 12 hours. And yet at Swatow, only 35 miles west of Lamock, the barometer was higher at 4h a.m. ($29^{in}.77$) than at midnight ($29^{in}.75$); the minimum ($29^{in}.70$) only took place about 3h p.m. Moreover at Swatow the wind, from E. (5) of early morning, had already turned NW. (2) at 9h a.m. to return to E. (1) in the evening.

These facts are not easily accounted for. Here is however an explanation suggested to my mind by the very delay in the gyration of the wind at the two stations together with the delay in the barometric variation at Fisher Island and with the direction we shall soon find for the Typhoon towards Ockseu, somewhat higher up in the Straits. The whirlwind had hardly taken shape when it set out straight towards the North from Pratas Reef towards Swatow (wind SE. at Lamock, S. at Fisher Island). But the atmospheric conditions which had been getting established during the preceding days could not be modified so quickly on the continent as at sea; the pressure kept high and the whirlwind, on arriving near Lamock, that is near the coast, was repelled; thrown back to sea again, it turned sharp round and made for the East: at Lamock, the pressure, disturbed for a moment, soon took its level again. The sharp bend in the course of the Typhoon also caused the wind to shift suddenly from SE. (2-3) to NE. (5-6) as it happened precisely at the moment when the Centre, which first was somewhat to the left and below Lamock, passed to the right of it, bearing Eastward towards Formosa.

This same evolution supplies an explanation of the slow sinking of the barometer at Fisher Island: the Centre must have been already pretty near to it so early as 4h a.m. and continued to get nearer till evening. The whirlwind was indraughted towards the continent and must have tended to reach it in spite of all obstacles. It seemed as if it would give time for the gyration of the air to get transmitted over the main land so as to make its entrance easier. It tacked about towards the Pescadores Group but this soon came to an end on account of the high mountain barrier on Formosa. It had then to veer about again in the evening: leaving Fisher Island Light-house on its right, it rose again to the North, even to NNW: hence the SSE. wind which only turned to SSW. some time after the passage of the Centre before the Light-house. It is evident that it had not come so near to that Light-house as to that at Lamock where the total variation of the barometer was both greater and more rapid.

Taking the observations made in the other Light-houses North of Formosa, let us seek to follow our Typhoon after it had passed Pescadores Islands.

Date	Hours	Ockseu Isl. Latit. 24.° 59′ — Longit. 119.° 28′ height 286 feet. Barom.	Wind	Weather	Turnabout Isl. Latit. 25.° 26′ — Longit. 119.° 59′ height 257 feet. Barom.	Wind	Weather	Middle Dog Isl. Latit. 25.° 58′ — Longit. 120.° 2′ height 257 feet. Barom.	Wind	Weather
		in			in			in		
Sept. 13th	Midn.	92.76	SSW 4	B.	29.75	SSW 3	B. C.	29.74	SSW 3	B. M.
	Noon	.77	SSW 4	B. C. V.	.79	SSW 4	id	.75	S 3	id
	6 P. M.	.74	SSW 4	B. C.	.76	SSW 3	id	.75	S 1	B. C. L. M.
,, 14th	Midn.	.77	SSW 2	C.	.79	variable 3	id	.81	SE 1	B. C. M.
	3 A. M.	.75	SSW 1	C. P.	.79	variable 1	B. C. M.	.78	SE 1	B. C. L. M.
	6	.76	SSW 2	O. M. R.	.78	E 2	O. M. R.	.80	E 1	O. R. M.
	9	.76	ENE 3	id	.78	ENE 3	id	.79	E 4	id
	Noon	.66	NE 6	id	.71	ENE 5	id	.78	E 4	id
	3 P. M.	.50	NE 8	id	.64	ENE 6	id	.74	E 5	id
	6	.47	NE 8	O. G. M. R.	.61	ENE 7	id	.71	ENE 5	id
	9	.45	ENE 8	id	.64	E 7	id	.72	ENE 6	id
,, 15th	Midn.	.40	E 8	id	.69	E 6	O. M. G.	.73	ENE 6	id
	3 A. M.	.42	SE 8	id	.66	SSE 7	O. M. R.	.74	ENE 4	id
	6	.45	SW 7	O. M. R.	.59	SSE 7	id	.68	E 5	id
	9	.58	SW 7		.52	SSE 7	id	.70	E 6	id
	Noon	.66	SW 6	C. M. D.	.60	SSE 7	id	.63	SE 6	O. G. R. M.
	3 P. M.	.67	SW 3	C. M.	.61	SW 6-7	id	.61	SE 7	in
	6	.71	S 3	C.	.69	SW 5	O. M. D.	.63	S 7	id
	9	.74	S 4	id	.72	SSW 5	O. M. R.	.73	S 6	id
,, 16th	Midn.	.74	SSW 4	id	.75	SSW 5	O. M. G.	.76	SSW 5	id
	3 A. M.	.75	SSW 4	id	.75	SSW 4	id	.75	SSW 4	O. R. M.
	6	.75	SSW 4	id	.75	SW 4	id	.78	SW 3	id
	9	.81	SSW 4	B. C.	.84	S 3	B. C. M.	.86	SW 2	B. C. M.
	Noon	.80	SSW 4	id	.85	SSW 3	id	.84	SW 2	id
	3 P. M.	.76	SSW 4	id	.81	SSW 4	id	.83	SW 2	id
	6	.77	SSW 3	id	.80	SSW 4	id	.85	SW 2	id
	9	.83	SSW 3	B. C. L.	.84	SSW 4	id	.84	SW 2	id
,, 17th	Midn.	.84	SSW 3	B. C.	.85	SSW 4	id	.85	SW 3	id

For the three Light-houses, the variation is very regular, from NE. to E.,SE. and SW. As for the strong SSW. winds which yet on the 13th blew before the NE. winds of the whirlwind, they belonged to the Southern portion of the depression which was attracting the Typhoon carried along with the great atmospheric current of which they were a part. At Ockseu, the first Light-house which the Centre could encounter on coming from Pescadores Is., the wind was from E. at the moment of the barometric minimum ($29^{in}.40$) which took place on September 15th midnight.

The variation of the wind from NE. to E.,SE. and SW. at the three Light-houses leaves no doubt as to the course of the Typhoon. After passing before Fisher Island on the 14th 6h p.m., it bore first Northward, then North-westward; it even seemed to be running almost straight Westward when passing some short distance South of Ockseu. But if it really was following the preceding depression, it was not to the West that its route lay, but to the North or even to the North-east where the centre of the depression was then with the Japan Typhoon: and that route it did indeed follow.

For we see the three barometric minima at Ockseu, Turnabout and Middle Dog following in succession at several hours' interval, and that evidently would not have happened, had not the whirlwind been running parallel to the line drawn between those stations. The minimum took place on the 15th at Ockseu ($29^{in}.40$) at midnight; at Turnabout ($29^{in}.52$) between 8h and 9h a.m.; at Middle Dog ($29^{in}.61$) at 3h p.m.

We append some observations made at Amoy and Foochow. Amoy lies between Lamock and Ockseu. Foochow is on the same parallel as the Middle Dog Light-house, but 25 miles farther West and consequently nearer to the track of the Typhoon.

Amoy

Latit. 24.° 48′ — Longit. 118.° 3′

Date	Hours	Barom.	Wind		Rain	Weather
		in				
Sept. 12th	10 A. M.	29.72	W	1		B. C.
	4 P. M.	.65	SE	2		id
,, 13th	10 A. M.	.69	SW	1		id
	4 P. M.	.65	SE	2	in	id
,, 14th	10 A. M.	.67	NNE	1	1.32	O. M. R.
	4 P. M.	.59	N	2		id
,, 15th	10 A. M.	.64	WNW	2	4.52	B. C.
	4 P. M.	.63	W	1		id
,, 16th	10 A. M.	.76	WNW	1	0.02	id

Foochow

Latit. 26.° 8′ — Longit. 119·° 38′

Date	Hours	Barom.	Wind		Rain
		in			
Sept. 12th	9 A. M.	29.786	NE	2	
	3 P. M.	.687	NE	2	
,, 13th	9 A. M.	.769	NW	1	
	3 P. M.	.689	SW	2	Showers
,, 14th	9 A. M.	.802	NE	3	
	3 P. M.	.722	NE	4	in
,, 15th	9 A. M.	.686	NE	5	3.080
	3 P. M.	.589	NW	4	
,, 16th	9 A. M.	.836	NW	1	2.850
	3 P. M.	.770	SW	2	
,, 17th	9 A. M.	.859	SW	2	

These Observations show that the Centre passed between Amoy and Ockseu, but nearer to the latter, and that on the coast the Typhoon was of no consequence as a storm. It was otherwise however at sea along the coast, as it appears from the following extract from the report of Capt. A. Gulland of the SS. *Glencoe,* sailing from Foochow to Hongkong.

SS. **Glencoe,** CAPT. A. GULLAND.

Date	Hours	Bar.	Wind		Course	Renarks
		in				
Sept. 14th	Noon	29.85	NE	8	Foochow river	Moder. gale increasing — thick rain.
	4 A. M.	.75	NE	8-9	S ½ E	*Gale increasing — weather threatening.*
	8	.65	ENE	9	SW ½ S	Strong gale with blinding rain — 7.25 Turnabout abeam 2 ½ miles.
,, 15th	Midn.	.62	SE	10	SSW	10.50 p.m.: Sudden shift to SE., blinding rain — 11 p.m., storm at its
	2 A. M.	.59	SE to S	8	SSW	Wind very unsteady in strength and direction — veering to S. [height.
	4	.65	SW	6-7	SSW	Gale moderating with fierce squalls and heavy rain — 3 a.m. wind SW.
	8	.73	SW	4-5	SW	Wind and sea decreasing fast — clearing overhead.
	Noon	.76	SW	2-3	SW	Moderate wind and fine clear weather.

Position at Noon: Latit. 24.° 18′ — Longit. 118.° 42′

The sudden shift of the wind to the SE. on the 14th, 10h 50^{m} p.m., undoubtedly marks the passage of the Centre some distance South of the steamer; its direction towards the NW. may be inferred from the variable (SE.-S.) wind which accompanied the barometric minimum near Ockseu on the 15th between midnight and 2h a.m.

In the series of observations made at the Ockseu Light-house, it may be noticed that the sinking of the barometer was rather suddenly checked on the 14th 3h p.m. till the moment of the minimum which took place on the 15th midnight, and it was altogether during that interval that the wind was strongest. With the SS. *Glencoe* there happened pretty much the same, as we have seen. Now this took place precisely at the time when the Typhoon, after ruuning towards Pescadores Is., was turning back to enter on the continent of China; the passage seems, as it were, to have cost it a struggle and an increased expense of energy to overcome the obstacle which comparatively high pressures apparently set up before it.

All this can be seen clearly in the observations graciously communicated to me by Comm. M. L. Bridger of H. M. S. *Sheldrake* which also sailed from Foochow to Amoy and found himself almost on the passage of the Typhoon when it was about to alight on the coast between Ockseu and Amoy.

H. M. S. **Sheldrake**, CAPT. M. L. BRIDGE.

Date	Hours	Barom.	Wind	Remarks
		in		
September 14th	8 A. M.	29.89	NE to ENE 2- 3	
	Noon	.85	NE to ENE 3- 5	
	1 P. M.	.79	ENE 4- 6	
	2	.74	ENE 4- 7	Confused sea.
	3	.71	E 4- 7	Haitan Straits — Turnabout.
	4	.70	E 4- 8	
	5	.69	NE 5- 8	
	6	.69	NE 5- 8	
	7	.68	N 5-10	
	8	.69	N by W 6-10	
	9	.70	NW 7-10	
	10	.69	NW 7-10	
	11	.69	NW 7-10	
,,	15th Midn.	.69	NW 7-10	40 miles SW. of Ockseu.
	1 A.M.	.69	NW 7-10	
	2	.70	W by N 7- 9	
	3	.70	WNW 6- 9	
	4	.72	WNW 5- 8	
	5	.72	W 4- 6	
	6	.77	W 3- 5	
	7	.84	WSW 2- 4	

The *Sheldrake*, on the 14th 7h p.m., crossed the track which the Typhoon was just going to follow; the fixity of the barometer till the 15th 2h a.m. and the great irregularity in the strength of the wind well seem to prove that it was not without difficulty that the whirlwind effected its passage.

We have seen that on the coast, at Amoy and Foochow, though so near the track, the force of the wind was but slight; it looks as if the Typhoon wanted to take its revenge at sea and make up for the hindrance it experienced on land. Here is a third document which abundantly proves this, viz. the continuation of the report of the Captain of the SS. *Tientsin*, thanks to which we may, as it were, witness the first doings of the "Wakayama" Typhoon. The steamer came in sight of the Chinese coast about the middle of September 14th. At noon in latit. 28°.17' by longit. 122°.25', she lay at the extreme limit of the two storms, that of Japan whose Centre was exactly 1200 miles away in the North-east, and that which came from the Formosa Strait, the Centre of which was only 320 miles off in the South, near Pescadores Is. For at 1h a.m. with the steamer, the wind turned to NNW. (force 6) already showing a tendency to get under the command of the Southern whirlwind; at 8h a.m. it came to N. (force 4) and the barometer was near reaching a maximum (29in.90), the hour of which must have been about 10h a.m. It is at this date that we take the report again.

S.S. **Tientsin**, CAPT. E. L. M. ROBINSON.

Date	Hours	Position Latit.	Position Longit.	Bar.	Wind		Remarks
				in			
S.pt. 14th	Noon	28°. 17'	122°. 25'	29.88	N	3	Small rain — sky overcast.
	4 P. M.			.87	NE	3	3 p.m. — Heachu Is. (Taichow Group) NNW. 19 miles.
	8			.87	ENE	4	
,,	15th Midn.	27. 15	121. 4	.84	ENE	4	Squally with showers — sky overcast.
	4 A. M.			.77	ESE	4	
	8			.82	ESE	4	Sky clear overhead with dark bank to Southward.
	10			.80	ESE	6	Wind freshened very suddenly accompanied with thick rain.
	Noon	26. 14	120. 13	.—	ESE	9	Heavy southerly sea — thick constant rain.
	2 P. M.			.67	SE	9	2.40 p.m. — Anchored under North of Matsou Isl. for shelter.
	3	26. 7	119. 58	.65	SE by S	10	Sky completely overcast.
	4	anchored		.63	S by E	10	
	5			.63	S by W	10	
	6			.63	SSW	10	
	7			.65	SSW	10	
	8			.70	SSW	10	
	9			.73	SW by S	10	
	10			.76	SW by S	10	10 p.m — Wind blowing its hardest amounting in our estimation to nearly
	11			.78	SW by S	10	a hurricane with thick incessant rain.
,,	16th Midn.			.79	SW by S	9	Midn.—Very heavy squalls of wind and rain.—Scud flying from Southward.
	1 A. M.			.77	SW by S	8	
	2			.77	SW by S	8	
	4			.77	SW by S	7	4 a.m. — Heavy rain — sky moderately clear.
	5	weighed		.78	SW	6	
	7			.82	SSW	6	5.50 — Weighed and proceeded on our voyage.
	10			.89	SSW	5	8.10 — West extreme of Tungsha Isl. East ½ miles.
	Noon			.89	SSW	4	Noon — Fine clear weather.

All the documents published about this Typhoon make out the central depression to have been quite inconsiderable, but it may have made up in extent what was wanting in depth. In fact everywhere the barometer sinks but little in spite of the violence of the storm at sea; everywhere also it sinks and rises again but sluggishly.

The Typhoon leaves the main land and takes to sea again.

Both the Gulph of Hanchufoo and the great estuary of the Yang-tze-kiang seem to offer an easy way of egress to sea for whirlwinds or Typhoons that have strayed on land. The Typhoon which now with so much difficulty seeks to find there an issue to return to sea again, is not the first and will not be the last of the season to bear out this supposition. Even those which succeed in emerging to sea are not without having lost much of their energy over the rough ground of the continent: when they come to pass even close to Shanghai, their action on the barometer is hardly perceptible; the vane shows indeed the existence of a whilwind by the variation of the wind, but the anemometer has nothing to register of the fury which in other conditions makes the approach of a Typhoon so terrible. In this case again, the Typhoon which displayed so little energy at Amoy and at Foochow will show itself still more benign at Shanghai, though here as in the South and all along the coast it ought to come out stronger at sea than on shore.

There was a slight minimum of the barometer registered at Wenchow in the afternoon of September 16th: this was our Typhoon continuing to rise Northward. After reaching the 30th parallel, it entered the Gulph of Hanchufoo near Ningpo, passed between the North Saddle Light-house and Zi-ka-wei, and made off for the ENE.

Zi-ka-wei Observatory

Date	Hours	Barom.	Wind		Therm.	Humid.	Rain	Clouds			
		in		miles	°	%	in				
Sept. 15th	1 A. M.	29.926	ENE	1.6	71.4	88				5	
	4	.899	NE	0.7	72.5	92		Ac	WSW	10	
	7	.926	ENE	3.6	74.5	89		Ac		3	
	10	.951	E	10.3	80.1	72				8	C
	1 P. M.	.902	ENE	11.7	82.2	70		Ac	W	7	C ESE
	4	.892	ENE	9.3	81.0	68		Ac		9	
	7	.911	ENE	8.8	77.2	82				10	
	10	.911	ENE	7.1	77.0	86				10	
,, 16th	1 A. M.	.887	ENE	3.5	75.4	94	in			10	
	4	.856	ENE	1.7	75.7	94	0.028	Ac		10	
	7	.881	NNE	1.1	77.0	95		Ac	S	10	br
	10	.893	SE	2.8	81.0	87	0.020	Ac	S	10	Cn
	1 P. M.	.848	NW	9.3	79.3	87		Ks	S	9	
	4	.833	NE	7.1	80.8	81	0.154	Ks	S	9	Cn NW
	7	.851	NNE	8.5	76.1	92				10	
	10	.909	N	8.7	72.7	93	0.792			10	Ni
,, 17th	1 A. M.	.848	N	10.4	72.0	94				10	Ni
	4	.823	NNW	12.2	71.2	91	1.851			10	Ni NW
	7	.869	WNW	13.4	71.1	93				10	Ni NW
	10	.893	WNW	18.6	75.2	81	0.236			10	Ni NW
	1 P. M.	.872	NW	13.2	75.0	73		K		10	Cn NW
	4	.863	NNW	7.1	77.4	70		Ac	WNW	8	
	7	.912	WNW	1.0	73.0	91		K		8	
	10	.958	NNW	1.2	72.0	92				10	

North Saddle light-house

Latit. 30.° 50′ — Longit. 122.° 41′ — height 273 feet.

Date	Hours	Barom.	Wind		Rain
		in			
September 15th	Midn.	29.93	SE	1	
	3 A. M.	.92	E	2	
	6	.92	E	2	
	9	.97	E	3	
	Noon	.95	E	3	
	3 P. M.	.94	ENE	3	
	6	.93	ENE	3	
	9	.95	E	3	
,,	16th Midn.	.91	ESE	3	
	3 A. M.	.89	SE	3	
	6	.89	SE	3	
	9	.94	SE	3	
	Noon	.91	SSE	3	
	3 P. M.	.89	SSE	3	
	6	.86	SSE	3	
	9	.89	SSE	3	
,,	17th Midn.	.86	S	2	
	3 A. M.	.70	SSW	3	Rain
	6	.63	W	5	
	9	.77	W	6	
	Noon	.80	W	6	
	3 P. M.	.82	NNW	5	
	6	.88	NNW	5	
	9	.96	N by W	4	

In the table of the Zi-ka-wei observations, notice must be taken of the direction of the *alto-cumuli* from South, whilst the lower wind blew from NNE., N. or NW. We thus find here again, even in the case of a rather insignificant whirlwind, the two upper and lower currents, converging below, diverging above, and making up a true circulation of air commanded by the whirlwind or more properly being the whirlwind. In the face of so many patent instances of the fact, if logic and common sense are not to be banished from meteorological studies, there can be no more denying of the existence in whirlwinds of an ascending current at the Centre and of a descending current at the periphery.

Last period: in Japan.

The depression — it cannot be called a *Typhoon* any longer, though still a true whirlwind — left the coast of China on the 17th about midnight. On the 18th, midn., it entered the Straits of Corea, keeping at equal distance from either land. In the Sea of Japan the track described an undulation which took it somewhat farther from Kioto after having got pretty near Hiroshima. On the 13th afternoon, the undulation continuing the track came back to touch the coast of Niphon to the North of Niigata; there it crossed the island in a North-easterly direction, passed close to the Siriyasaki Light-house at the Northern extremity of the island and lastly in the course of the 19th went to skirt along the Kuril Islands in the direction of Kamtchatka.

The wind had no strength to speak of except at a certain height above the level of the sea, as at the Yeboshisima and Tsunosima Light-houses in the Straits of Corea and at the Siriyasaki Light-house.

The following tables will give an idea of the passage of the Typhoon on the coast of Japan: the barometric minima have been determined graphically by means of the usual observations made at the stations.

Meteorological Stations of Japan.

Nagasaki

Lat. 32.°44′ — long. 129.°52′.

Date Hours.	Barom.	Wind		Rain
	in		miles	in
Sept. 17th 9.30 A. M.	29.990	SW	6.7	1.670
3.30 P. M.	.900	S	12.0	
9.30	.943	S	9.2	
,, 18th 9.30 A. M.	.964	SW	5.8	0.040
3.30 P. M.	29.945	W	5.8	
9.30	30.015	SSW	0.5	
,, 19th 9.30 A. M.	.036	N	5.6	0.060
3.03 P. M.	.013	NE	9.7	
9.30	.048	NNE	1.6	
,, 20th 9.30 A. M.	.027	NE	7.2	1.570

Probable lowest reading of the barometer: in 29.880 3 a.m., on the 18th

Hiroshima

Lat. 34.°20′ — long. 132.°27′.

Barom.	Wind		Rain
in		miles	
29.969	NNE	0.4	
.872	WSW	8.0	
.916	SW	5.2	in
.880	SW	15.5	0.001
.858	SW	15.2	
.924	WSW	4.4	
.970	NE	5.7	0.004
29.990	ENE	7.7	
30.009	NNE	4.1	
.036	NNE	5.6	1.260

in 29.840 5 a.m., on the 18th

Kioto

Lat. 35.°1′ — long. 135.°46′.

Barom.	Wind		Rain
in		miles	
30.041	WSW	2.7	
29.958	SSW	7.4	
30.011	NW	1.1	in
29.982	SSW	3.1	0.020
.920	SW	10.0	
.974	SW	3.7	
30.020	W	0.6	0.090
29.959	NW	3.1	
30.012	NNW	2.6	
.050	WNW	0.6	0.710

in 29.920 3.30 p.m., on the 18th

Niigata

Lat. 37.°55′ — long. 139.°3′.

Barom.	Wind		Rain
in		miles	
30.009	SW	3.5	
29.976	NE	5.0	
.996	ENE	1.3	in
.912	SE	9.5	0.300
.819	W	4.9	
29.843	SSW	7.6	
30.009	N	3.4	0.665
29.984	NNE	3.5	
30.072	SW	2.8	
.080	W	0.8	1.135

in 29.780 8 p.m., on the 18th

Yeboshisima light-house

Lat. 33.°41′ — long. 129.°59′ — height 182 feet.

Date Hours.	Barom.	Wind		Rain
	in			in
Sept. 16th 9 A. M.	29.99	S	light	
9 P. M.	.99	S		
,, 17th 9 A. M.	.93	S	light	
9 P. M.	.93	S		
,, 18th 9 A. M.	.89	S	breeze	0.25
9 P. M.	.94	SW		
,, 19th 9 A. M.	.96	NW	light	0.20
9 P. M.	30.02	NE		
,, 20th 9 A. M.	29.99	NE	light	0.30
9 P. M.	.94	E		

Probable lowest reading of the barometer: in 29.84 3 a.m., on the 18th

Siriyasaki light-house

Lat. 41.°26′ — long. 141.°29′ — height 150 feet.

Barom.	Wind		Rain
in			
29.98	NW	breeze	Nil
30.04	NW		
30.06	Calm		
29.94	SE	light	
.90	SE	light	
.70	SE	breeze	
.86	NW	breeze	
29.98	NW		
30.08	W	light	
.08	NW		

in 29.65 2 a.m., on the 19th

Velocity of translation.

The velocity was clearly very variable in the beginning of the Typhoon; also in the Strait of Formosa, on account of the uncertainty of its course. Once in China, on September 16th, its mean velocity can be estimated at $8^3/_4$ miles an hour. On the 17th and 18th, that is all the time of its passage over the Eastern Sea, between Ningpo and the South of Corea, the velocity was about $15^1/_2$ miles; but in the Sea of Japan, it increased very much, reaching an average of $27^1/_2$ miles.

"ASH" TYPHOON

Thirteenth Typhoon: 24th — 28th September 1881.

TRACK :

				Latitude	Longitude
September	24th	Midn.	East of Luzon	16° 0′	124° 0′
		Noon		18. 50	122. 35
,,	25th	Midn.	East of Formosa	21. 50	122. 35
		Noon		25. 30	124. 0
,,	26th	Midn.	Eastern Sea	29. 30	126. 20
		Noon		33. 0	128. 20
,,	27th	Midn.	Japan Sea	39. 0	131. 30
		Noon		44. 30	137. 0
,,	28th	Midn.	Pacific	45. 50	143. 0

EVENTS :

Storm spreading far and wide.

Loss of the English steamer *Ash* and of the British barque *Nouveau Mondelli*.

Lowest reading of the barometer on board the Barque *Siberia* in the Sea of Japan, on the 27th about midnight = 28^{in}.21.

On September 26th 5 a.m. I sent to the *Shanghai Mercury* the following letter:

Sir — For several days the barometer has been descending and the Northerly winds have been persistently blowing; the presence of clouds principally in the East, and their great lines from the South to the North, all indicate clearly enough the existence of a violent Typhoon at sea, although far enough from the coast of China. At this moment it may have reached our parallel and be about to turn a little to the East to rage upon Japan. If meteorological observations were telegraphed from Nagasaki and Yokohama, the course of the tempest would be already easy to determine, and a warning, evidently useful in this circumstance, could almost certainly be forwarded from Shanghai to one or other of these two ports of Japan.

But in the absence of any communication from abroad and in view of the distance of the tempest, I can only make simple conjectures, founded however on the experience of past Typhoons. I am ...

It was a Typhoon, to be sure, and one of the fiercest among those that swept our seas during the last season; it was at that moment passing at the latitude of Shanghai, 260 miles from the coast, and bearing pretty straight towards Nagasaki, since it sought the Straits of Corea to penetrate into the Sea of Japan.

This Typhoon differs from all its predecessors in that its Centre kept away from all land; yet, though its fury was felt far and wide, it was hampered at sea in its development.

Cause of its direction towards the Sea of Japan.

For what reason did it prefer Japan to China? Issued from the maritime region to the East or to the South-East of the Philippines and proceeding first in the direction of China as far as the great Strait that separates Luzon from Formosa, why did it alter its course to rise towards the North and North-east? The first cause was that at that moment the atmospheric pressure was generally higher on central China and on the coasts than at sea and on Japan. From September 16th and during the passage of the small Typhoon which had come from the Strait of Formosa, the barometer had taken to rising rapidly at Hankow (600 miles West of Shanghai) and that had contributed not a little to repel the Typhoon towards the sea. On the 22nd, the pressure was at its maximum for the month (30^{in}.20) with northerly winds blowing steadily from the first days of the month; the mean pressure between the 18th and the 25th amounted to 30^{in}.07. — At Zi-ka-wei the barometer kept at 30^{in}.02 on the average; it had shown a first maximum (30^{in}.13) on the 19th, and a second (30^{in}.12) on the 21st with strong

ENE. and NE. winds belonging both to the monsoon and to the Typhoon coming from the South-east.

The same winds were also blowing at Nagasaki; from the 21st the prevailing winds over Japan were from N. or from NW. At Nagasaki and Hiroshima the barometer was lower than on the coast of China, and much lower than upon Central China. The maximum observed on the 22nd was $30^{in}.058$, but the mean from the 18th to the 25th was only $29^{in}.926$. — *At Hiroshima, maximum on the 22nd, $30^{in}.163$; mean height, $29^{in}.944$.* If notice be taken of the fact that the farther towards the interior of Japan and the eastern coast, the higher the pressure (at Tokei, maximum $30^{in}.276$ on the 22nd; average from the 18th to the 25th $30^{in}.047$), it must be granted that an area of comparatively low pressures extended over the Eastern Sea which separates China from Japan and consequently that this kind of aerial valley or atmospheric depression must have attracted the Typhoon preferably to any other region on either side. Such is the cause which made the Typhoon turn aside when about to enter the Luzon and the Formosa channel, and which kept it at sea, directing it Northward. But the pressure was still higher on the coast of Shantong than at Shanghai, whilst it was comparatively low on the Sea of Japan: in this latter direction was it therefore that it bent its way. We know on the other hand that the preceding whirlwind had been passing there and was perhaps still running off in the North Pacific, drawing its successor in its wake in virtue of that law, namely that a whirlwind which succeeds another one within a few days' interval, will seek to follow it, unless from the great variability of the atmosphere, another more powerful focus of attraction should spring up. And this is so certain, that we see this maritime depression itself on the 23rd and 24th moving in part to the East and making as it were a bond between the preceding Typhoon and that which is coming from the South: it seemed as if running before the high pressures on the periphery of the great whirlwind.

The second and chief cause of the direction taken by the Typhoon was the great atmospheric current which settled all along the Chinese coast on September 19th, as I shall soon explain.

On the periphery of the Cyclone. — Anticyclone.

We have seen that, almost all over China and Japan, the barometer stood highest on the 21st or 22nd of September. That excess of pressure was due to the winter Monsoon, combined with the high pressures both following upon the Typhoon of the 17th-19th and preceding the Typhoon of the 25th-28th. The familiar effects of what has been called *Anticyclone* were therefore generally well marked everywhere, on the coast of China as well as in Japan.

Thus at Zi-ka-wei, for the interval from the 19th to the 25th September, with the barometer standing high, as stated before, the mean temperature was $69^{\circ}.1$ against $74^{\circ}.4$ for the month; the vapour tension: $0^{in}.599$ against $0^{in}.733$.

At Tokei (Japan) the mean temperature from the 20th to the 26th, was only $63^{\circ}.0$, that of the month being $72^{\circ}.8$; the corresponding figures for tension of vapour were $0^{in}.534$ and $0^{in}.677$.

These figures then imply a high atmospheric pressure, with comparatively low temperature and tension of vapour. For it was the cold air from the upper regions, descending at the periphery of the Cyclone or Typhoon at an enormous distance from the Centre, which condensed the vapour held by the lower strata: hence the incessant rains during that period. The full explanation already given of the internal mechanism of these huge whirlwinds, and particularly what has been said on the occasion of the "Wakayama" Typhoon, will dispense me from entering into more particulars with regard to such simple and natural facts.

What was the situation of the Centre at that time, that is about September 22nd, can only be surmised from its probable position on the 24th, when first noticed East of Luzon. On September 22nd, the Centre can be taken to have been in latit. 13° by longit. 131°30′, more than 1 250 miles from Shanghai and 1 400 from the capital of Japan. A good size indeed for a Typhoon! Its violence, as we shall see, answered to its vastness, though the amount of central depression was but moderate.

First notice of the Typhoon.

In the course of September 24th, there were two telegrams sent from Manila to Hongkong: the first, at 1.15 p.m., gave notice of a Typhoon raging to the ENE. of Luzon and bearing Northward; the second, at 6 p.m., was more circumstantial: it reported the Typhoon to be then lying close to the North-eastern coast of Luzon and bearing more to the West.

This second telegram was not such as to allay the fears of the people of Hongkong. When therefore, on the morning of the 25th, the wind which for the last five days had been from NE., veered to N. and took to blowing fresh (at Cape d'Aguilar, force 7), the barometer sinking at the same time, though slowly, they must have supposed the Typhoon to be coming straight upon them. But soon after 12 noon, the wind shifted to WNW. and abated; on the next day 26th it came to N. again and freshened (force 6), but the barometer was already rising and about noon the wind returned to NE. to blow steadily from that quarter till October 12th: it was the regular Monsoon. The Typhoon had then passed by Hongkong on its way Northward; but the Hongkong meteorologists would probably have wondered if informed that, at the moment they most apprehended a visit of the Typhoon, it was lying nearly 500 miles away to the North-east and making for the North. The track indeed, contrary to the information supplied by the second telegram from Manila, instead of bending to the West on the evening of the 24th, left that very direction which it was following and turned straight to Northward.

The Typhoon therefore did not penetrate into the channel which separates Luzon from Formosa, but came to skirt along the Eastern coast of the latter, as shown by the observations made in the Harbour master's office at Tai-wan-foo and Tamsui.

Tai-wan-foo

Latitude 22.° 58′ — Longitude 120.° 13′

Date	Hours	Barom.	Wind		Rain	Remarks
		in				
Sept. 23rd	8 A. M.	29.791	N	fresh		Fresh wind and fine weather throughout the day. Moderate sea on the bar.
	4 P. M.	.672	N			
	8	.693	N			
,, 24th	8 A. M.	.711	N	strong		Strong wind and fine weather all day — smooth water on the bar.
	4 P. M.	.621	N			
	8	—	N		nil	
,, 25th	8 A. M.	.606	N	strong		Strong wind and fine weather — smooth water on the bar.
	4 P. M.	.671	N			
	8	.669	N			
,, 26th	8 A. M.	.665	N	strong		Strong breeze and fine weather — moderate sea on the bar.
	4 P. M.	.826	N			
	8	.676	N			
,, 27th	8 A. M.	.766	calm			Calm up to 8 a.m.

Tamsui

Latit. 55.° 10′ — Longit. 121.° 25′

Date	Hours	Barom.	Wind	Rain	Weather
		in			
Sept. 23rd	7 A. M.	29.857	NE 1	in	C. O.
	1 P. M.	.797	NE 4	0.20	C. O.
	7	.810	NE 6		O. M. Q.
,, 24th	7 A. M.	.775	NE 6		O. M. D. Q.
	1 P. M.	.720	NE 6		C. O.
	7	.725	NNE 7		O. M. D. Q.
,, 25th	7 A. M.	.718	NNE 6		O. M.
	1 P. M.	.718	N 4		O. M.
	7	.761	NNE 3	0.50	O. M.
,, 26th	7 A. M.	.849	NE 2		B. C.
	1 P. M.	.871	NE 4		B. C.
	7	.970	calm		B. C.
,, 27th	7 A. M.	.960	S 1		C. O.

The remarkable persistency of the wind from N. at Tai-wan-foo and from NNE. at Tamsui all the time of the passage, may have been due to the force of the winter Monsoon already steadily blowing on the coast of China at that season. That mighty very high lying current was the principal obstacle which kept the whirlwind at sea: it is likely not to have been very wide to the East of the coast, its limit being to all appearances indicated by the track of the Typhoon which followed it from South to North. This fact is most interesting and we are going to see that it was the cause of other not less noteworthy circumstances.

It will not be without interest yet to adduce other proofs of the existence on the coast of China at this season of the winds belonging to the NE. monsoon and of their strength. — If we take our station at the top of the Light-house on Fisher Island in the Pescadores group, we find that, up to September 20th, the wind was from SE. or unsettled; on the 17th, 18th and 19th, there was almost a perfect calm; lastly on the 20th at 3 p.m. there began to blow a light wind from NW. (force 1); at 9 p.m. it turned to NE. (force 1), and next day finally settled NNE. (force 2-3): it was the winter monsoon which had just made its appearance. Getting strength from the approach of the Typhoon, it rapidly increased in intensity, viz. force 3-4 on the 22nd, 4 on the 23rd, 5 on the 24th; then went decreasing on the 25th (4-2) and still more on the 26th (2), being in opposition with the westerly winds which ought to have been blowing after the passage of the Typhoon, but were not able to take the upper hand; on the 27th the monsoon rose again to force 4 and continued thus to the end of the month, blowing steadily fromg NNE.

At Lamock Island Light-house, it was also on the 19th that the Monsoon set up, but the persistent wind was from ENE; on the 25th the passage of the Typhoon brought light NW. and W. winds which, even on the next day, gave room to regular winds from ENE. (force 4-6).

At Middle Dog Light-house also, same appearances, so that it clearly follows that it was the setting of the NE. Monsoon which preserved China from the fury of this terrible whirlwind. It skirted along that huge polar current on the edge of which, as I have said, the pressure was naturally lower, and was thus directed northward, keeping all the time away from the coast, and finally took to the Sea of Japan.

This arrangement of the atmospheric currents along the coast of China also accounts for the disposition of the higher clouds at Zi-ka-wei at the same time: they lay in long bands from S. to N. and proceeded from SSW. to NNE., showing the existence above the Monsoon of an opposite upper current. But on the morning of the 26th there appeared a bar of low clouds little above the Eastern horizon, which, together with the fall of

the barometer and the great strength of the N. and NW. winds, gave to surmise the presence of a serious perturbation at sea to the East.

We have seen that at all the Light-houses on the coast, the approach of the Typhoon had first added considerably to the force of the settled Monsoon, but that on its moving away the wind in some places had turned somewhat to NW. and even to W., in every case abating almost entirely. The same happened at Zi-ka-wei: after the passage of the Centre at our latitude, te wind abated and came to W. then to SW. without ever freshening, and those westerly winds were perfectly convergent. That long interval of calm, after the barometric minimum of the 26th morning, set me wondering at the time: it now appears quite simple and natural, once aware of the fact, then yet ignored, that the whirlwind had to cope with that huge NE. current so well established all along the coast since the 19th (1).

The enormous influence of this Monsoon of the Chinese coast upon the Typhoon will make itself felt again in another manner, even in the midst of the storm, to which we may now revert.

Along the track.

This influence of the Monsoon and of its distribution along the coast of China becomes palpable on comparing the observations made in the great sea which extends from Formosa to Corea with those made in the Sea of Japan, far from regions protected by that huge atmospheric current. The essential difference between the two sets of observations is as follows.

Whilst the track ran parallel to the Chinese coast, being constantly kept at a distance by the polar winds firmly settled there, the whirlwind was, as it were, pressed against that insuperable barrier, or rather was confined between two impenetrable walls not far apart from each other. Its central region, that of the lowest pressure, was drawn to an excessive length all along the path: it seemed to be encroached upon and almost levelled up by the high pressures the whirlwind had to contend with. If the Typhoon was able to keep its stand and go on its course, it was only through its great store of energy, owing to which we see frightfully strong winds near the Centre, even though the barometer was uncommonly high. In the Sea of Japan, on the contrary, it found free play, the obstacles on its way being comparatively insignificant : the depression therefore became deeper and more regular, the wind still keeping its excessive violence.

---

(1) The importance on the coast of China of that phenomenon of the Monsoon or periodic winds cannot well be realized except with the help of observations made at the top of the Light-houses. The meteorologist is surprised at the variability of the winds on the coast at the sea level, compared with what they are even only at a height of 200ft. where they are almost perfectly steady and always strong. At such an altitude, there is but *one* wind from September to April, viz. *North-easterly* wind, at times rising to hurricane force. During the warmer months on the contrary, from May to September, the prevailing winds are from SW. and they are more frequent and stronger than at the sea level. All this in my opinion, clearly shows how unreasonable it is to deny the existence of Monsoons and to admit nothing but trade-winds. A little practical meteorology is better than all possible arguments which are no grounded on actual facts. (*See my paper on the inclination of the winds and their variation at various heights* — 1881).

Sailing vessel **Faugh Ballaugh**

CAPTAIN D. RÜTE

Bound from Amoy to Newchwang.

Date	Hours	Latit.	Longit.	Barom.	Wind		Remarks
				in			
Sept. 23rd	Noon	27° 27′	123° 45′	29.77	NNE	5	Fine and hazy — high sea from NNE. and E.
	3 P. M.			.73	NNE	7	setting in — Hard squalls and rain.
	4			.73	NNE	8	Wore the ship westward.
	6			.77	NNE	9	
	8			.80	NNE	10	
	10			.81	NNE	10	Dry and cloudy.
,,	24th Midnight			.80	NNE	10	Wore the ship eastward.
	5 A. M.			.75	NNE	10	Clear weather.
	8			.77	NNE	10	
	Noon	27. 28	123. 19	.73	NNE	10	Hard squalls — high sea from N. to E.
	4 P. M.			.64	NNE	10	Wore the ship westward.
	8			.65	NNE	10	
	10			.65	NNE	10	
,,	25th Midnight			.60	NNE	10	
	1 A. M.			.56	N by E	11	
	3			.51	N	11	
	4			.49	N by W	12	Rain.
	5			.49	N by W	12	
	6			.45	N by W	12	
	7			.45	NNW	12	
	8			.45	NNW	12	Barometer unquiet.
	9			.45	NNW	12	Hard squalls and dry — sea from NW. to E.
	10			.45	NNW	12	Barometer unquiet.
	Noon	26. 35	122. 42	.44	NNW	12	Hard squalls and rain.
	3 P. M.			.47	NW	11	
	6			.54	NW	11	id id id
	8			.60	NW by W	10	Moderating.
	9			.65	NW by W	9	
,,	26th 6 A. M.			.82	NW	5	Fine weather.

Steamer **Tientsin**

CAPTAIN: E.M. ROBINSON

Bound from Amoy to Shanghai.

Date	Hours	Latit. Longit.	Bar.	Wind		Remarks
			in			
Sept. 24th	Noon	27° 30′ 120° 53′	29.77	NNE	6	Left Amoy Sept. 22nd 5 p.m. — Experienced strong NE. to NNE.
	4 P. M		.76	NNE	6	winds. Barometer steady from 29in.76 to 29in.75.
	8		.75	NNE	7	Sky clear — heavy NE. sea.
,,	25th Midn.		.74	NNE	7	3.45 p.m., cleared Bullock harbour.
	4 A. M.	Taichow Isles	.70	N	8	Heavy NE. sea and clear weather.
	8		.67	N by W	9	
	10	28. 44 121. 49	.67	N by W	9	
	Noon	anchored	.63	N by W	10	9.30 a.m., anchored in Barren Bay (lat. 28.° 44′ — long. 121.° 49′) for
	2 P. M.		.62	NNW	10	shelter. Clear weather.
	4		.60	NNW	10	Noon, observed aneroid oscillating between 29in.63 and 29in.68—Heavy
	6		.60	NNW	10	gusts at time of hurricane force.
	8		.61	NNW	10	Barometer oscillating slightly.
	10		.61	NW by W	10	
,,	26th Midn.		.62	NW	8	Tremendous gusts of wind at interval — clouds passing from N.
	2 A. M.		.64	NW	7	
	4		.70	NW	6	Heavy gusts still continuing — sky clear.
	5	Weighed	.71	NW	6	
	7	29. 24 122. 18	.75	WNW	6	Cross sea from NE. and W. — sky clear.
	Noon		.81	WNW	6	
	6 P. M.					Light westerly winds—heavy NNE. swell— fine weather to Shanghai.

Barque **Lydia** from Shanghai to Kutchinotzu (Japan).

Date	Hours	Latit. Longit.	Bar.	Wind	Remarks
			in		
Sept. 23rd	Noon		29.98	NE	
,,	24th Midn.			NE strong breeze	
	4 A. M.			NE strong gale	
	Noon	30° 41′ 124° 30′	.87	NE gale increasing	
,,	25th Midn.		falling		Terrific squalls — high sea.
	8 A. M.		.78	NNE	Furious gale with all the appearance of a typhoon raging to the
	Noon		.72	NNE typhoon	Furious typhoon — heavy rain. [southward.
	4 P. M.				Typhoon increasing — a furious squall blew fore lower topsail clear
	4.30		.66	N	[away.
	6			NW	
	10		.58	NW	Typhoon raging furiously—rain, high sea—Mean lower topsail blown
,,	26th Midn.	29. 35 124. 50	.54	NW	Midn. to 3 a.m., typhoon raging with heavy rain. [to pieces.
	Noon	30. 14 126. 30	.60	NNW moderate	Moderating — fine weather.
,,	27th Noon		.92	NNW light	Light and variable winds throughout 24 hours.

It is needless to insist upon the enormous extent of the central region in this Typhoon: very seldom does it happen, in such small and swiftly moving whirlwinds, to see the barometer and the wind steady for ten or twelve hours at a stretch. This length of the central part lay along the direction of the track.

The inconsiderable depth of the depression must also be noticed. There were three ships which got very near the Track, and yet on board that one which came closest to it, the *Faugh Ballaugh*, the barometer did not sink below $29^{in}.44$. This was on September 25th 3 p.m., the ship lying then about 290 miles SSE. of Zi-ka-wei, where the barometer read $29^{in}.846$. The barometric difference in that direction thus did not exceed $0^{in}.41$, an insignificant amount which alone could hardly account for the violence of the wind. At Nagasaki, almost at the same moment, the barometer marked $29^{in}.814$, when the distance to the Centre could be estimated at near 480 miles. Here then there was a not inconsiderable diminution of pressure and also a very low gradient of depression, which must have particularly contributed to carry the whirlwind in that direction.

Zi-ka-wei. — Previous to the passage of the Typhoon on the morning of Sept. 26th, the barometer had been sinking slowly but quite steadily: it stood at maximum ($30^{in}.120$) on the 21st 9 a.m. and fell gradually to $29^{in}.761$ on the 26th, 3 a.m. The following table will give an idea of the regularity of this variation and also of the strength of the Monsoon which continued to blow almost to the time of the passage of the Centre.

Zi-ka-wei Observatory

Date	Hours	Barom.	Therm.	Humid.	Wind		Nebulosity			Rain
		in	°	%		miles				
Sept. 21th	10 A. M.	30.113	71.6	74	NE	13.7		10 Cn	ENE	
	4 P. M.	.064	71.1	79	ENE	13.3		10 Ni	NE	0.098
,, 22th	10 A. M.	.072	73.4	78	ENE	13.2		10 Ni	E	
	4 P. M.	29.997	74.3	80	ENE	15 0		10 Cn	ENE	0.319
,, 23th	10 A. M.	30.005	75.2	67	NE	12.5		6 C	NE	
	4 P. M.	29.943	73.9	66	NNE	13.8	K W	7 C	NE	
,, 24th	10 A. M.	.992	73.6	61	NNE	11.4		6 C	NE	
	4 P. M.	.927	73.9	63	NE	8.6		3 C		
,, 25th	10 A. M.	.931	72.1	68	NNE	12.4	Ac	8 C		
	4 P. M.	.849	72.7	64	NNE	15.2	Ks SSW	9 C	NNE	
,, 26th	3 A. M.	.761	68.0	80	NNW	13.4		3		
	10 ,, ,,	.872	74.3	66	NW	17.0		5 C	NW	
	4 P. M.	.915	77.0	58	NW	12.7		3 C	N	
,, 27th	10 A. M.	30.045	75.7	63	W	4.2	Ac SW	9		
	4 P. M.	29.996	76.3	60	WSW	4.0	Ac SW	9		
,, 28th	10 A. M.	30.059	75.9	66	WNW	2.0	Ac SW	7		
	4 P. M.	29.998	78.6	50	Variable	2.0		3 C		
,, 29th	10 A. M.	30.107	78.8	53	SW	5.0		0		
	4 P. M.	.055	78.4	53	W	6.1		0		
,, 30th	10 A. M	.138	76.5	64	NNE	6.0		3 C		
	4 P. M.	.091	76.1	54	NE	9.4	K WNW	7 C		

The Typhoon on the coast of Japan.

A first instance of the violence of the Typhoon in the vicinity of Japan is that of the British Brig *Menatitlan*. Captain Edwards reports: "On Monday the 26th September, when in latit. 31°17′-longit. 126°40′, encountered a terrific typhoon; cut away both masts, lost our boats, tore up the decks and doing a considerable lot more damage. Ballast shifted, ship thrown on her beam ends".

The Typhoon preserved its violence, but now, once disentangled from the Chinese Monsoon, it took shape and got developed into a true atmospheric whirlwind. The Barque *Presto* will show it to us, as, on the 26th, noon, it passed close to Quelpaert Island, just before entering the Strait of Corea.

— Sailed from Nagasaki on the 24th September for Tientsin, fine weather; on the 25th, thick, dirty, rainy weather, wind east, strong NE. sea running, at 8 a.m. off Cape Gotto, barometer gradually falling, at 6 p.m. heavy gale and sea; brought vessel to the wind; on the 26th, at 10 a.m. heavy typhoon raging and torrents of rain;

barometer 28.90; all sails furled, different seas running, the wind being violent, vessel went over on her beam and leeside of decks completely under water. For the safety of life and property we were compelled to cut away the foremast which took bowsprit and jib-boom of main top-gallant mast along with it; and sprung the mizzen mast. After this the sails blew out the gaskets; wind increased from E. to WNW. Arrived at south end of Quelpaert at eleven; barometer commenced to rise; fine weather, at noon; then calms for three days; rigged jury mast and proceeded; on the 29th, passed what we took to be part of the mast we cut away; foremast 6 feet out of water, end of lower yard 3 feet water out, all painted white, South end of Quelpaert NNE. 35 miles; anchored at Woosung on the 3rd October.

On the western coast of Kiu-siu Island, the barometer did not fall so low on account of the greater distance from the track of the Centre, yet there were violent gusts. On board the Japanese barque *Kanagawa-maru* (capt. Exstrand), the barometric minimum ($29^{in}.42$) was observed on the 26th noon, near Kosiki Islands (latit. $32°.12'$ - longit. $129°.35'$): "at 11 a.m. the mizzen stay and staysail carried away; whilst securing the mizzen mast, the fore topmast staysail blew out of the bold rope; wind increasing in violence all the time. About this time a heavy sea struck the ship forward and washed away the forecastle railing and head board. The ship being now under the fore-lower topsail only, tried to set the main topmast staysail, but it carried away before it could be set. At noon, blowing a typhoon and wind hauling round to the SW., tremendous heavy sea running, ship labouring and straining heavily.

It was the passage of the Typhoon in these parts which caused the total loss of the British steamer *Ash*, as we shall see further on.

Nagasaki—A correspondent to the *Shanghai Courier* writes under date of September 27th: — "Yesterday there was a heavy typhoon here, and 6 coal loaded junks sank at their anchors. Sampans innumerable were sunk or stove in and many lives were lost, steamers and sailing vessels were dragging about the harbour. I went on shore in the morning and could not get on board again, so sudden did it come up on shore. Tiles were flying about indiscriminately, sheet iron roofs were flapping in all direction, buidings were blown in, roofs taken off, fences flying right and left, flag poles falling, and people were pretty much scared. I felt unsafe myself in one house which swayed and rocked as though on earthquake were shaking it up generally." And yet the Centre passed more than 100 miles to the North-west of Nagasaki. The following table gives the meteorological observations made at the Imperial Observatory and published together with those of the other stations in Japan by Mr. Arai, Surveyor-in-chief and director of the Tokei observatory.

Nagasaki

Latit. 32.° 44′ — Longit. 129.° 52′ — height 189 feet.

Date	Hours	Barom.	Wind		Therm.	Humid.	Nebulosity	Rain	Remarks
		in		miles	°	°/₀		in	
Sept. 25th	9.30 A. M.	29.870	NE	4.9	70.3	96	10 Ni	2.005	
	3.30 P. M.	.814	NE	2.7	72.8	98	10 Ni		From 2 to 2.35 p.m., thunderstorm in the W., N., E. and SE.
	9.30	.822	E	5.8	72.1	98	10 Ni		
,, 26th	Midnight	.798	E	4.2	74.0	92	10 St		
	6 A. M.	.625	SE	14.7	78.7	74	10 St		
	7	.583	SE	16.1	79.5	77	10 St		Sea in the harbour very high.
	8	.550	SE	16.9	79.8	72	10 St		
	9	.551	S	20.5	78.0	80	10 St	0.11	
	10	.484	S	35.6	81.1	68	10 St		
	11	.432	SSW	40.2	79.5	75	10 Ni		
	Noon	.377	SSW	39.1	77.8	82	10 Ni		
	0.30 P. M.	.376	SSW	—	76.6	88	10 Ni		Heavy rain.
	1	.385	SSW	36.0	76.6	84	10 Ni		
	2	.435	SW	47.4	74.5	84	10 Ni		
	3	.514	SW	35.4	74.1	86	10 Ni		
	4	.594	SW	28.7	74.3	88	10 St		
	5	.655	W	26 0	75.4	80	10 St		
	6	.704	W	24.2	74.9	76	10 St		
	9	.827	W	21.6	74.0	74	10 St		
,, 27th	Midnight	.912	W	13.1	72.4	72	5 St		
	6 A. M.	.970	NW	3.6	68.7	77	0		
	Noon	.984	NNE	6.8	76.5	57	2 Ac K.		

Nota — A building ½ ken breadth and 1 ken long in the Observatory was blown away to the distance of 48 feet from its base and unroofing the observatory and neighbouring houses.

On the 27th, 8 a.m., 4 masts of pretty large junks, standing out of sea, are seen from the observatory.

Considering the proximity of the Centre and the great force of the wind, it may be taken for granted that at the moment of shortest distance the wind was perpendicular to the radius: hence the direction of the wind (SSW.) was identical with that of the track in the Strait of Corea.

For the Strait we have two valuable documents published by the Tokei observatory, viz. the report of the captain of the Japanese steamer *Chitose Maru* anchored at Itsuhara, Tsushima Islands (latit. 30° 10′ - longit. 129° 20′) in the very middle of the Strait; and that of the Captain of the *Annei Maru* in the Corean harbour of Fusan, on the South-eastern coast of the great Peninsula, in latit. 35° 6′ by longit. 129° 2′.

Steamer Chitose Maru

at Itsuhara, Tsushima Isl. Corean Strait.

Date	Hours	Barom.	Wind
		in	
Sept. 26th	1 A. M.	29.68	NE
	6	.59	ENE
	11	.43	E
	10	.32	ESE
	Noon	28.80	SE
	1 P. M.	.73	SSE
	1.30	.70	—
	2	.59	S
	2.30	.69	—
	3	29.00	SSW
	4	.25	SW
	5	.35	—
	6	.70	WSW
	7	—	W

Annei Maru

at Fusan, Corea.

Date	Hours	Barom.	Wind		Remarks
		in			
Sept. 25th	1 A. M.	29.87	N	3	Clear
	8	—	NNE	3	Cloudy
	Noon	.85	NNE	3	Raining
	4	—	NNE	7	id
,, 26th	Midn.	—	NNE	6	id
	1 A. M.	.80	NNE	5	id
	8	.70	NNE	6	
	Noon	.66	NNE	7	Heavy rain
	1 P. M.	.42	NE	8	id
	3	.10	E	9	id
	4	28.92	E	11	id
	5	.60	NW	12	id
	6	—	W	12	
	7	29.25	W	10	Light rain
	9	.55	W	8	
,, 27th	Midn.	.70	W	6	Clear

The Centre therefore passed between Tsushima Islands and Corea, but nearer to the island than to the continent. We may also remark that its velocity of translation had decreased considerably in the Strait: after being of about 35 miles from noon to 2 p.m., it fell to 18 or 19 miles an hour between 2 and 5 p.m. The check

to the speed was due to the narrowness of the passage and to the difficulty to pass over the two Tsushima islands, the mountains of which rise as high as 2 100 feet; hence also the deformation of the central region near Itsuhara.

The Typhoon in the Sea of Japan.

The observations made in the interior of Niphon and at the Light-houses on the coast show the Typhoon, like the preceding one, to have kept as much as possible away from land in the middle of the inner sea. Herewith are the most interesting observations made at the various stations:

Stations	Latit.	Longit.	Passage of the Centre: Date	hours	barom.	wind	Greatest force of the wind	miles	h		Rain
					in	miles		miles			in
Nagasaki	(32° 44′ —	129° 52′)	26th	0.30 p.m.	29.376	SSW	38.5	SW	47.4	2 p.m. 26th	0.110
Hiroshima	(34. 20 —	132. 27)		6.0 p.m.	29.522	S	27.8	SW	38.8	8 p.m. 26th	2.335
Wakayama	(34. 14 —	135. 9)		9.30 p.m.	29.777	S	31 0	SW	33.3	Midn. 27th	0.550
Kioto	(35. 1 —	135. 46)		9.14 p.m.	29.794	S	3 7	SE	13.4	6 p.m. 26th	0.389
Tokei	(35. 40 —	139. 45)	27th	5.0 a.m.	29.867	S	12.5	S	22.1	9 a.m. 27th	0.933
Niigata	(37. 55 —	139. 3)		6.0 a.m.	29.700	SE	8.1	W	23 6	9 a m. 27th	0.040
Nobiru	(38. 23 —	141. 12)		7.0 a.m.	29.793	S	36.0	S	39.6	6 a.m. 27th	0.010
Hakodate	(41. 46 —	140. 44)		9.0 a.m.	29.588	ESE	20.0	SW	40.0	Noon 27th	—

From these data, the Typhoon would seem to have moved in the Sea of Japan with a pretty steady velocity of $36^1/_2$ miles an hour on the average. From the observations at Hakodate given below, it is evident that in the course of the afternoon and evening of the 27th it got into the North Pacific through the Strait that separates Yesso from Saghalien: the contraction and cramping it was subjected to as it rose towards the Gulph of Tartary must inevitably made it swerve to the right towards the Ocean, and the Strait North of Yesso was just at hand to supply a means of egress without scaling over either of the mountainous islands; but its speed, as was natural, slackened considerably.

Let us retrace our steps for a moment and get nearer to the track in the middle of the Sea of Japan. We shall find two ships struggling with the storm, from which we can learn the situation of the Centre on the 27th midnight and obtain some useful information with regard to the violence of the Typhoon in that quarter.

The German barque *Siberien*, Captain Schultz, of 367 tons, belonging to Schleswig, was in ballast on a voyage from Wladivostok to Chefoo, and had only been three days at sea, when on the night of the 26th Sept. and morning of the 27th in latit. 39° N., long. 130° E., she passed through a typhoon of extraordinary violence, in which the barometer went down to $28^{in}.21$ (?) at 1 a.m. on the 27th. The storm commenced with the wind from NE., which shifted round to N., NW., and WSW., and blew with such terrible force that the *Siberien* was soon lying on her beam ends. At 1.30 a.m. had to cut away the main-mast, which in going over the side carried away the top of the mizen-mast and brought on deck the fore top-gallant mast, the royal yard and everything belonging to it. All the copper on the ship got chafed and everything on deck disappeared.

I am indebted to the kindness of Captain Davies of the steamer *Europe* for a circumstantial account of his voyage from Nagasaki to Wladivostock, during which he was caught in the Typhoon not far from where the barque *Siberien* also was grappling with the same storm.

S.S. *Europe*, from Nagasaki to Wladivostok—"Saturday 24th September, at 5.30 a.m., weighed anchor and proceeded; had light NE. wind and fine pleasant weather till 6 p.m., vessel then off North end of Iki Island; wind then freshened to a strong NNE. breeze and high sea running from NE. and NNE., which continued till midnight — Barometer steady at $29^{in}.90$.

"—Sunday 25th—Strong breeze and high sea running—1.30 a.m., moderating; steady breeze at NE.—

4 a.m., came on heavy squalls with rain at intervals—Noon till midnight, moderate NE. wind and dull overcast weather — Barometer 29in.90.

"Monday 26th—Morning, moderate NE. wind and cloudy—1.30 a.m., Dagelet Isl. bore E. 6 miles distance—4 a.m. set in squally from the NNE. and threatening appearance from E. and ESE. —Barometer steady at 29in.90 — 8 a.m. wind increasing with blinding rain squalls — Noon, blowing a hard gale from NE. with torrents of rain and sea rising fast: barometer falling.

Date	Hours	Barom.	Wind		Course	Remarks
		in				
Sept. 26th	Noon	29.90	NE	hard gale	NNE	lat. 38.° 48′ — long. 130.° 51′
	1 P. M.	.90	NNE			
	2	.85	ENE	hurricane	NE	
	3	.78	E by E			Wind suddenly shifted.
	4	.64	ENE		ENE	Torrents of rain — high sea.
	6	.50	ENE			Vessel shipping heavy bodies of water fore
	8	.41	E by E			and aft.
	9	.38	E by E			Ship unmanageable.
	10	.25	NE			
	11	.14	NE			
,,	27th Midn.	.04	NNE	furious		
	1 A. M.	28.90	NNE			Gale still raging with unabated fury—vessel
	2	.80	N	terrific	NE	under balanced reefed main trysail, unable to
	3	.76	NNW	squalls		keep head on to sea, labouring heavily.
	4	.94	NW		NNE	From 2 to 3 a.m., the heaviest squalls which
	5	.97	WNW		N	were something terrific in force—vessel com-
	6	29.16	W		NNW	pletely helpless.
	7	.34	W			4 a.m. Wind began to lull veering NWward
	8	.35	W by N	moderate	NNE	—high confused sea running, vessel labouring
	9	.39	W by N			and straining heavily.

8 a.m., sea a little more smooth and regular, set single trysails and kept on our course carried westerly winds and fine weather to Port.

Return of the Typhoon into the Pacific.

Hakodate. — The Typhoon has been stated to have issued from the Sea of Japan through the Strait that separates Yesso from Saghalien. This comes out clearly from the observations made at Hakodate.

Hakodate

Latit. 41.° 46′ — Longit. 140.° 44′

Date	Hours	Barom.	Therm.	Wind	
		In	°		miles
September 26th	Noon.	30.106	68.0	E	10.0
	3 P. M.	.056	68.0	ENE	10.0
	6	.045	65.0	ENE	7.0
	9	.031	65.0	ENE	6.0
,,	27th Midn.	29.891	66.0	ENE	15.0
	2 A. M.	.861	66.0	ENE	10.0
	4	.795	68.0	E	15.0
	6	.721	68.8	ESE	30.0
	7	.708	69.5	ESE	35.0
	8	.634	69.5	ESE	30.0
	9	.588	70.0	ESE	20.0
	10	.677	70.0	ESE	20.0
	11	.656	72.5	SW	20.0
	Noon.	.662	73.0	SW	40.0
	1 P. M.	.653	71.5	SW	30.0
	2	.647	69.5	W	30.0
	3	.665	69.0	W	15.0
	4	.681	67.8	W	27.0
	5	.691	67.0	W	25.0
	6	.685	67.0	W	23.0
	8	.681	66.5	W	30.0
	10	.740	64.5	W	20.0
,,	28th Midn.	.744	64.0	W	25.0
	3 A. M.	.829	63.5	W	23.0
	6	.882	62.0	W	15.0
	9	.947	64.0	WNW	5.0

The convergence of the ENE., E. and ESE. winds before the passage of the Centre is manifest. The Barometer had fallen pretty rapidly up to the 27th 9 a.m., but from that moment the pressure kept low till evening, with the wind blowing strong from W. Thence may be inferred that the Typhoon remained for same time to the North of Hakodate close to Yesso. On the 28th, about 9 a.m., whilst at Hakodate there was a light wind from

WNW. with the barometer high; some little distance off, at Siriyasaki light-house, on the North-easternmost point of Niphon, there blew a gale from NW., a sure sign of the Centre of the Typhoon being to the North-east of Yesso, after extricating itself from the Gulph of Tartary.

Casualties at sea.

This Typhoon of the 26th September will be sadly remembered as the one in which the British steamer *Ash* went down with all hands, — a day's voyage out from Nagasaki. The *Ash* was a British steamer of 919 tons, commanded by Captain Lucock, and running under charter in the coal trade between Nagasaki and Shanghai. There were 24 foreigners in the crew and several Chinese; and two well-known Shanghai river pilots were on board, Mr. C. M'Donald and Mr. J. H. Wills, the former as pilot, the latter as passenger. Some lights were seen on the island of Kuro on the 29th Sept. by Captain Stout of the *Waverley,* but he did not pay any attention to them. The Russian gunboat *Sobol* left Nagasaki and searched the Goto islands, but found no trace of the *Ash.* Ship's boats were twice seen by vessels on voyages between Shanghai and Japan, but strangely none of them ever sought to pick up a boat, even to set at rest the doubts as to the fate of the missing steamer. A British gunboat, the *Foxhound,* lay in Shanghai harbour all the time, but no action was taken either by the agents of the *Ash* or the British Consul, to institute a search; — the search by the Russian gunboat *Sobol* was done at the request of the U. S. Consul-General at Shanghai, acting on behalf of Mrs. Wills. Thus the *Ash* was lost, was talked of for a week or two, and forgotten, — all but by those whose relatives went down with her.

The British barque *Nouveau Mondelli,* Captain Stegeman, is supposed to have been lost in the same Typhoon. She left Keelung (Formosa) about a week before that storm and was never heard of since. She had a crew of nine. *(North-China Daily News).*

Fourteenth Typhoon: 29th September — 10th October 1881.

TRACK :

				Latitude	Longitude			
September	29th	Midn.	East of Luzon	14° 30′	125° 30′			
		Noon		14. 30	123. 45			
,,	30th	Midn.		14. 30	122. 30			
		Noon	Luzon	14. 30	121. 30			
October	1st	Midn.		14. 10	120. 15			
		Noon	China Sea	14. 15	118. 30			
,,	2nd	Midn.		14° 20′	116° 40′		14° 20′	116° 40′
		Noon	China Sea	14. 40	114. 25	China Sea	14. 20	114. 45
,,	3rd	Midn.		15. 15	112. 15		14. 35	112. 50
		Noon		16. 0	110. 50		15. 20	111. 10
,,	4th	Midn.		17. 0	109. 15		16. 0	109. 30
		Noon	Gulph of Tongking	18. 30	108. 15		17. 0	108. 10
,,	5th	Midn.		20. 30	107. 30	Gulph of Tongking	18. 0	107. 0
		Noon		22. 30	108. 30		19. 40	106. 0
,,	6th	Midn.		24. 20	111. 0		24. 10	104. 50
		Noon	China	26. 0	113. 50		26. 40	106. 0
,,	7th	Midn.		29. 0	116. 0		29. 0	106. 30
		Noon		32. 0	117. 0		31. 15	108. 0
,,	8th	Midn.	Yellow Sea	34. 0	119. 30	China	32. 45	109. 0
		Noon		36. 20	125. 30		35. 30	110. 0
,,	9th	Midn.	Japan Sea	37. 0	132. 30		37. 30	112. 0
		Noon		39. 30	138. 0		38. 45	114. 30
,,	10th	Midn.	Niphon :	37. 30	143. 0		40. 0	117. 30
		Noon	Pacific	?	?		39. 0	121. 15
,,	11th	Midn.		?	?	Yellow Sea	38. 0	124. 0
		Noon					37. 0	126. 0
,,	12th	Midn.					36. 0	127. 30
		Noon				Co ea :	34. 0	130. 30
,,	13th	Midn.				Japan :	32. 30	133. 0
		Noon				Pacific.	?	?

EVENTS :

Wreck and loss on the Steamer *Quinta* on the coast of Hainan on the 4th of October.
Immense disasters in Tongking.

Here have we again one of those Typhoons whose occurrence is so frightful a calamity for the populations of the countries they overrun. Even the ravages of the "Kiang-si" Typhoon are slight in comparison with the destruction and countless ruins caused by this Typhoon all through a kingdom in a single day, the imperishable memory of which I recall in naming it the "Tongking" Typhoon.

First notice of the Typhoon, — its long track.

It was Manila again that first gave notice of this Typhoon. On September 30th, 7h 35^{m} a.m., a telegram was addressed to the Governor of Hongkong announcing a Typhoon in the East, approaching Luzon. On the next day, October 1st, 11h 25^{m} a.m., another telegram stating that the Centre had just passed South of Manila bearing westward: *violence but middling.*

The direction stated was indeed that which it followed for a long time yet in the China Sea; it afterwards bent more and more to the North-west; on October 4th got into the Gulph of Tongking; on the 5th went over Haiphong and the Kingdom of Tongking, spreading havoc on its passage. It then rapidly followed the curve on which it had started: on the 6th rose Northward; on the 7th turned to North-east; on the 8th came to sea again somewhere above Shanghai; on the 9th crossed Japan from West to East, to be lost sight of in the Pacific like so many others.

On Luzon.

Failing meteorological observations from Manila or any other point of the Philippines, I shall confine myself to giving an extract from the Manila *El Comercio* as translated by the *Hongkong Telegraph*.

"The steamship *Mendez Nunez*, which arrived at Manila on the 4th October from Batangas (45 miles south of Manila), brought intelligence of a terrible storm which had visited that province. The wind blew with typhoon force, driving from the NW. and veering round by W. to SW., and a tremendous fall of rain added considerably to the damage occasioned by the storm. In Calumpan, a village to the north of Batangas, the substantially built premises of Mr. Manuel Javier Martinez were carried away from their foundations by the inundating flood, with the whole of the inmates, eleven in number. The bodies of five of these unfortunates were recovered on the beach at San Luis, a rather surprising circumstance when it is remembered that they must have been carried some 24 miles, and further must have doubled Cazador Point. In Calatagan a pilot boat with the personal effects of the alcade of that province came to grief, and at San Luis a schooner laded with sugar foundered. The steamship *Oriana* was compelled to seek shelter at Balayan."

This information, coupled with the short indications contained in the telegrams, shows that the Typhoon, after coming from the East of Luzon, crossed this island in the evening of September 30th or in the morning of October 1st; the Centre having passed to the South of Manila (according to telegram) and to the North of Batangas (according to report of *Mendez Nunez*), was probably, on October 1st midn., in latit. 14°0′, and entered the China Sea by 121° longit. The Typhoon also appears to have been much more violent in the southern half-circle with westerly Winds than in the northern half-circle with Easterly winds.

China Sea.

It must have been during the first hours of October 1st that the Centre of the Typhoon got into the China Sea, for on that day, at a short distance from the coast of Luzon, we find the British ship *Earnock* with strong NW. wind at noon and SW. winds at 9 p.m. It is true that the positions of the ship were not given with any great precision, as may be seen from the following extract from the report of Capt. G. F. Parson. The ship *Earnock*, of 1198 tons, had sailed from Glasgow on June 11th, bound for Shanghai by the way of the cape of Good Hope. She arrived at destination on October 24th.

— "... Passed through Gaspar Straits (latit 3° S. — longit. 107° E.) on September 20th; came up the eastern side of the sea (China Sea), just skirting the shoals, and when north of them steering for the Luzon coast about Manila.—1st October, at noon, wind unsteady, W. to NW., a northerly sea and slightly falling glass; became aware we were approaching a typhoon bearing somewhere NE. of us. Shortened sail to allow it time to pass ahead. At 6 a.m. found we were approaching it too rapidly; kept ship more away to the Eastward, but at 9 p.m. the barometer falling rapidly and weather getting much worse, put the ship's head to the Southward under lower topsails. Wind being then SW. and blowing a heavy gale till 4 a.m. on the 2nd.—Made the South end of Formosa on the 7th."

S.S. Fleurs Castle. — On October 2nd, at 5h 30m p.m., the SS. *Fleurs Castle* bound for Shanghai, crossed the very Centre of the Typhoon in latit. 15° by about 113°30′ longit., which observation gives the means of accurately laying out the track from Luzon to this point. Here is the interesting relation addressed to me by Capt. J. B. Thomson.

Steamer **Fleurs Castle**

October 2nd Noon — course N 26° E — barom. 29in50 — wind NW. — lat. 14.° 28′ — long. 112.° 24′ — Strong increasing breeze with violent squall and heavy rain — sky black and threatening, heavy swell from N. — barom. falling rapidly.
1.30 P. M. — Slowed engines : barom. 29in25 — wind increasing — sky black and lowering.
2.40 — Barom. 29in10 — wind blowing with hurricane force and veering to W.
3.30 — Barom. 28in30 — wind NW. blowing with terrific force — Ship heading about NNE.—engines going slow. — There was now very little sea as there was no heavy body of water on deck, the wind apparently cutting the tops of the waves off and causing a blinding scud which broke right over us.
4.30 — Barom. 28in35.
5 — Barom. 28in30, lowest reading.
5.30 — The weather suddenly brightened, the wind falling almost to a *Calm*.
6 — Barom. 28in30. *A large number of birds lighted on the ship almost covering her and remained until 7p.m.*
6.30 — id 28in50.
7 — id 28in30. The wind suddenly burst upon us again with renewed fury from SW.
8 — id 28in90.
9 — id 29in00.
10 — id 29in10.
11 — id 29in20. Ship laying to heading SSE.
October 3rd 3 A. M. — id 29in30. Bore up and ran before the gale — Barometer rising rapidly and wind moderating.
Noon — id 29in40 — Wind SW. 8-7 — latit. 15°. 54′ — longit. 114°. 16′ — Dark squally weather with heavy confused sea which continued until our arrival at Hongkong.

This report is most interesting : the whirlwind is perfectly well defined with its NW. wind turning to W. and afterwards to SW. after the passage through the central region. The ship did not sail along a diameter of the whirlwind, but owing to her movement combined with that of the whirlwind, she described a curve whose convexity looked towards the Centre, its apex being on the very Centre. The duration of the calm was nearly an hour and a quarter, the velocity of the Typhoon about $10^1/_2$ miles an hour, whence may be inferred a length of 10 or 12 miles for the diameter of the central region, which enjoyed a clear sky with sunshine and was enlivened with the presence of myriads of birds which, caught in the storm, had sought a refuge there.

Notice must be taken of the depth of the central depression indicated by the reading of the barometer $= 28^{in}.30$. The ship may then have been in latit. 15° by longit. 113°. At the same hour on board H. M. S. *Magpie* in the bay of Hoihow (Hainan), the barometer maked $29^{in}.78$: the total depression was then $= 1^{in}.48$ for a distance of 345 miles. On board the *Fleurs Castle*, from noon to 6 p.m., the barometer fell $1^{in}.20$, equal to the enormous amount of $0^{in}.20$ per hour. It must however be kept in mind that the steamer was going towards the Centre, though surely at a greatly reduced speed in the midst of that storm of North-westerly wind.

Steamer Quinta. — On finishing the description of this Typhoon, I shall give a short account of the sad event through which this steamer was destroyed after being wrecked on the South-west coast of Hainan. For the present I shall only take out of the Captain's report what can be of any use to follow the progress of the Centre.

October 2nd — 8.30 A. M. — left Hongkong. Passed Sharp Islands at 11.30. The wind was then from the E., the sky clear and the breeze fresh with a big sea : steering S 35° W. true.
Noon — bar. 30.10
4 P. M. — 30.05
8 — 29.98 : weather threatening and sea increasing.
3rd — Midn. — .90 : there were all appearances of a typhoon passing over the vessel.
4 A. M. — .88 : very heavy squalls with rain and the wind was round to the N.
Noon — — : latitude 19.° 3′ — longitude 110.° 55′ by observation : current to the West of 50 miles in the 25 hours. Wind and sea rising.
4 P. M. — .56 : at 2h. p.m., sighted Tinhosa Isl. and knowing very well that we could not keep the vessel against the big sea and the strong breeze and the furious current, thought of steaming to seek the shelter of Tinhosa.
4.30 — — : anchored at Tinhosa with 45 fathoms of chain — latit. 18.° 40′ — longit. 110.° 28′.
8 — .44
9 — — : wind blows very hard in most violent gusts with heavy rain — Tinhosa bearing E., 3 miles distant.
4th — Midn. — .44 :
4 A. M. — .46 : weather clearing up a little.
9 P. M. — .56 : till midnight the wind blowing hard in the same direction.

Though the indications of the direction of the winds, in the foregoing report, be wanting in precision, those of the barometer are suficient to prove that the steamer was anchored at a good distance to the North of the

track, as we shall see besides from other observations made at Hainan. The track therefore entered the Gulph of Tongking on October 4th, midnight.

The track, so early as the 3rd, had begun to bend to the north as if to avoid the continent, viz. Cochinchina, towards which it was directed ever since leaving Luzon : it then got into the Gulph of Tongking, inclining Northward more and more. The marked curve it described round Hainan and the Lien-chow peninsula had therefore the effect to keep the barometer low and to increase the duration of the storm raging to the North of the Gulph. Thus with the chinese steamer *Tong-ting* which already on September 30th noon, had taken shelter off Baksha (South part of Lien-chow), the NE. wind had, on the 3rd noon, force 9; on the 4th midn., force 10, which kept on with E. wind at 6 p.m. and with SE. wind on the 5th from midnight to 6 a.m., and on (force 6) to the 6th 4 p.m. The barometer, low since the 4th midn., only began rising on the 5th 6 a.m. Its minimum, 29^{in}.65, took place on the 4th about 6 p.m., with the wind E. 8-10.

Some more detailed information can be gathered from the excellent series of observations made on board H.M.S. *Magpie* by lieutenants Carpenter and Belam, from which I have already borrowed largely.

H. M. S. **Magpie**

Hoihow bay (Hainan Island)

'Latit. 20.° 3' — Longit. 110.° 20'

Date	Hours	Barom.	Wind	Therm.	Clouds Upp. Low.	Weather	Remarks
		in		h °			
Sept. 29th	4 A. M.	29.898	SE 1	4 80.4	0	B. *M.*	
	10	.956	ENE 2	12 83.5	1 C	B. M.	
	4 P. M.	.859	NE 2-3	4 84.1	K SE 3 Cs	B. C. M.	4.20 p.m. — Clouds rapidly from NE. A very red and fiery
	10	.898	NE 4-5	12 80.3	10 Cs	O. M. P. Q.	Several passing showers in the squalls. [sunset.
" 30th	4 A. M.	.843	NE 3-4	4 82.0	4 Cs	B. C. M. Q.	2 a.m. — A squall force 5 with heavy rain for 25 min.
	10	.902	E 3-5	12 77.8	10 C	O. P. Q.	4.10 — Clouds rapidly from NE.
	4 P. M.	.849	NE by E 3-4	4 81.8	10 Cs	O. M. Q.	A large halo round the moon—Cumuli rapidly from ENE.
	10	.906	ENE 3-4	12 81.0	2 C	B. C. M.	
Octob. 1st	4 A. M.	.816	ENE 3-4	4 81.0	1 C	B. M. Q.	4 a.m. — Cumuli in patches from ENE. [the breaks.
	10	.896	ENE 3-4	12 83.0	9 C	C. M. Q.	10.30 — Cumuli rapidly from ENE.—Ac. visible through
	4 P. M.	.814	NE 3-4	4 82.6	9 Cs	C. M. Q.	Clouds clearing away at intervals for few minutes.
	10	.857	ENE 4-5	12 81.1	10 St	O. M. Q.	
" 2nd	4 A. M.	.794	NE by E 4-6	4 81.0	10 St	O. M. Q.	[ship.
	10	.850	NE by E 3-4	12 83.5	5 C	B. C. M. Q.	5.20 p.m. — A heavy rain squall passed to Southward of
	4 P. M.	.753	NE by E 3-5	4 82.5	6 C	B. C. M. Q.	8 — A low light scud drifting rapidly with the wind.
	10	.811	NE by E 3-5	12 81.3	10 St	O. M. Q.	
" 3rd	4 A. M.	.734	NE 5-6	4 81.5	10 St	O. M. Q.	
	10	.766	NE 6-8	12 82.2	Ac E 6 Cs	C. B. M. Q.	5.30 p.m. — Clouds broke a little showing Ks and Ac
	4 P. M.	.675	NE 7-8	4 79.0	10 St	O. M. P. Q.	10 — heavy rain squalls. [from E.
	10	.740	NE 6-8	12 78.0	10 St	O. M. Q. L.	
" 4th	4 A. M.	.619	NE 5-7	4 79.9	10 St	O. M. P. Q.	
	10	.664	ENE 6-8	12 80.3	10 St	O. M. *R.* Q.	2 p.m. — Rain ceased a little.
	4 P. M.	.549	ENE 7-8	4 78.5	10 St	O. M. *R.* Q.	
	10	.627	E by S 6-8	12 78.5	10 St	O. M. *R.* Q.	
" 5th	4 A. M.	.557	E by S 8-9	4 78.0	10 Ni	O. R. Q.	
	10	.663	SE by S 8-9	12 80.0	10 St	O. M. Q. P.	7 a.m. — A low scud drifting rapidly in the wind,
	4 P. M.	.648	SE by S 4-5	4 81.0	9 St	O. M. Q. P.	
	10	.772	SE by S 4-5	12 80.8	Ac S 9 St	C M. Q.	
" 6th	4 A. M.	.794	SE 2-3	4 79.2	10 St	C. M. Q.	4.15 a.m. — A few flashes of lightning to WSW.
	10	.867	SE 2-3	12 83.2	9 Cs E	C. M. Q.	
	4 P. M.	.791	SE 1-2	4 83.0	8 Cs E	C. B. M.	Clouds moving slowly from NE
	10	.885	SE 1	12 79.6	7 Cs	C. B. M.	

In the Straits of Hainan, according to the observations of the *Magpie,* the winds from NE. or from E. seem to have settled as prevailing winds about September 19th at the same time as on the eastern coast of China; but they were far from having the same regularity as at the altitude of the Formosa Strait light-houses as I already remarked when treating of the "Ash Typhoon." We therefore see the wind, on the approach of the Typhoon coming from Luzon over the China Sea, to vary slowly from E. to ENE. and to NE., to come to E. again on the passage of the Centre, and lastly to turn to SE. being there perfectly convergent to the centre which was then crossing over central China.

This variation of the winds on the approach of the Centre of the whirlwind we have already seen over and over again in other Typhoons, but more particularly in the "Shanghai" Typhoon of July 15th and 16th : the wind to a great distance on the route about to be followed by the Centre, then rising northward, was S. and gradually, under the action of the whirlwind, turned to SE. and to E; then according to the side observed, either again to SE., S. and SW., or to NE., N. and NW. It would then appear frequently to happen that in the fore part of a whirlwind the currents are quite divergent, whilst at the back they are generally found to be almost perfectly convergent, as we found it to be the case with the "Shanghai" and with the present Typhoon. This difference in the winds, being divergent before and convergent back of the Centre is solely owing to the fact that the whirlwind moves within a strong well settled atmospheric current and along with it. There will be no difficulty to apply this theory to the present case when the winds blowing steadily on the Southern coast of China are not from S. as in the former case, but from E. and NE., being the winter monsoon.

These facts also supply an explanation of the slow sinking of the barometer and of the consequent long duration of that period before the passage of the Centre, and also inversely of its rapidity in rising again to its original height after reaching the minimum. The whirlwind, as it proceeded along with the general current blowing in those parts, met, as it were, no obstacle ahead, and the E. and NE. winds it raised on its passage mixed with the prevailing winds of like direction; in the hinder half on the contrary the winds of the main current came into collision with the NW., W. and SW. winds of the whirlwind : hence a diminished violence of the resulting wind and a condensation or compression of the air involving an increase of pressure.

The Typhoon enters Tongking.

—Tongking, whose eastern coast is all washed by the great Gulph of the same name, is comprised between Cochinchina to the South, Yun-nan to the North-west and Kwang-si to the North-East; it extends between the parallels of 20°.0′ and 22°.30′, and the meridians of 103° and 106°. Its capital is now Bacht-Ninh to the north of the Song-ka river, 51 miles from the sea. On the Song-ka, about the same distance from its mouth, is the former capital Ha-noi or Keicho, having its harbour at Haiphong. This port was open to foreign trade in September 1875; it has two principal forts which are held by the French. The mouths of the several branches of the Song-ka form a great delta between the parallels of 20°.0′ and 20°.50′; they communicate with each other partly by natural means, and partly by canals constructed by the inhabitants.

The Typhoon must have reached Tongking in the evening of October 5th about the 20th parallel and must have traversed it in the middle, passing near both the old and the new capitals. At all events, it left Haiphong on its right, as clearly proved by the observations of the captain of the Chinese steamer *Kang-chi* then lying inside of the bar at Haiphong, which a few days later was to go to the rescue of the crew of the *Quinta* wrecked on the coast of Hainan.

Chinese Steamer **Kang-chi**: Captain Marsdur.

Lying at Haiphong (latit. 20°.30′ — longit. 106°.)

Date	Hours	Barom.	Wind		Weather
		in			
October 5th	6 A. M.	29.88	NNE	6	Overcast — rain.
	8	.78	NNE	6	
	10	.75	NNE	7	
	Noon	.68	NE	8	Heavy rain.
	1 P. M.	.58	NE	8	
	2	.51	ENE	9	
	4	.46	ENE	10	
	6	.40	E	9-11	
	7	.43	E by S	9-11	Heavy squalls and rain.
	8	.53	SE by E	10	
	10	.70	SE	8-10	
,, 6th	Midn.	.80	S	6- 8	
	2 A. M.	.81	S	6- 7	Weather moderating.
	4	.84	SSW	4	
	6	.89	SW	3	

Since the wind turned from SE. to S. and SSW., it is evident that the Typhoon made for the North-west and for the North, or that, after spreading havoc over Tongking, it must have penetrated into Kwang-si near the limit between that province and Yun-nan. — The paragraph on *Casualties* will offer the detail of the frightful disasters caused by the Typhoon.

Proofs of the existence of two distinct whirlwinds in this "Tongking Typhoon".

That we may get a clear view of the further progress of our Typhoon, it is well that we somewhat retrace our steps and consider some few facts which had been purposely left out.

"On the 8th October, the British steamer *Lido* arrived at Hongkong harbour after having gone through some excessively bad weather and having been in considerable danger off the Gulph of Tongking. She was from Pangkok to Hongkong, and she left the former port on the 28th September. At midnight on the 1st October, Ceicor de Mor Island (latit. 10°.30′—longit. 108°.50′) being passed, the appearance of the sky became very ominous, there being a large ring round the moon, and haze, and the barometer was falling. In consequnce of these signs of coming bad weather, everything was made snug on board in preparation for it and at noon on the following day (2nd) it was made evident that these precautions had not been taken unnecessarily, for a heavy sea came rolling down from the NNW., the barometer then being 30in.10 — At 10 p.m. in latitude 14°.30′ — longit. 110°.10′, the ship was struck by a heavy gale from the NNW.: the captain hove the ship on the port tack. — On the 3rd the gale increased, and there was a heavy cross sea which continually buried the deck and flooded the cabins fore and aft. A large quantity of water got below into the stoke hole. At noon, the barometer was still falling, and had got to 29in.50, with the wind from the NW.—The morning of the 4th broke with a perfect hurricane from the WNW.; the barometer had then fallen to 29in.20 — At noon it was noticed that there was a slight change for the better, and the gale began to show signs of moderating: the barometer had risen to 29in.30 and continued to rise until it reached 29in.40 at midnight. — The 5th opened with a brisk gale from the SW. and at 4 a.m. the engineer reported that the coal was getting short, a great quantity having been washed from the bunkers into the bilges. All the available wood on board was at once brought into requisition, which together with a 65 gallon cask of oil on board, was all consumed by about 8 p.m. For the benefit of all concerned, rice was then burned to help the coal, as the ship was still 260 miles from Hongkong.—At midnight on the 6th the weather had much moderated, the wind being from S., and all available sail was set." (*Daily Press*).

To understand the particulars of this report, we must remember that the SS. *Fleurs Castle* which, in the middle of the China Sea crossed the central region of the Typhoon, had the barometer first falling rapidly to rise afterwards again with equal rapidity, which fact implies a great regularity in the shape of the whirlwind also borne out by the very regular variation of the winds. Further on, however, when the Typhoon was about penetrating into the Gulph of Tongking, it was otherwise. With the *Lido*, on the morning of October 4th, the wind was still WNW., at the time when the Typhoon, which had passed over the *Fleurs Castle*, must have already been pretty far in the West; moreover the barometer, which has sunk far less than on the *Fleurs Castle*, did not beging to rise again till noon on that day and that it did first with excessive slowness, the rise for the whole

of that day being only $0^{in}.20$, whilst the *Lido* was making northward. Here then we have an anomaly which must be explained.

Let us again revert to the *Magpie*, in the bay of Hoihow (Northern coast of Hainan), and take the series of half-hourly observations made by lieutenants Carpenter and Belam.

H. M. S. **Magpie** (Hoihow).

Date	Hours	Barom.	Wind		Hours	Date	Barom.	Wind	
		in					in		
October 4th	9. 0 A. M.	29.676	ENE	6-8	11. 0 A. M.		29.634	E by S	7-9
	30	.684	,,	,,	30		.614	,,	,,
	10. 0	.664	,,	,,	Midnight	October 5th	.608	,,	8-9
	30	.661	,,	,,	30 P. M.		.608	,,	7-8
	11. 0	.659	,,	,,	1. 0		.579	,,	,,
	30	.645	,,	,,	30		.571	,,	,,
	Noon	.639	,,	,,	2. 0		.557	,,	,,
	30 P. M.	.619	,,	,,	30		.551	ESE	7-9
	1. 0	.595	,,	7-9	3. 0		.555	E by S	8-9
	30	.585	,,	7-8	30		.557	,,	,,
	2. 0	.579	,,	6-7	4. 0		.559	,,	,,
	30	.566	,,	,,	30		.553	,,	,,
	3. 0	.566	,,	,,	5. 0		.553	,,	,,
	30	.566	,,	,,	30		.561	,,	,,
	4. 0	.550	,,	7-8	6. 0		.561	ESE	,,
	30	.551	SE by E	6-8	30		.608	,,	,,
	5. 0	.559	E by S	6-8	7. 0		.616	,,	,,
	30	.567	E	,,	30		.615	E by S	,,
	6. 0	.546	,,	7-9	8. 0		.617	,,	,,
	30	.534	E by N	,,	30		.630	,,	7-9
	7. 0	.558	E	8-9	9. 0		.639	SE by E	8-9
	30	.586	ESE	5-6	30		.644	,,	7-9
	8. 0	.696	E	7-8	10. 0		.661	SE by S	8-9
	30	.614	,,	,,	30		.665	SE	7-9
	9. 0	.630	E by S	6-7	11. 0		.647	,,	6-7
	30	.624	,,	5-7	30		.643	SE by S	,,
	10. 0	.628	,,	6-8	Noon		.629	,,	,,
	30	.620	,,	7-9	30 P. M.		.633	,,	,,

The sluggishness of the barometer to rise again, both on board the *Lido* in the offing and on board the steamer *Tung Ting* off Backsha (South of Lien-chow) corresponds in these more detailed observations to two well defined minima, viz. one ($29^{in}.534$) on the 4th, 6.30 p.m., and the other of greater duration on the 5th, between 2 and 5 a.m. ($29^{in}.551$). There must have been at that moment two whirlwinds, a short distance apart, not on a common track, but the second lying somewhat more to the South than the first. The steamer *Fleurs Castle* would seem to have gone through their common central region before they were quite distinct yet: hence the great interval of calm between the two storms; hence also for her the almost perfect regularity in the variation of the barometer and of the wind. The Centre of the second whirlwind must have passed by the *Lido* on October 4th about or after noon; for it was only in the evening or the following night that she had the wind to turn at last to SW.

On the South-eastern coast of Hainan, the steamer *Quinta* had her first minimum on the 3rd, little before midnight; on the 4th the rise had only been of $0^{in}.02$ at 4 a.m. and of $0^{in}.10$ at 9 p.m. Lastly, as we shall see when describing the ravages of the whirlwind all over Tongking, the duration of the storm was quite uncommon and it was accompanied with truly diluvial rains; at Hanoi and Nam-dinh it began so early as the 4th 11 a.m. with a violent NW. wind, which continued with increasing force till 8 or 9 p.m., when suddenly a comparative calm set in, which continued all through the 5th.

The storm soon took to blowing again with a new fury : the wind had turned to NW. and did not begin to lull before 11 p.m. or the 6th midnight. Such a furious NW. wind for 24 consecutive hours cannot be explained except by supposing two distinct whirlwinds separated from each other as shown on their tracks.

And now it may be asked whether they were already distinct on the passage over Luzon. I do not think so, though the moderate strength of the storm at Manila, contrasted with its violence at Batangas, would seem to show the division to have already commenced. The effect was probably due to the mountains lying north of Manila. They must have acted on this occasion in the same manner as they had before with the double "Manila-Macao" Typhoon of August 19th-22nd; as also the high mountains of Formosa had done twice, viz. with the double Typhoons "Pescadores-Chusan" of August 22nd-31st and "Taiwan-foo-Amoy" of September 5th-8th. But the mountains of Luzon are far from equalling in height those of Formosa and consequently the splitting of a large Typhoon does not take place so readily. Therefore was it, as we have seen, that one of the two whirlwinds of the "Manila-Macao" Typhoon at first was nothing more than a tornado which afterwards got its development on the China Sea. There must probably have been something of the kind on September 30th, the splitting being incomplete on Luzon and the division into two distinct whirlwinds not being definitively accomplished before the 3rd of October.

The two whirlwinds over China.

We may now get back to our two whirlwinds which we left on the coast of Tongking.

Their passage below Macao and Hongkong had been indicated by a minimum of the barometer ($29^{in}.84$) in the afternoon of October 3rd-wind ENE. 4-5. The barometer rose again somewhat on the 4th and 5th, but soon came to a stand; it even fell slightly between the 6th and the 9th. The fact appears still more strikingly in the observations of the coast light-houses up to Foochow where we find a minimum on the 8th, with the regular winds of the North-east Monsoon completely extinguished and partially replaced by Westerly winds.

Still higher up, at Wuhu on the Yang-tze-kiang, minimum of the barometer in the evening of the 7th, with rain and violent wind from WNW.

At Zi-ka-wei, barometric minimum on the 8th, 3 a.m., $29^{in}.844$, whilst on the 4th the reading had been $30^{in}.242$; the wind had varied from E. to WNW. through S.

If we go up so far as Shantong, we also find a considerable barometric variation at the NE. cape light-house : minimum, $29^{in}.70$ on the 8th afternoon; wind N. 6, veered on the next day to NW.5-4, then SW.3-4.

The upshot of all this is, that one of the two whirlwinds, after turning the island of Hainan, must have alighted on the Chinese coast to the North of the Gulph of Tongking. It ran rapidly over the provinces of Kwang-si, Kiang-si and Tchi-kiang in the course of the 5th, 6th and 7th, crossed the great river near Wuhu on the 7th about noon, rose farther north to the old mouth of the Hwang-ho and got to sea again south of the Shangtong peninsula on the morning of October 8th. — Herewith we give an extract from the Bulletin of Zi-ka-wei Observatory relative to this passage.

Zi-ka-wei Observatory.

Date	Hours	Barom.	Therm.	Wind		Nebulosity		Rain	Remarks
		in	°		miles				
Oct. 5th	4 A. M.	30.192	64.4	ESE	5.5		0		
	10	.252	75.4	E	12.7	K	6 C E		
	4 P. M.	.158	74.5	E	11.8	Ks W	4		
	10	.177	66.4	E	3.1	Ac	1		
,, 6th	4 A. M.	.125	64.4	E	2.5		0		
	10	.150	75.6	E	7.9		6 C		
	4 P. M.	.053	75.2	E	9.3		5 C		
	10	.108	66.9	ESE	1.9		0		
,, 7th	4 A. M.	.032	65.1	E	2.3	K W	4		
	10	.045	76.6	SE	9.3	Ac SW	9		
	4 P. M.	29.908	75.4	S	7.9	Ac	10		
	10	.891	72.5	S	7.1		10	in	9 p.m. rain commenced.
,, 8th	4 A. M.	.862	65.5	W	10.6		10 Ni	0.410	Heavy rain from 2 to 3 a.m.
	10	.941	67.3	WNW	15.8		10 Ni WNW	0.012	
	4 P. M.	.927	67.5	NW	11.8		10 Ni		
	10	.982	65.3	WNW	6.1		10		
,, 9th	4 A. M.	.987	62.6	NW	7.1	Ac W	10		
	10	30.062	68.2	NW	4.8	Ac W	8		
	4 P. M.	29.993	72.3	E	3.5	Ac W	7 C		
	10	30.043	63.7	SSE	3.5	Ks W	10		

This first whirlwind, after thus coming to sea again, moved away westward and passed over Japan on October 9th. We shall follow it thither after giving a short account of the second whirlwind, which passed all over Tongking, carrying ruin and death on its passage.

We have no means to follow it closely through central China which it crossed farther west : it also must have risen farther north than its companion : in fact it is in the northern provinces that we shall be able to trace it again with the help of the observations of Chang-kia-chwang and of Tientsin in Chili, of Newchwang north of the Gulph of Lao-tong, of Chefoo and of cape Shangtong light-house.

All over that region, as also lower down on the banks of the Yang-tse-kiang, the barometer stood at its maximum, which in the north also was the maximum of the month (at Chang-kia-chwang, $30^{in}.536$). We need not point out again how those high pressures were simultaneous with a comparatively low temperature (minimum $43^{\circ}.6$ on the morning of the 6th), a low tension of atmospheric vapour ($0^{in}.206$ on the 5th 4 p.m.) and of a low degree of moisture (41% on the 5th 10 a.m.). Such phenomena are of constant occurrence in these conditions and are now familiar to us.

At Chang-kia-chwang, on the 5th, the barometer took to sinking. Wind steady from NE. with rain, veered on the 8th to W., on the 9th to SW., which direction it retained yet on the 10th, but without ever increasing in force all that time. The barometric minimum ($29^{in}.909$) was observed on the 9th about 4 p.m., after a gradual fall of $0^{in}.627$. Let us add that, up to the evening of the 7th, whilst the wind below blew from NE, the upper currents on the contrary were running from SW. to NE. On the 8th, sky completely unclouded; on the 9th and 10th, Cirri from E. or NE.

These facts, compared with the variation of the winds and of the barometer at Tientsin, at Newchwang and particularly at the two stations of Shantong where the winds, on the 10th and 11th, turned to SW., N. and EN. and were pretty strong, force upon us the conclusion that the Typhoon or rather the depression, having lost much of its violence in rising northward on the 9th and 10th, bent its way eastward to cross the Gulph of Pechili and get into the Yellow Sea on the 11th and 12th.

At Zi-ka-wei, after the passage of the first whirlwind which made away towards Japan, the barometer rose slightly, but began to fall again on the 10th, and, in spite of the high pressures brought about at this latitude by the action of the "Hongkong" Typhoon then passing over Luzon, it had a minimum on the 12th. The wind,

which naturally had come back to ESE., on the 10th turned again to W. through S. and to NW., but did not get stronger, owing very likely to the opposition of the Southern Typhoon and particularly to an area of low pressures extending westward into the interior, which at that moment was the real cause of the direction taken by the Typhoon to pass over Hongkong. That whirlwind continued descending and crossed the South of Corea from NW. to SE.; in the course of the evening on October 12th, it passed between Nagasaki and Hiroshima to disappear in the Pacific somewhere to the South and South-east of Japan: all the time of this short run, it showed no violence, neither had the depression retained any depth.

The first whirlwind on the contrary had held out well and its passage over Japan was well defined. We left it on the North of Shanghai, as, on the 8th about midnight, it was getting into the Yellow Sea by the old mouth of the Huang-ho. On that same day afternoon, it traversed Corea from West to East between the parallels of 36° and 37°, which direction it kept on to the meridian of 132°. On the morning of the 9th, it bent northward, and in the afternoon crossed Niphon above Niigata; it then followed the eastern coast of the island a short way down and lastly made away into the Pacific, bearing SE. or E.

This strange path, as stated above, is well set off in the observations of the Japanese stations, of which I subjoin a short abstract.

			Lowest reading of Barometer			Winds				Mean velocity	
Nagasaki	(Latit. 32° 44′	— Longit. 129° 52′)	in 29.745	on the 8th	about 6 P. M. —	ESE.,	S.,	SW.,	W.,	on the 8th:	9.9 miles
Hiroshima	(,, 34. 20	— ,, 132. 27)	29.590	,, 9th	,, Midn. —	NE.,	S.,	SW.,	NNW.,	,, 9th:	8.0 ,,
Kioto	(,, 35. 1	— ,, 135. 46)	29.660	,, 9th	,, 3 A. M. —	NE.,	SE.,	SSW.,	NW.,	,, 9th:	4.9 ,,
Niigata	(,, 37. 55	— ,, 139. 3)	29.550	,, 9th	,, 3 P. M. —	SE.,	SW.,	WSW.,	NW.,	,, 9–10th:	13.2 ,,
Tokei	(,, 35. 40	— ,, 139. 45)	29.562	,, 9th	,, 6 P. M. —	NNW.,	NNE.,	SSE.,	NW.,	,, 9th:	10.0 ,,

Velocity of translation. — This was very variable with the regions run over by the two whirlwinds. The movements of the first whirlwind, which kept its original energy longer and came nearer to Shanghai, were more rapid than those of the second one, as appears from the following figures:

From Luzon to Tongking, mean velocity of the two whirlwinds: 9 miles an hour.

Through China: for the 1st whirlwind, 15 miles; for the 2nd., 12 miles.

On the Yellow Sea, Japan Sea and Japan: 1st whirlwind: 30 miles. — 2nd whirlwind: 13 miles.

CASUALTIES

Loss of the German Steamer QUINTA on the coast of Hainan.

The *Quinta* anchored at Tinhosa Island on the 3rd October. On the 4th as she was nearing the rocks, the wind from ENE. and sea from SE. being very violent, and might be smashed, tried to weigh at 5 p.m., and got the starboard anchor up; but without getting away, the anchor stock being pulled off. The port chain was carried away to the extent of 30 fathoms. Brought the vessel up against the wind, and steamed against it; but she would not answer her helm, and so was forced to keep off before the wind. The captain tried to make a low sandy beach which extended between the two islands, but the ship again refused her helm and drifted sideways in, and struck with the fore end on some rocks which were near the shore, the after part being on the sand. The engine went full speed astern trying to get her off, but the effort was futile. The vessel laid over on her starboard side, and everything on deck was broken or cast away. The ship made no water until the 5th October. As soon as daylight set in, the landing of the passengers was commenced. This was a work of great difficulty and danger, for the weather was still very bad and there was an exceedingly heavy surf to be got through. However, after great exertions, everyone was got safely off the vessel to the shore, with the exception of two Chinese

women and one child, who were drowned the last evening by the capsizing of one of the boats. Having got the passengers on shore, everything was done that was possible to arrange for their comfort, and to alleviate the hardships of their unfortunate position. Canvas, stores and materials were got on shore, and a camp was set up on the beach near the ship. Two of the crew were despatched overland to Hoihow. The natives, instead of rendering assistance, devoted their energies to the plunder of the steamer, and after all the cargo had been removed, the ship was burned and she was completely gutted, only the bare iron shell of the hull remaining. On the 10th October, a lot of fishermen came ashore and some difficulty arose between them and the five soldiers sent by the Mandarin of Moonchow, who would not let them pass towards the place where the passengers' huts were erected. Half-a-dozen of the crew armed themselves and assisted the soldiers against some sixty or seventy of the would-be robbers, and succeeded in driving them away. A reinforcement of thirty-five soldiers was granted. No further trouble was experienced of this kind. The existence at this place was not of a pleasant kind, until on the 18th the *Kang-chi* was sighted. She took all on the island on to Hoihow, which port was reached on the following day at noon. The *Paladin* took them all on board and brought them on to Hongkong.

In October 1880 three equally sad shipwrecks had taken place on that inhospitable island and two of the crews had met with most inhuman treatment. It was high time to put a stop to such barbarous doings. The Government of Germany has made the Chinese to give compensation for the rifling and burning of the *Quinta*.

The Diasters in Tongking.

Haiphong — The Saïgon *Ère Nouvelle* publishes an account, compiled from letters received from Haiphong, of the Typhoon which visited the coast of Tongking on the 5th October. The storm is described as the most frightful which has visited the country within the memory of man, and as having brought ruin and desolation where immediately before all was smiling prosperity. Words would fail to give any adequate idea of the horror of the phenomenon at which the community had the misfortune to assist.

From the morning of the 5th the sky was dull and lowering, and a fine rain fell, interrupted now and then by the fierce rays of the sun. At about half past 11 the tide commenced to rise and with it came the first symptoms of a terrible atmospheric disturbance. The wind freshened considerably and was not long before it was blowing a tempest. Under its influence there was soon a heavy sea in the river, and the men-of-war *Perceval* and *Surprise* had to place themselves under steam. At 2 p.m. the squalls which succeeded each other seemed as though they would tear up the ground itself. Nothing seemed able to withstand the combined action of the wind, and of the river and sea, the mixed waters of which rose in immense waves and dashed against the banks, which they were not long in breaking through and washing away, when the flood rushed furiously over the plain, inundating in a few seconds plantations and meadows, and houses were threatened with ruin. In a word, a few minutes were sufficient for the elements to destroy the results of years of toil, and to transform into liquid plains what the night before had been flourishing gardens and rice fields. At 6 o'clock night fell, and with it came anxiety, despair, and preoccupations of all kinds, for far from abating, the storm increased in violence and seemed to reach the paroxysm of its fury. Everything which up to then had been able to resist the force of the wind was uprooted; the large trees were torn up, and nothing could be heard but the roaring of the storm and the cracking of trees. In the European houses there was over three feet of water. Men, women and children were there, crowded together with animals which had come to seek a last shelter, while all the furniture was floating about, smashing up and threatening wounds to the occupants of the apartments. Darkness reigned over all this

disorder and rendered more poignant he despair of the feeble witnesses of the cataclysm. At last 3 o'clock on the 6th. arrived, and at this time the storm, satisfied with its work, began to lull, and the tide to recede. At half-past 5 darkness was succeeded by the break of day, and the European could then survey the extent of his loss. The damage is immense, and fortunes acquired slowly and with difficulty have been lost in a day. The loss of life was also considerable. The bodies of 227 Annamese have been already recovered at Haiphong alone, and no doubt more will be found. Of five pilots who were at the mouth of the river four managed to reach the shore, after leaving their boats, but the fifth Mr. Bertrand, disappeared. The number of junks known to have been lost up to the 8th was 61 and fears were entertained for two vessels which had left the port at 11 a.m. — (*Daily Press*).

Tallee. — There were 6 feet of water in the houses three and four miles distant of the sea shore. The current was so strong that it swept away the entire town, the number of persons drowned being estimated at over 3000. The paddy fields throughout the district have been completely ruined. A large number of boats which convey the rice from the interior of the country to Haiphong have been sunk, and others have had their cargoes damaged. It is reported that the value of the rice lost and damaged will amount to over 300 000 dollars.

The Vicar Apostolic for western Tongking, a few days after the disaster, sent to Paris the following telegram: "Frightful Typhoon. - 200 churches, 34 parsonages and college destroyed. - 2 000 houses of christians blown down. - 60 000 christians ruined. - Enormous loss, great suffering. Mgr. Puginier begs for relief".

We subjoin some extracts from letters of French catholic Missionaries in Tongking which appeared in the "Missions Catholiques"; we trust they will not by found devoid of interest.

Mgr Puginier, Vicaire apostolique du Tonquin occidental écrivait: — "Le 4 Octobre, nous faisions la coupe d'un bois pour l'usage de la cuisine; nous avions gravi la montagne avec les travailleurs. Cependant le ciel était couvert, un assez fort vent de NW. soufflait depuis le matin et par intervalles tombaient quelques gouttes de pluie, Dans le courant du mois de September, nous aurionsregardé ce temps comme un signe de typhon: mais la mousson de NE. étant établie et la saison des tempêtes à peu près passée, aucun de nous ne songeait à ce qui allait arriver. Le soir, avant de prendre notre repas, nous voulions jouir de l'agrément de la nuit et du silence de la solitude. Vere les 11 heures, le vent soufflant toujours du NE., devint subitement très-fort et se déclara par rafales, accompagnées d'une pluie fine semblable à un épais brouillard. Un changement instantané venait évidemment de se produire dans le ciel, et je prévins mes deux missionnaires que nous allions avoir un typhon. — La nuit fut très-agitée, ainsi que la matinée du 5; il n'y avait plus à en douter, la tempête avait commencé. Vers les 2 heures de l'après-midi, le vent devint plus terrible et les rafales plus fortes et plus fréquentes. A 5 heures elles redoublérent encore, et à partir de ce moment, le typhon était déjà très-violent. Mais c'est surtout de 7 à 9 heures que le vent de NW. atteignit sa plus grande intensité. C'était horrible et on croyait entendre le bruit continuel du tonnerre; cependant il n'y avait ni foudre ni éclairs. Tout le monde était dans une auxiété indicible; à chaque instant, on était menacé d'être écrasé par la chute des maisons dont le craquement continuel faisait frissonner. Dans cette période le mal avait déjà été considerable et un grand nonbre d'habitations avaient été renversées. A 9 heures du soir, nous eûmes un instant de calme relatif et nous espérions que la tempête allait finir. Mais, aprés quelques minutes, le vent d'W. se déchaîna subitement encore plus terrible que le précédent. Les maisons déjà ébranlées s'écroulaient les unes après les autres et les débris étaient emportés à une très-grande distance. Des arbres séculaires qui, jusque-là, avaient affronté toutes les tempêtes, étaient déracinés ou rompus par le milieu du tronc. — Une chose contribuait à rendre le typhon plus redoutable et augmentait les désastres: c'est l'inondation qui couvrait une grande partie du pays: sa hauteur variait de 3 à 4 mètres selon la profondeur des champs. En certains endroits, les eaux n'étant pas arrêtées par des digues, furent refoulées par le vent d'W. et, en moins d'une heure, atteignirent une hauteur de 2 ou 3 Mètres. Malheur aux villages qui par leur position formaient un obstacle à leur passage, il étaient submergées et les habitations étaient sapées par les flots. Tout était renversé et emporté; des maisons solidement bâties et renforcées à l'intérieur par de nombreuses et grosses colonnes en bois de fer n'ont pu résister à la force des vagues et du vent; on a vu disparaître même des socles de colonnes en pierre que quatre heures auraient eu de la peine à porter. Des chrétientés, situées dans cette zône particulièrement maltraitée, ont été abîmées; une de 70 néophytes en a perdu 45; une autre de 48 a eu 28 morts et une troisième de 20 nouveaux n'en compte plus que 12. Les villages païens ont été au moins aussi éprouvés; un, entre autres, d'environ 280 habitants a 150 victimes.... Après 2 ou 3 jours, la plaine inondée présentait un aspect horrible; les cadavres des noyés avaient surnagé et on les voyait par centaines. Les fleuves de leur côté en charriaient continuellement; car toutes les barques qui n'avaient pas eu le temps de se réfugier dans les petits cours d'eau, ont été submergées et les infortunés qui les habitaient ont été noyés. C'est une désolation générale; on ne se souvient pas d'avoir vu la pareille au Tonquin. Le nombre des victimes du typhon dans les deux provinces de Hà nôi et de Nam-dinh se compte par milli rs. Les relevés officiels, faits par les mandarins, sont déjà très-considérables: mais ils sont encore bien au-dessous de la vérité; la raison en est que les communes, cachant au gouvernement les quatre-cinquièmes au moins de leur population, n'ont dû décla-

rer les morts qu'en proportion des contribuables. D'après les renseignement relativement exacts que j'ai reçus de différentes paroisses, j'estime que dans ces deux provinces seulement, le nombre des maisons grandes ou petites, tant chrétiennes que païennes, renversées, et des barques qui servaient d'habitations coulées, monte à plusieurs centaines de mille. D'après les comptes rendus de nos missionnaires j'évalue, au minimum, le chiffre des maisons chrétiennes abattues à 14000. En Europe, on se ferait difficilement une idée du dénûment qui régne en ce moment dans les familles de la classe pauvre des provinces ravagées par le typhon, et c'est presque toute la population. La mission, de son côté, a eu sa bonne part de malheurs; en résumé: 10 maisons abattues et des pertes considérables au chef-lieu de la mission; 26 cures ou annexes, plus de 200 églises ou chapelles, au moins 14000 maisons de chrétiens et un collége renversés."

Mr. Cosserat, Provicaire de la Mission et Supérieur du Collége de Hoang-ngouiène écrit: "Dans la soirée du 5 Octobre, un affreux typhon s'est abattu sur nous, et en quelques heures le cher collége de Hoang-ngouiène n'a plus été qu'une ruine! Plus des deux tiers des maisons ont été renversées. La force du vent était épouvantable! La chapelle, avec ses six rangées de colonnes de bon bois avait une force de résistance énorme à cause de son poids; cette force était encore doublée par un plancher qui, à un pied au-dessus du sol, reliait toutes les colonnes les unes avec les autres. Le vent du Nord, la prenant en flanc, *l'a poussée tout d'une pièce à* 40 *centimètres de la place* puis le vent d'Ouest, la prenant ensuite debout, lui a enlevé et fracassé six mètres de toiture et en même temps *a fait incliner les* 90 *colonnes de l'édifice!* La classe de rhétorique a été enlevée de sa place et poussée à 2 mètres de distance avant d'être disloquée et de tomber. Il y a, en comptant tout depuis les plus modestes cases jusqu'aux cases les plus solides qui servaient de classes, 241 travées de renversées dans notre seul collége, ce qui ferait si elles eussent été réunies entr'elles, un prolongement de 482 mètres de longueur! Au milieu de notre malheur nous devons rendre grâce à Dieu de ce que les 200 personnes du collége ont pu passer saines et sauves au travers de cette avalanche de maisons qui s'écroulaient de toutes parts. Les villages situés dans les terrains bas et inondées ont été bien autrement éprouvés; quelques-uns, dit-on, ont disparu completement; le vent et les flots conjurés ont entraîné maisons et habitants. Partout le nombre des maisons abattues est incalculable. En plusieurs endroits des gens réfugiés dans les pagodes ont été écrasés par cinquantaines et plus à la fois. Le typhon si tristement célèbre de 1867 n'était rien comparé à celui-ci!"

Fifteenth Typhoon: 11th — 18th October 1881.

TRACK :

				Latitude		Longitude	
October.	11th	Midn.		?		?	
		Noon	Luzon	?		?	
,,	12th	Midn.		17°.	30′	123°.	0′
		Noon		18.	0	122.	0
,,	13th	Midn.		18.	30	120.	40
		Noon	China Sea	19.	0	118.	15
,,	14th	Midn.		20.	20	116.	30
		Noon		22.	0	114.	45
,,	15th	Midn.		24.	45	113.	30
		Noon	China	27.	0	114.	30
,,	16th	Midn.		29.	0	116.	0
		Noon		31.	30	118.	20
,,	17th	Midn.	Corea	34.	0	122.	0
		Noon	Japan	36.	20	127.	0
,,	18th	Midn.		37.	30	139.	30
		Noon		Pacific			

EVENTS :

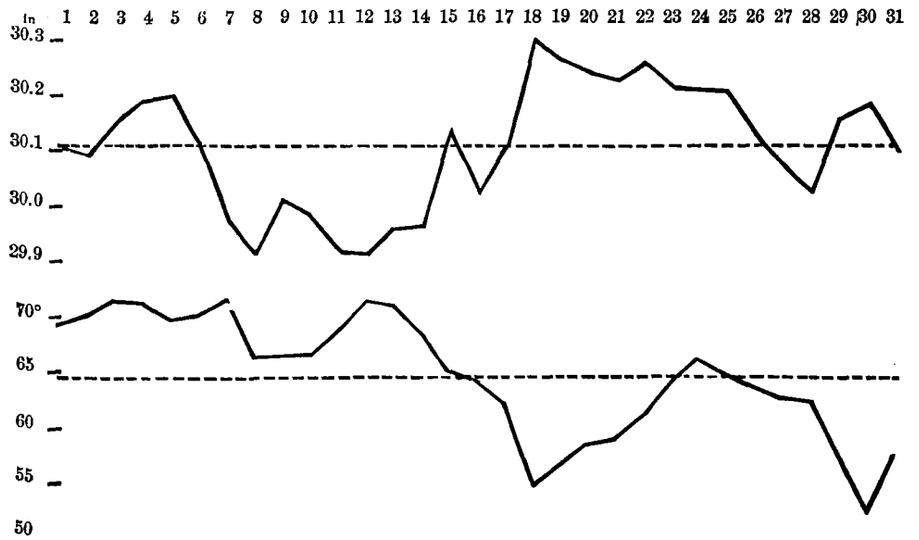
Immense disaster in the native craft at Macao and Hongkong.
Wreck of the E. and A. S. N. C. steamer *Brisbane* at Fish Reef on the 10th October.
Wreck of the British ship *Geraldine Paget* on the Pratas Shoal on the 14th October.

Atmospheric conditions on China before the Typhoon.

The following diagram will, I think, give a correct idea of the atmospheric perturbation brought about in China by the passage, simultaneously but a great distance apart, of the two whirlwinds which made up the famous "Tongking" Typhoon.

Zi-ka-wei Observatory

Mean variation of the Barometer and Thermometer in October 1881.



The two whirlwinds, which we have followed up as far as we could, must themselves, in their progress through China, have become subdivided into secondary whirlwinds of less importance; Southern China offers several large mountain masses and extensive chains which must undoubtedly have acted like the mountains of Formosa and Luzon. In fact, there was at least one more whirlwind: less violent yet than the first two on their passage over our district, it appeared in its turn near Shanghai, following in their wake in the direction of Japan. On the 14th about 6 a.m. it passed over Zi-ka-wei, swift in its run, but devoid of energy; in the afternoon it alighted on Japan somewhat above Nagasaki, and on the 15th 11 a.m. passed on the north of Tokei.

Notwithstanding this succession of three whirlwinds one after the other, the pressure was slow to regain its level on China; the temperature still was pretty high, above the mean for the month. The "Tongking" Typhoon must not only have become subdivided; it also must have spread partially over China and tended to keep down the pressure. But there is nothing better to show how considerable the perturbation was at this time than the break in the regularity of the NE. Monsoon, which yet at the end of September seemed so well established all along the coast, particularly at the altitude of the light-houses. The North-easterly wind was light, unsteady and sometimes replaced by Westerly wind. There is therefore nothing wonderful if, after the "Ash" Typhoon (September 25th-27th), one of the most violent of the season, had been repelled far from the Chinese coast by the polar current which had settled there so early as the 19th, we see another whirlwind of equal importance make its way towards the coast of China and have no difficulty to break over the continent. The obstacle had been removed for the time by the very cause which had attracted this Typhoon from the Pacific to that quarter.

Telegram from Manila to Hongkong.

Manila 12th October 1881, 9.20 a.m. — "Another typhoon is coming from the East of Luzon; its direction seems to be NW. by W."

A second telegram dated Manila 12th October, 11.20 am, says: — "The Typhoon is now raging in the provinces north of Luzon; it seems to incline a little more to the N. than in the beginning."

The Typhoon bore West-north-west and came to pass *over* Hongkong: the telegram was therefore of the greatest moment for the English settlement.

The Typhoon on Luzon.

The *China Mail* has some interesting notes on the Typhoon that visited Manila, translated from the Manila papers.

"The official report from the Jesuit Father in charge of the observatory sets forth that the typhoon which visited the islands on the 12th October was nearly of the same force as that which occurred on the 19th August last, with this difference that this time the radius was much smaller. The greatest force of the wind was marked by the anemometers between 11 and 12h in the night; there were gusts of 32 meters per second, or 70, 4 English miles per hour, but this was only for a short time; the mean velocity of the wind in the strongest period of the storm did not exceed 23 meters per second. The typhoon would have been blowing with stronger force in the northern provinces. The wind shifted from N. to S. by W. from the provinces of Isabel downward; and as in this direction the winds ran low, it is doubtless that these districts will suffer the most. The direction of the typhoon, before it entered the islands, appears to have been to the WNW., but shortly was twisted towards the N. by the indentation of the coast. The lowest reading of the barometer was 29".619, and it stood in that state

from 3 p.m. to 8 p.m. on the 12th, when it began to rise; a like fact was observed in the typhoon in August, and, in our opinion, this is owing to the obstacle offered to the run of the typhoon by the high mountains in the interior of Luzon. The quantity of rain fallen was $1^{in}.587$."

From the foregoing indications we can infer that the track crossed Luzon between 17° and 18° latit. There may have been some slackening in the progress of the Typhoon over the island, perhaps also some momentary deformation or flattening of its lower part against the eastern side of the mountain, or even a splitting of the whirlwind, which circumstances would go to account for the great duration of the barometric minimum at Manila and the violence of the storm notwithstanding the great distance of the main Centre; but all this was no more than a momentary and local action and does not seem have impaired the simplicity and unity of the whirlwind, which reached the coast of China in the course of the 14th. Even on the Southern coast of Formosa, at Takow and Taiwan-foo, nothing can be detected in the observations, implying a splitting or a considerable deformation.

Where the Typhoon was coming from when it reached Luzon, it is hard to say for want of any detailed observations in the island. A phrase in the Hongkong *Daily press*, which might have cleared up this question, makes it on the contrary but more obscure; it is as follows: "From the report of the German ship *Regulus*, from Cardiff, which arrived here on the 17th (October), we find that she was caught in a Typhoon on the coast of Luzon on the 10th. No damage, however, seems to have been sustained by her, at least none has been reported." According to this, so early as the 10th, the Typhoon would have been raging on the coast of Luzon (probably the eastern coast), which would imply its having originated in that quarter at this very time. There may perhaps have been a misprint : the 10th for the 12th, yet I am rather inclined to admit the formation of a Typhoon in that region at the moment when low pressures obtained over central China and naturally occasioned high pressures at sea.

Pratas Reef. — Wreck of the British ship *Geraldine Paget* (Captain Wilkinson).

She left Hongkong for Portland (Oregon) on the 28th September and met with light Easterly headwind until the afternoon of the 12th October, when a heavy sea from E. set in and a strong wind commenced at the N. and gradually worked round to the E. At noon on the 13th it commenced to blow a perfect hurricane. By 4.30 p.m. all the sails beeing lost, had to bear the ship under bare poles, weather continuing the same with very heavy rain squalls, the wind blowing the vessel on her beam-ends, making her ship large volumes of water over her lee rails. On the 14th at 1.40 a.m. saw breakers on the lee. The night was as black as anything could be, and at 2 a.m. the ship struck on the eastern side of the Pratas shoal. Seeing the condition of the ship was hopeless, at daybreak the captain and crew took to the boats, and in doing so an able seaman named Richard Dyer was drowned. They pulled towards a fishing junk, which brought them to Hongkong. The unfortunate men lost everything except what they stood in. — *(Daily press.)* (1).

Since the wind which threw the *Geraldine Paget* upon Pratas Reef was E. (hurricane force), the Centre of the Typhoon must have left the Reef to the North of its track : it must have passed it within a short distance on the 14th October about midnight. The distance between the point where the Typhoon left Luzon and Pratas Reef may be set at 260 miles : it was run over in about 24 hours, or at an average speed of 10 to 11 miles.

(1) The *Geraldine Paget* was wrecked about a mile and a half to the Southward of where the *Bolton Abbey* lies. It will be remembered that this latter ship had lost her masts in the "Pescadores and Chusan" Typhoon on August 22nd, 300 miles East of Luzon. She sailed 900 miles under jury masts and, after struggling against several Typhoons, came to be lost on the eastern side of Pratas Reef, on September 30th 1881.

Steamer Oaklands. — She was en route from Tai-wan-foo to Hongkong when on the 14th October, at 6 a.m. the barometer had fallen to 28^{in}.50 and at that time the wind was blowing with terrific force from the ENE.; at 10 a.m. the wind fell nearly calm, leaving, however, a confused sea. At noon the breeze freshened, and the wind struck the ship direct from the Wd. The gale went on to rage with renewed violence and at two o'clock the barometer was down to 28^{in}.30. After this it became evident that the Centre of the storm had passed over the locality of the vessel, which by this time had some booms and sails blown away and the compradore's house knocked to pieces. At 6 p.m. the storm had begun gradually to subside, but there was still a mountainous sea, and the ship, which was "flying light" rolled rails under water. A large number of Chinese junks were passed all dismasted and otherwise damaged by the heavy weather.

It is to be regretted that there be no indication of the position of the ship between 10 a.m. and noon, when she stood right in the Centre of the Typhoon; nor does the barometric minimum 28^{in}.30, observed shortly after noon, seem to be quite to be depended upon.

H. M. S. Magpie and P. and O. SS. Rosetta.

The only truly complete document I have received relative to this period of the progress of the Typhoon, is the report of lieutenant Belam R.N. of H.M.S. *Magpie* which sailed from Hoihow to Hongkong and on October 14th lay off the Ladrones Islands, 35 to 40 miles South of Hongkong.

It is singular that the storm should have been so late to break out on that coast, which extends below Macao as far as Hainan; the distance of the Centre to the *Magpie* was not more than 140 or at most 150 miles on the morning of October 14th, when the wind, hitherto so variable, settled at last between N. anb NNW. with force 6.

As for what took place to the North of the track, we fortunately find it in the report of Captain R. Bonlm of the P. and O. SS. *Rosetta*.

On the 14th about midnight, the *Magpie* and the *Rosetta* were pretty much at the same distance of the Centre of the Typhoon, and both ships' barometers stood about the same height; but the storm had set in only with the ship that lay farther North. The Centre passed much nearer the *Magpie* (barom. minim.: 29^{in}.145) than the *Rosetta* (barom. minim.: 29^{in}.410), but the storm would not seem to have been worse for the former ship, whence we may infer the Typhoon to have been generally more violent in the Northern than in the Southern half-circle.

At the moment of the barometric minimum, observed almost simultaneously on board the *Magpie* and the *Rosetta*, the wind was NW. with the former and SE. with the latter. Since the direction of the Centre was to NW. the diametrically opposite winds experienced by the two ships were circular or perpendicular to radii of the whirlwind. The diluvial rain at both places must be noted; as for lightning, it only appeared ahead of the Centre, not behind it.

H. M. S. **Magpie**: *Lieut.-Commander Carpenter R. N.*

from Hoihow (Hainan) to Hongkong.

Date	Hours	Position	Barom.	Wind		Thermom. Dry	Thermom. Wet	Clouds		Weather	Swell			Remarks
			in			°	°							
October 11th	8 A. M.		29.944	ESE	2	81.6	78.0	3	Cst ESE	B. C. M.	Swell	SSE	1	0.30 a.m — A large halo.
	Noon	Off Mame-chau Isl.	.900	,,	1-2	83.0	78.2	1	,, ,,	B. M.	,,	S	1	
	4 P. M.	21.°34′ — 111.°45′.	.840	,,	1	82.0	78.0	1	,, ,,	,,	,,	S	2	
	8		.867	,,	1-2	81.8	78.0	0		,,	,,	S	2	A few flashes of lightning.
,,	12th Midn.		.897	,,	1-2	80.8	77.6	4	Cst ESE	B. C. M.	,,	S	1	
	4 A. M.		.853	,,	1	80.0	77.2	4	,, ,,	,,	,,	S	1	A red sunrise.
	8	From Name-chau to	.894	ENE	1	79.8	77.0	1	C ,,	B. M.	,,	S	1	6.35 a.m. — Weighed.
	Noon	Namo harbour.	.869	ESE	1	82.6	77.5	0		,,	,,	SE	1	
	4 P. M.		.819	S	1	83.5	79.0	Ks	2	B. C.	,,	SE	1	6.15 p.m.— Anchored in Namo.
	8	21. 36 — 112. 34.	.815	E	1	82.0	77.0		0	B. M.	,,	SE	1	8 — Sea very phosphorescent.
,,	13th Midn.		.811	calm		80.8	76.3		4 St	B. C. M.	,,	SE	1	
	4 A. M.	From Namo harbour	.776	N	1	80.3	76.0	K. Ac	4	,,	,,	SE	1	6.40 a.m. — Weighed.
	8	towards Hongkong.	.820	E	1	80.7	76.2		3	,,	,,	SE	1	
	Noon	21. 33 — 112. 59.	.752	N	1-2	83.8	78.3	Ks	SSW 3	,,	,,	SE	1	
	4 P. M.		.697	E by N	2	83.0	79.9		7 St	,,	,,	ESE	2	4 p.m. — Swell increasing — a very
	8		.687	NNE	1	82.8	80.1		10 ,,	O. M.	,,	ESE	3	yellow sunset — rainbow.
,,	14th Midn.		.636	N	2- 3	83.5	77.8		10 ,,	,,	,,	ESE	3	9 — Long swell ESE — rain.
	2 A. M.		.586	,,	4- 5					O. *M.* Q.				11.30 — Rain ceased.
	4		.529	,,	4- 6	80.8	76.0		10 ,,	O. Q. D.	,,	N-NE	4	4 a.m. — Wind increasing rapidly.
	6		.483	NNW	7- 8					,,				7 — Hove to under steam off the Ty-
	8	Hove to under steam.	.426	N	7- 8	77.6	76.0		10 Ni	,,	,,	NW	6	pong Isl. — Heavy rain.
	10		.298	,,	9-10					O. *Q. R.* M.				
	11		.234	NNW	9-11					,,				9.20 — Squalls very heavy.
	Noon	21. 37 — 113. 51.	.158	NW	10-11	78.0	76.0		10 Ni	,,	,,	NNW	8	
	0.30		.145	,,	,,					,,				12.50 — Torrents of rain — high sea
	1 P. M.		.150	WNW	,,					,,				running.
	2		.193	W	,,					,,				
	3		.150	W	,,					,,				
	4		?	W by S	,,	78.8	77.0		10 Ni	,,	Sea	W	8	
	6		?	W	9-10					,,				
	8		.515	,,	,,	78.5	77.0		10 Ni	,,				
,,	15th Midn.		.606	,,	6-7	77.8	76.2		10 ,,	O. Q. D. M. L.	Swell	W	7	1.20 a.m. Thunder and lightning to
	4 A. M.		.680	SW by W	2-3	78.0	75.4		10 ,,	O. M. *L.*	,,	W	6	Eastward.
	8		.818	WNW	2	77.0	74.5		10 ,,	O. P. *L.* M.	Confused		6	5.30 — Heavy rain — swell heavy
	Noon	21. 56 — 114. 20.	.814	SW by S	2-3	78.0	77.1		10 ,,	O. M. L.	SW	E	5	and confused.
	4 P. M.		.817	N	1	78.0	75.2		9 Cst	C. M.	,,	E	4	9.45 — *R. L. T.* for 1 hour.

Nota — On 12th October the sky was covered with detached patches of Cirri, all more or less pointed towards direction of the coming storm. — During the storm lost one boat. — Afterward passed several junks bottom up.

P. & O. S.S. **Rosetta:** Commander R. Barlow

from Shanghai to Hongkong.

Date	Hours	Course	Kn.	Barom.	Wind		Position Latit.	Position Longit.	Remarks
				in			°	°	
Oct. 14th	1 A. M.	S 60° W	13	29.687	NE by E	7	23. 6′	117.25′	In all sail and furled awnings — closed ports — dull gloomy weather, with frequent rain squalls.
	2			.617					
	3			.611					Battened down hatchways and secured everything for bad weather — Increasing wind and sea.
	4			.572	ENE-NE	9			
	5	S 80 W		.565	ENE				4 a.m. — strong gale — rain at times — a very high sea from SE., ship rolling heavily.
	6			.568					
	7			.535	E by N-ENE	10			7 — Hard gale — frequent rain squalls, dull gloomy weather.
	8	S 79 E	9	.508					7.45 — Eased engines to half speed and rounded to with head
	9			.505	E by N—E	10-11			E by S. to get an offing and avoid Centre of typhoon bearing
	10	S 73 E	5	.457					S by W.
	11			.417					9 — Frequent furious gusts of wind and rain with very heavy
	Noon	S 55 E		.420	E by S—ESE	11	22.29′	116.14′	sea — engines racing badly.
	1 P. M.	S 35 E	4	.410	SE by E	11			11 — Tremendous sea from SE. and E. — 11.30; shipped a very
	2			.413	SE	11			heavy sea damaging the deck.
	3			.413					Noon — Hard gale with furious gusts of almost hurricane force
	4			.433	SE	10			and much rain — ship taking large quantities of water on board.
	5	S 25 E		.460	SE by S	9			1 p.m. — Hard gale with furious squalls of long duration with
	6			.510					torrents of rain — ship barely having steerage way at times fall-
	7		5	.540	SSE	8			3 — The same weather. [ing off 4 points in the gusts.
	8			.611	SSE	7-8			4 — Strong gale with hard squalls at times, ship labouring hea-
	9	S 16 E		—	S by E				6 — The same weather. [vily and taking water over.
	10			.698					8 — Decreasing gale and sea with frequent hard gusts of wind
	11		7	.708	S				8.45 — Full speed — 9.20 : slow. [and heavy rain.
	Midn.	West	6	.708	S	6			11 — Frequent hard squalls of wind and rain with lightning
									11 — Weather clearing — turned ship's head to W.
									Midn. — Overcast weather — strong winds and squally.

The storm does not seem to have extended very far North : it hardly raged beyond the Strait of Formosa; at Tamsui, in the Northern part of that island, it was yet violent enough (SE. 6), but at Foochow it had come almost to nothing (N. 3). Within the Strait itself, according to the report of the captain of the P. and O. Steamer *Sunda*, bound for Hongkong, "after passing cape Turnabout (latit. 25° 30′), nothing but bad weather was experienced until Hongkong was reached. A very heavy gale blew continuously from SE. and the sea was excessively rough."

According to these data, the Typhoon properly said, on the way from Luzon to Hongkong had towards the North a radius of 350 or 360 miles. At Hongkong, on the very track, the storm only set in about 8 or 9 a.m. (NNE. 5-7) with the Centre no more than 130 or 140 miles off.

The small size of the Typhoon may perhaps be accounted for by the lateness of the season. The Monsoon, interrupted by the atmospheric depression above mentioned, already tended to take its regular course again, and the Typhoon, whose direction was different, must have been cramped and as compressed in that great current. It yet pursued its course, propelled by the powerful action which had called it up, but, as we are going to see, did not get far inland.

Macao and Hongkong

The Centre of the Typhoon passed very near Hongkong and if the wind was not so very strong there, it must have been owing to the peculiar situation at the foot of a mountain (1825 feet) in a group of islands. The harbour is not open to any but westerly winds, which yet must naturally lose some of their violence in passing over numerous islets, so that altogether it may be deemed one of the safest in the world. Eastward of the harbour, the peninsula of Kowloon forms an inner harbour which is nearly landlocked, and which affords protection to vessels in all weathers, but the situation is not a convenient one. On the approach of a Typhoon the native crafts almost invariably seek shelter over towards the northern side of the harbour.

The situation of Macao with full exposure to the SW. monsoon, renders it a more agreable and salubrious

residence during the hot season than Hongkong, but not a safer harbour. Macao, a Portuguese settlement in China, stands on a small peninsula projecting from the south-east end of Hiang-shan island. The peninsula is nearly 2 miles long, less than a mile wide at its broadest part, and is connected with the island by a low, narrow, sandy isthmus, across which extends a barrier wall to exclude foreigners from the interior of the island. The town is built on the declivities round the harbour 200 to 300 feet in height, the shore beneath being embanked, so as to form a marine parade, backed by a terrace of white houses. (1)

I subjoin some detailed accounts of the storm, from the Hongkong papers.

Hongkong — A telegram was received from Manila on Wednesday morning (12th) advising a typhoon travelling NW¼W., and a subsequent telegram said, it seemed to be inclining a little more to the North. No apprehension of danger was entertained in Hongkong in consequence of this, as it was expected the storm would clear this place and be heard of from the North. On Thursday afternoon, however, the extreme sultriness indicated bad weather in the neighbourhood, and during the night the barometer fell rapidly. Early yesterday morning 14th the wind was chopping about between NW. and NE., and sometimes the clouds were observed to be moving in a direction different from the lower current of air. At eight o'clok the typhoon gun was fired, and the vessels in harbour prepared for bad weather, as did also the Dock Company's people. The Chinese, however, did not seem to apprehend a heavy storm and many of them kept their craft in their usual place off the Praya. One of the earliest accidents was to the Hongkong Dispensary launch. As she was coming in, opposite the office of the Messageries Maritimes Company, she was swamped, apparently through the men not keeping her head to a large wave that came up, and she sank in three fathoms of water. The three men on board saved themselves by swimming to a lighter which was near by. The wind blew in gusts all the morning and the glass continued to fall rapidly, and it was feared that we were about to be visited by a genuine typhoon. These fears were heightened when shortly after noon the wind rapidly increased in violence, and it was about this time that the principal damage was done.

A report has been sent in to the Harbour Master by Mr. A. F. Sampson, detailing the damage done by the gale. It shows that the estimates formed of the destruction to property were in no way over-estimated. A large number of junks and cargo-boats were sunk at the different piers all along the Praya. But the most damage had been done at Yau-mah-ti, where an immense number of cargo-boats, junks and sampans, were lying on the rocks there. One or two junks had sunk out in the harbour, and the masts were standing above the water. The beach at Yau-mah-ti is literally covered with wreckage. The whole strength of the gale, which is admitted to have been the strongest experienced here for many years, was felt in that locality, and it is feared that in addition to the damage done to the native craft, a great many lives have been lost. The police under Inspectors Cradock and Cameron rendered most efficient service in rescuing the people from the junks, cargo-boats and sampans, which were driven ashore, and suceeded in saving about 200 men, women and children from watery graves.

An inquest was opened at the Government Civil Hospital on the 17th on the bodies of eleven Chinese drowned in the late gale. Dr. Marques gave evidence that all the deceased appeared to have met their deaths by drowning.

Macao — The gale has, it seems, done quite as much damage afloat as a "small typhoon." Over 50 junks of all sizes have been completely wrecked, and quite as many damaged, which is not to be wondered at,

(1) China Sea Directory — Vol. III.

seeing the crowded state of our harbour on the approach of bad weather. Up to the hour I pen this, my informant gives the following account of junks lost: — 1 large junk; 11 timber and firewood junks; 16 open cargo boats; 14 salt junks of all sizes; 5 Tanca boats; 3 water boats; 5 passage boats. We have no Humane Society here, but the Water Police under our energetic Harbour Master, Mr. Cinatti, did very good service and rescued many crews from wrecked junks.

Canton — I write a few lines this morning which I will endeavour to get on board the steamer to inform you of the terrible destruction to property and the great loss of life which has occurred on the Canton River during the late gale. The loss of life did not all take place on the river, but was caused in many places, especially in the suburbs and in the country around, by floods and inundations, reports coming in all day yesterday from all quarters of the great damage done, attended in most cases by considerable loss of life. These floods have been, in addition to the ordinary cause of a high state of the river, very much aggravated by the banks in many places breaking and letting in millions of tons of water, which has, in places, played sad havoc with the rice crop, which is just now heavy in the head and more liable to damage than at any other time. The water has been three feet deep in many of the streets of Canton and Honam, and the lower floors of hundreds of houses have consequently been for many hours under water. The hulk of the *Kinshan* arrived here last night in tow of a Hongkong tug, and I hear that a steam launch was seen yesterday near Chuenpee cruising about the river picking up dead bodies. The launch had two boats in tow for the reception of the drifting dead, and the characters on the flags which were flying indicated that the work was being done by the Tung Wah Hospital, which is certainly a very thoughtful and creditable action on the part of the committee of that institution.

Macao harbour

Mr. D. CINATTI.

Barom.	Wind		Rain
in			
29.715	SW-NW	1	
.700	NNE	2	
,,			
.604	N	5	
,,			in
.558	N-NNW	5- 7	0.18
.510	N-NNW	7- 8	
.444	N-NNW	8- 9	
.370	N-NNW	8-10	
.307	NNW-NW	9-11	0.02
.236	NNW-NW	10-11	0.01
.175	NNW-NW	11-12	0.02
.139	NW	11-12	0.12
.120	NW	11-12	0.09
,,			
,,			
.151	NW-WNW	10-11	0 12
,,			
.193	WNW	9-10	0.13
,,			
.253	WNW	9-10	0.24
.338	W-WSW	8-10	0.23
.393	WSW	8-10	0.40
.467	SW	8-11	0.08
.531	SW	6- 7	0.10
.574	SW	4	0.16
.611	SW	3	0.05
.631	SW	3	0.06
.662	SW	3	0.02
.690	SW	2	0.17
.737	SW	1	

Rain fall : in 2.20

Date October 1881	Hours
13th	4 P. M.
	10
14th	Midnight
	4 A. M.
	8
	9
	10
	11
	Noon
	1 P. M.
	2
	3
	4
	5
	5.30
	5.45
	6
	6.30
	7
	7.30
	8
	9
	10
	11
15th	Midnight
	1 A. M.
	2
	3
	4
	5
	6
	7
	8

Hongkong harbour

Capt. F. W. SCHULZE of S.S. "Keelung".

Barom.	Wind		Rain
in			
29.721	NE	1	
.747	NE	3	
.713	NE	2-3	
.620	NE by N	3-5	Rain
.559	NE by N	5-6	
.535	NNE	5-7	
.519	NNE	5-7	Rain
.333	NNE	5-7	id
.278	NNE	6-7	id
.177	N by E	5-7	id
.098	NE by N	7-9	id
.038	N by E	7-9	id
28.962	NE by E	6-9	id
.938	ENE	3-7	id
.938	E	3-5	id
.958	E by S	3-5	
29.001	NE by E	3	
	E	light	
.056	SE-S	1-0	
.121	S SSW	1-3	Rain
.175	SSW	7	id
.307	SSW	7-9	id
.421	SSW	7-9	id
.513	SW	7-9	id
.573	SW	7-9	id
.637	SW by W	5-7	id
.647	SW by W	5-6	id
.767	SW by W	3-5	id
.767	SW by W	3-5	id
773	SW by W	2-5	id
.777	SSW	3	id
.822	SSW	2	id
.889	SSW	1	id

Rain fall { in 5.17 at Stone Cutters' Island. 3.40 at Victoria Peak.

The Typhoon on China.

At Macao and Hongkong, the wind, after the passage of the Centre, settled at SW. and gradually abated whilst the barometer rose again: the Typhoon therefore must have bent its course from NW. to N. or even to NE.

During this new period the Typhoon seems partly to have spread over the region along the coast North of Hongkong, for in the observations of the light-houses we see the barometer, after rising slightly on the evneing of the 14th and the morning of the 15th, fall somewhat again and then keep its level till the evening of the 16th.

At Zi-ka-wei on the contrary, the barometer, after being almost stationary till the 14th noon, rose rather suddenly, to fall again on the 15th 10 a.m., slowly at first, but on the 16th 8 a.m. more rapidly, down to a minimum of $29^{in}.882$ at 3 p.m. The wind, first from NE., was from E. (10.6 miles) at 10 a.m., ESE. (8.6 miles) at noon, SSE. (0.6 miles) at 5 p.m., W. (3.0 miles) between 7 and 8 p.m. and NNW. (7.9 miles) about 10 p.m., thus indicating the passage West and afterwards North of Zi-ka-wei of a whirlwind, which was nothing else than our Typhoon, but considerably mitigated. The rapidity in the fall of the barometer and the evolution of the wind gives to think that the Centre must have passed within a short distance. For all along the Yang-tze-kiang, at Hankow, at Wuhu and at Chinkiang the wind was about N., varying between NE. and NW., thus showing the Centre to have been to the East of those stations.

The Typhoon then, after leaving Hongkong, followed a track already gone over by several of its forerunners, but like them it lost much of its violence in going over an uneven though not very mountainous country, and passed close to us harmless and almost unheeded. But it was taking to the sea again and soon showed, as we shall see, that its energy was not all spent.

Let us state at once that on October 17th about midnight, a small secondary whirlwind which had followed closely upon the Typhoon, made rapidly towards the sea somewhat South of Zi-ka-wei, most likely through Hangchoo Bay: it is pretty clearly indicated in the observations of the light-houses at the mouth of the Yang-tze-kiang and also at Zi-ka-wei by the wind returning to NNE. for a short while in the middle of the night of the 16th-17th.

This is, I think, sufficient evidence of the passage of the Typhoon over our region, and it is unnecessary to give the detail of observations made elsewhere. But we must not leave unnoticed this curious effect on the violence of a powerful whirlwind of a comparatively short run over the continent, which we found before in the case of several other whirlwinds: the natural inference is that an indispensable condition for the existence and energy of a whirlwind consists in the absorption and condensation of enormous volumes of vapour, which condition cannot be fulfilled except on the sea or at least very near the coast.

The Typhoon on the sea and in Japan.

Though our Typhoon, in its passage near Shanghai, may have been ever so mild, it yet exhibited some little energy on the coast, for at the light-houses at the mouth of the Yang-tze-kiang, the force of the wind varied between 4 and 8. The following particulars also prove that it soon returned to something like its pristine fury.

"The British barque *Charley*, Capt Andrew Ray, left Shanghai on the 9th October. Passed North Saddle (latit. 30° 50′-longit. 122° 40′) 16th at noon. Wind SE. moderate, with dark heavy sky to the Northward.

About 2 p.m., wind backed to the NW., with heavy squalls and thence to W., then NW., N., NE. with strong gale. — 17th, wind NNW., still blowing hard."

"The British brigantine *Lucy* left Newchwang on October 11th; had light and moderate breezes from NNE. with mostlly fine and clear weather until noon of the 16th when the wind gradually hauled round to the E. with strong puffs and heavy rain: North Saddle bearing SW $^1/_4$W. 17 miles. At 4 p.m., strong breezes from S. with heavy cross seas. — Midnight 17th, it blew a gale from the S. to the W. with cross seas."

It was towards the Sea of Japan again that the whirlwind bent its way after leaving the Chinese coast North of Shanghai on the evening of the 16th. On the 17th noon, it crossed the southern part of Corea and entered the Sea of Japan, bearing Eastward. About 8h p.m., it touched the coast of Niphon somewhat to the South of Niigata (latit. 37°. 55 - long. 139°. 3'.) and traversed the island over its greatest width, inclining more and more to SE. and S; on the 18th about 2 a.m. it passed near Tokei and at last ran into the Pacific, very likely in the direction of the South-east.

With the exception of the station of Niigata, close to which there passed the Typhoon or rather the small whirlwind, the wind was everywhere uncommonly light, even at Tokei where the fall of the mercury had been more considerable.

We give here below an abstract of the observations made in the principal meteorological stations of the Japanese Empire.

Stations	Latit.	Longit.	Barometric minimum calculated		Fall of the barom.	Winds	Velocity in 24 hours	Rain fall on 17th and 18th
			in		in			in
Nagasaki	32° 44'	129° 52'	29.83	17th Noon	0.19	NE WNW N	150 miles on 18th	0.035
Hiroshima	34. 20	132. 27	29.73	,, 4 P. M.	0.34	N ENE NW NNE	130 ,, ,,	0.003
Kioto	35. 1	135. 46	29.72	,, 5 P. M.	0.36	N W NW	150 ,, ,,	0.845
Niigata	37. 55	139. 3	29 62	,, 8 P. M.	0.52	ENE ESE SE NW N	296 ,, ,,	0.350
Tokei	35. 40	139. 45	29.61	18th 2 A. M.	0.47	ESE NNW NNE N	116 ,, ,,	0.210

Velocity and extent of the Typhoon.

Velocity — It was very variable and increased very rapidly. From the 13th to the 15th, in the China Sea, it was of about 10 $^3/_4$ miles an hour; from the 15th to the 17th, on China, of 15 miles; whilst from the 17 to the 18th, on the Yellow Sea and the Sea of Japan, it averaged 36 $^1/_2$ miles.

Extent—I have already given some few indications with regard to the small size of the Typhoon proper. As for the atmospheric depression resulting from the action of the whirlwind, we see, in the course of the evening, on the 11th, the barometer beginning to sink on board the *Magpie* anchored off Mamo chow island (latit. 21°.34' - longit. 111°.45') some 780 or 800 miles from the Centre; there was yet no storm at Manila whose distance to the Centre did not exceed 240 or 250 miles. The other stations on the coast of China do not lend themselves to a similar enquiry, on account of the numerous whirlwinds which sprang out of the preceding Typhoon and succeeded each other rapidly over that region.

The "Hongkong" Typhoon once gone, the Monsoon NNE. wind settled all along the coast of China, at least at the height of the light-houses, with an incredible steadiness and violence, so that, on looking over the register of barometric observations, one might almost believe in carelessness or even culpable interpolation on the part of the observator: for day and night the direction of the wind seems perfectly unchangeable, its force not

being less constant and keeping between 7 and 9 of the Beaufort scale (0-12), and that not only for two or three successive days but for whole weeks and months. But the records of all the stations are alike, the fact happens regularly every year during the period of the winter Monsoon; it must then be admitted as unquestionable.

In a first paper on that question (1), I took the fact of those strong and persistent winds on the Chinese coast during winter as being due to another cause besides that which causes the Monsoon, namely to an admixture of the tropical North-easterly trade winds: for in summer, when the Monsoon blows from S. or SW. and is perfectly well defined, even at the altitude of the light-houses, the winds are far from having the same steadiness both as to direction and force, nor the same violence as with the opposite Monsoon; there is always an admixture of North-easterly winds which persist obstinately and seem to struggle for mastery with the prevailing winds belonging to the Monsoon. We cannot therefore henceforward expect to see any Typhoons venturing into that region: they will be sure to be repelled as that of September 25th was, as also that of October 25th in the most curious manner, as we soon are going to see.

(1) — Sur l'Inclinaison des vents, 4° - Zi-ka-wei 1881.

Sixteenth Typhoon: 18th — 30th October 1881.

PROBABLE TRACK:

		Latitude	Longitude
October 18th Midnight	Philippines	13° 15′	122° 15′
,, 19th ,,		13. 30	120. 20
,, 20th ,,		13. 45	118. 15
,, 21st ,,	China Sea	14. 15	116. 0
,, 22nd ,,		15. 0	114. 0
,, 23rd ,,		16. 15	110. 40
,, 24th ,,		18. 15	107. 20
,, 25th ,,		24. 0	105. 0
,, 26th ,,		31. 0	107. 30
,, 27th ,,	China	37. 0	111. 30
,, 28th ,,		42. 0	117. 30
,, 29th ,,		40. 30	129. 0
,, 30th ,,	Japan	37. 0	137. 30

EVENTS:

Great violencee on Mindoro (Philippine islands).

Wreck and loss of the Steamer *Humboldt* on Lincoln Shoal on October 23rd.

On the coast of China before and during the passage of the Typhoon.

The intensity of the Monsoon about the light-houses on the Chinese coast was also felt at sea some distance off. It is likely also to have received a considerable accession of strength, even to a great distance, from the passage of this Typhoon, as may be gathered out of the following report of capt. Th. Shaw of the steamer *Hoihow* from Chinkiang (Yang-tze-kiang) to Hongkong.

Steamer **Hoihow** — Captain Th. Shaw

from Chinkiang to Hongkong.

Date	Hours	Latit. — Longit.	Bar.	Wind		Neb.	Remarks
Oct. 18th	9 P. M.	Leave Chinkiang	in			5	Fine weather.
,, 19th	Noon	Off Woosung	30.25	NE	4	3	Fine weather.
,, 20th	Noon	28.°10′ — 121.°50′	.16	NE by N	8	8	Strong breeze and cloudy weather with a heavy sea.
,, 21st	Noon	24. 33 — 118. 51	29.99	NE	9	9	Running under Reefed F. Topsails and Foresail — very heavy sea flooding the deck with water fore and aft, and doing considerable damage.
	4 P. M	Off Amoy	.97	NE	9	9	
,, 22nd	7 A. M	Leave Amoy					The barometer is too low for an ordinary NE. gale; there must be a Cyclone
	Noon	23. 46 — 117. 44	30.04	NE	8	9	Strong gale and high sea — running under Reefed Sails. [to the Southward.
	4 P. M.	Off Lamocks	29.97	NE	8	9	The same weather.
	8	Off Breakers Pt.	30.02	NE	7	9	Moderating.
,, 23rd	9 A. M.	Hongkong					Fresh breeze and cloudy weather.
	Noon		30.00	NE	5	10	Rain.

The ship on the 20th, noon, already experienced a strong breeze (force 8), and yet she was more than 900 miles from the Centre, then hardly getting out of the Philippine Archipelago. The decrease in the strength of the NE. winds on the 22nd and particularly on the 23rd was owing to the position of the Centre which was drawing towards the coast of Cochin China, in consequence of which the whirlwind tended to make the winds turn to E. and ESE.

The Typhoon in the Philippines.

Telegram from Manila. — "Manila, 18th October 3.50 p.m.: A typhoon is raging in the islands; its vortex is going to pass to the South of Manila and with regard to its direction it appears to be W$^1/_4$ NW."

A correspondent of the Manila paper *El Comercio* wrote from Mindoro Island lying South of Manila and of Batangas, that nothing, on the morning of October 18th, yet gave any foreboding of the frightful storm about to burst out in the evening, only that the horizon looked threatening to the West with the wind blowing fresh from N.; about noon it turned to NW., freshening again; at 5h p.m. it hauled to W. and blew a true hurricane till 2 a.m. on the 19th. Strange to say, there was not a drop rain all the time of the passage of the Typhoon over Mindoro during the night of the 18th-19th.

According to these two documents which complete each other, it is clear that the track of the Typhoon passed to the North of Mindoro, within a short distance. The position of of the centre, on the 19th midn., may consequently be set at latit. 13° by longit. 120°.

China Sea.

Paracels Islands. — Wreck of the American ship *Humboldt* on the Lincoln Island (latit. 16°.40' — longit. 112.44').

It is the second disaster of this Typhoon season on those Islands : The English Steamer Elgin, in May, was lost on the Bombay shoal, and now the American ship *Humboldt* came to be wrecked on Lincoln Island, 35 miles further South. It was the Typhoon from Mindoro which cast her on the reef on October 22nd 8 p.m. The report of the captain is full of heart-rending details about the catastrophe and the hardships the seventeen survivors had to endure for eight days on that desert islet, which is only 1$^1/_2$ mile long by $^3/_4$ mile in width and about 20 feet high. In the centre of this island is a well dug by the Hainan fishermen close to stunted cocoa-nut tree, into which the salt water filters : it was indeed salvation to the poor fellows. A fire was obtained by means of the lens of one of the instruments, and it was kept burning constantly to attract the attention of any passing vessel. The party was divided into two, one under the captain and the other under the chief officer, who were stationed on either side of the island to keep watch day and night for any vessel which might pass within sight, and flags were got up to direct attention. On the 30th October the *Gordon Castle* (captain W. Waring) was sighted and, to the great joy of the castaways, she was seen to make for the island.

The poor fellows were taken to Hongkong and a report of the case found its way into the local papers, but it does not say a single word of the direction of the wind and the variation of the barometer during the storm. It is therefore impossible to make out the direction of the track in relation with the Paracels. We can fortunately supply this want with the help of the following document.

French M. M. S. **Yangtse** (2393 tons): Captain H. Lormier

from Saigon to Hongkong.

Date	Hours	Latit. Longit.	Barometer	Wind	Weather
			in		
October 21st	Noon	12. 12' — 110°. 48'	29.82	NE 4	Fine weather.
,, 22nd	Midn.		.78	N 5	Overcast — high sea.
	7 A. M.		.58	NNW 7	Overcast — heavy sea.
	Noon	14. 52 — 112. 33	.43	W 10	Rain — heavy sea.
	1.30 P. M.	15. 5 - 112. 43	.42	WSW 10	id id
	6	15. 21 — 113. 40	.42	SW 10	id id
	11	16. 7 — 114 28	.54	SSW 7	Moderating.
,, 23rd	Noon	18. 8 — 114. 40	.78	S to E 3	Overcast — rainy — high sea.

The *Yang-tse* got very near the Centre in the afternoon of October 22nd; its position at noon must have

been between 15° and 16° latitude by 112°. 30′ longitude. From Mindoro to this point the distance is about 480 miles which the Typhoon travelled over in 60 hours at the very moderate velocity of 8 miles an hour. The depression was not very deep either, as may be seen from the barometric observations of the *Yang-tse*, and the wind was not yet of any great violence.

British S.S. **Hainan**

Hoihow harbour.

Date	Hours	Barom.(1)	Wind		Weather
		in			
October 22nd	7 A. M.	30.00	NE	7	O. M.
	Noon	29.95	,,	7	,,
	2 P. M.	.88	NNE	7	O. C.
	8	.93	,,	8	Q. R.
,, 23rd	6 A. M.	.88	NE	9	Q. R.
	8	.93	,,	10	,,
	Noon	.88	,,	9	,,
	3 P. M.	.83	,,	9	,,
	8	.88	,,	9	,,
,, 24th	5 A. M.	.83	E	8	B. C. Q.
	8	.90	,,	7	,,
	Noon	.94	NE	7	,,
	2 P. M.	.92	,,	7	,,
	5	30.03	,,	4	,,

(1) Correction unknown.

Here may be seen how persistent the NE. Monsoon was and how it kept the barometric variation within narrow limits. The sluggishness of the mercury in sinking and afterwards in rising again is an indication that the Typhoon had described a curve round Hainan to penetrate into the Gulph of Tongking and overrun that kingdom again.

There is no notice of any damage done by this new Typhoon following so close upon its terrible forerunner; the country was evidently indebted for immunity to the NE. Monsoon, which counteracted the energy of the whirlwind.

We may observe that the track of this "Humboldt" Typhoon passes through most of the points visited at the beginning of the month by the "Tongking" Typhoon; on crossing the Philippines however, the Centre kept at a rather lower latitude, so that the general direction of the track is rather more inclined to the North.

Monsoon and swell in the China Sea.

The steamer *Keelung* (Capt. F. Schulze), which we found at Hongkong during the passage of the Typhoon of October 14th, left that port on the next day for Singapore. On the 17th about noon, on passing East of the Paracels, she had the wind veering to NE. force 1. There can be no doubt that it was due to the far reaching influence of the China coast Monsoon, for there soon arose a long swell from the same quarter which gradually gained in intensity, whilst the sky, hitherto clear, became overcast. On the 18th, same wind, force 2; heavy NE. swell. On the 19th midn. the ship lay then on the same parallel as the Centre of the Typhoon, then on Mindanao, 545 miles away in the East. At 6 a.m. the wind turned rather suddenly to WNW. 3; at 8 a.m. it went back to NW. and at noon settled again NNE. 2-3. This momentary evolution of the wind towards the West was really the only indication of a Typhoon in the East. Lastly on the 20th, 6 a.m., by latit. 8°. 35′ and longit. 108°, the ship finally left the region where the NE. Monsoon prevailed; she found SE. winds again, and somewhat lower down light SW. winds. But the undulations of the sea continued long yet in the same direction; the learned Capt. Schulze, in a report full of interesting information, notes it as *high swell from NE.* as far as latit. 2° 13′ by

longit. 104° 40' (October 22nd 4 a.m.).—It will be remembered that Capt. Th. Shaw, of the steamer *Hoihow*, had already found a strong Monsoon and a high sea at the mouth of the Yang-tze-kiang (latit. 31°). It will be easily understood how, with such a barrier ahead, the Typhoon could not get fully developed.

Causes of its direction towards Tongking.

As I have just remarked, the NE. Monsoon between latit. 20° and 10°, if still extant, was comparatively light: it could not, as on the coast of China, be an effective obstacle to the passage of a whirlwind through the China Sea. Now there was, according to all appearances, an area of low pressures on the North of Indo-China, extending over Tongking and the southern provinces of China, Yun-nan and Kuang-si, which may well have had its origin in a detached portion of the atmospheric depression which accompanied the "Hongkong" Typhoon of October 14th. That Typhoon, we know, lost all its energy as soon as it had passed Hongkong and Macao, and gave rise to at least two whirlwinds which ran up Northward; it is therefore not unlikely that a portion of the depression may have continued to extend to the West and have been the cause which called a new Typhoon from the Philippines in that direction through the China Sea. Now all this is not a gratuitous hypothesis, and the log-book of H. M. S. *Magpie,* which has already enlightened us on many a point, supplies us from Hongkong a proof of the existence of those low pressures West of that port and of the Gulph of Tongking. On October 19th and 20th, Cirri are entered as rather numerous, particularly on the 20th, their direction being first SW., then WSW.; at 3 p.m. on this last day there was observed a bank of low clouds passing rapidly from E. to W. If we keep in mind the real constitution of an atmospheric depression, with more or less convergent winds below and divergent winds above, it will appear that those observations made at Hongkong are quite sufficient to reveal the cause which brought over Tongking that Typhoon which originated in the Philippine Archipelago.

At Hongkong the barometer was high on the 18th and 19th (30^{in}.02), and began to fall during the night of the 19th-20th, reaching a minimum (29^{in}.805) on the 21st 2 p.m. : the wind had passed from N. to E. where it settled till the evening of the 24th, to come then to N. The barometer got high again on the 24th and 25th, and there was another minimum on the 27th. This second fall was caused by the violent Typhoon we shall find at that date South of Formosa near the entrance of the Strait; it was its presence on the North of Luzon, even before the "Humboldt" Typhoon had reached the coast of Tongking, which accelerated the rise of the barometer at Hong-kong on the 21st afternoon and brought the wind round to N.; for the first minimum observed at that date was truly an effect of the "Humboldt" Typhoon, though its Centre still continued to approach the coast of China.

We thus find two causes that kept the "Humboldt" Typhoon from the Chinese coast, viz. the huge aerial current which makes up the NE. Monsoon and which will soon again repel the "Monsoon" Typhoon, and the high pressures which this same Typhoon farther North gave rise to on its approach. This last cause, I mean the approach of a new whirlwind in the East, was soon completely to mar the effect of the passage of the "Humboldt" Typhoon in its run northward through central China.

The Typhoon in the North of China.

The gradual fall of the barometer observed at Zi-ka-wei from October 22nd (max. : 30^{in}.31) to the 28th 1 p.m. (minim. : 30^{in}.00) must, I believe, be ascribed rather to the Typhoon which came from Luzon and Formosa at the end of the month than to the "Humboldt" Typhoon which rose from the West northward, though this latter may have a small share in it, since the ENE. winds which blew up to the 25th inclusively, abated and became variable on the 26th and 27th only to freshen again somewhat on the 28th, turn to N. on the 29th, and be superseded at the end of the month by W. and S. winds.

To trace our "Humboldt" Typhoon on China where it certainly penetrated on the 24th or 25th, we must have recourse to the observations made in our stations of Northern China.

Hankow — Let us first state that at Hankow (600 miles inland), we find a few indications of the passage of the whirlwind in the West. The barometer fell indeed as it did at Zi-ka-wei and continued to fall until the 28th, but at Zi-ka-wei, owing to the great distance, the passage of our whirlwind was not indicated by anything but the considerable weakening of the ENE. winds belonging to the other Typhoon, whilst at Hankow its passage in the West and afterwards in the North-west was marked by a real variation in the direction of the wind. On the 25th the wind was between N. and NNW.2; on the 26th it came to NNE. 2, at noon NE.2, and continuing its rotation, SSW., in the evening; on the 27th perfect calm all day long; on the 28th NE. again, then NW. 2 These observations of Mr. N. Titoushkin are of great value for the determination of the route followed by the whirlwind : it really passed to the West of Hankow in the course of the 26th and was still going up northward.

Chang-kia-chwang. (latit. 38°.17'-longit. 116°.14') and **Newchwang** (latit. 40°.35'-longit. 122°.0'). — For five days together, from the 21st to the 25th, the S. wind blew uninterruptedly; on the 26th and 28th it was succeeded by SW. and W. winds and the barometer fell. During this same period there blew at Newchwang a pretty strong SSW. wind, which turned to W., N. and lastly NNE. (7-8) on the morning of the 28th. The minimum of the barometer was observed at Chang-kia-chwang on the 27th between 4 and 6 p.m.; the wind still kept SW. to 8 a.m. on the next day, when it turned to NE. and got considerably fresher (26.5 miles about noon). At Newchwang the minimum (29^{in}.87) was observed on the 28th 3 a.m., and as I stated before, the wind soon came to NNE. and blew violently for the rest of the day.

The upshot of all this is that, before the whirlwind came to those northern regions, there was an area of atmospheric depression North of Peking, on Mongolia. That depression caused a strong aerial current to blow from the South over the northern provinces of China and greatly facilitated the coming of the southern whirlwind by opening an outlet for it. The whirlwind passed to the West and the North of Peking in the evening of October 27th; to the North and to the East of Newchwang in the morning of the 28th : its passage brought heavy weather all over the Gulph of Pechili and the North of the Yellow sea: on the 28th, wind NNE. 7-8 at Newchwang, NW. 6 at Chefoo. At cape Shantong, on the 29th, wind : N. 9-8.

The whirlwind in Japan. — The whirlwind came into the Sea of Japan just North of Corea and made for Japan. Its passage over Niphon was hardly noticed, the barometer alone revealed it. It penetrated into the island by 37° latit., and came to issue into the Pacific above Tokei, where the barometer fell to 29^{in}.585 on the 30th 6 a.m.: this was also the minimum for the month. The wind, which was SSE. before noon on the 28th, passed to WNW., then to NNW. on the 30th, and came back to SE. and SW. in the afternoon of the 21st. These last winds, constantly light, were convergent to a centre of depression, of small consequence in itself, but which nevertheless, on passing from W. to E. North of Niigata, brought there violent winds, viz. on October 31st from W. (25 miles) and on November 1st from WNW. (15 miles). It was a second whirlwind coming like the preceding, from the North of China which it had crossed in the same direction and over the same track; it also came from the SW. and must have been part of the same Typhoon, from which after leaving Tongking, it must have broken loose on striking against the mountain chains of Southern China.

Velocity of translation — It increased very rapidly, as will be seen from the following means :

In the China Sea, from the ..... 19th to the 22nd : 5.2 miles.
" " " ..... 22nd " 25th : 9.7 "
On central China, from the ..... 25th to the 28th : 18.3 "
In the North of China and the Sea of Japan, from the 28th to the 30th : 21.7 "

"MONSOON" TYPHOON

Seventeenth Typhoon: 24th — 30th October 1881.

TRACK :

October 24th	East of Luzon, on Pacific.
" 25th	March slow between Luzon
" 26th	and Formosa northwardly.
" 27th	
" 28th	*Re*-curving towards the East.
" 29th	On Pacific, South of Japan.
" 30th	

EVENTS :

Progress very slow. — The Typhoon suddenly thrust away into the open sea.
Loss of the German Frigat G. T. *Muntz* on the coast of Batanes island, on October 26th.
Loss of the American ship *New Era* on Cape Bojeador (Luzon), on the 25th.
Great flood in the Provi..ce of Ilocos (Luzon).

Reason of the name of "Monsoon" Typhoon.

H. Piddington, in his Sailor's Horn-book, speaking of the various tracks of Typhoons observed in the China Seas, mentions a particular one in the following terms:

"It is perfectly well ascertained by a good log and notes from the commander of the vessel, Captain Shire, of the Barque *Easurain*, first travelling out from the coast (east) of Luzon and then curving to the N. by E., but when arriving at about 50 miles from the South point of Formosa, suddenly *re*-curving again, so as to travel out to Eastward! making thus, if we suppose the Cyclone to have originally come up from the ESEward from the Pacific Ocean, in about latit. 15° and longit. 130°, a double curve analogous to the curves of the Cyclones of the Gulph of Mexico, and occurring not far from the tropic, or with us in latit. 20° and in the West Indies from 25° to 36° N."

It was in November 1847 that this Typhoon took place, and, from what I am going to say, most probably on the first days of the month.

On October 29th 1880, a Typhoon formed in the region South of the Philippines Archipelago, after rising from S. to N. over the China Sea towards the West of Luzon, appeared at the Southern entrance of the Formosa Strait as if to enter it and pass to the North of Formosa; but, repelled by a stronger power, it came back a short way and turning eastward, escaped into the Ocean to the East of Formosa. My paper on the "Typhoons of 1880" gives the evidence relative to that singular track.

And now we find in 1881 a third instance of the inability of Typhoons to pass through the Formosa Strait at this time of the year: for the present Typhoon of October 24th-29th after being almost reluctantly attracted in that direction, was repelled from the Strait by an irresistible force and compelled to escape eastward into the open sea. There must therefore exist in that region, at this time of the year, a powerful force depending upon the state of the atmosphere, which generally hinders the passage of whirlwinds and protects the coast of China against

their incursions. That force is nothing else than the NE. Monsoon, and such is the reason of the name given to the Typhoon which offers us an opportunity of ascertaining this remarkable fact.

Here we find a most curious confirmation of what I stated on another occasion about the mutual attraction which Typhoons or depressions seem to exert on one another and which often determines their direction.

The "Humboldt" Typhoon still lay on the Chinese continent, but devoid of energy as it had become subdivided and spread over a vast extent of country. Two principal fragments or rather misshapen whirlwinds were then rising Northward one behind the other to make their way towards Japan. From the 24th to the 28th October, the atmospheric pressure on central China must have been low, whilst the action of violent polar winds on the coast and pretty far South on the sea must have raised here the pressure. If a whirlwind came to spring up on the Philippines, its direction might then be pointed towards China. The condition of the atmosphere seems to have been favourable to such a formation and, on October 24th, there really was a Typhoon making its appearance on the North-eastern coast of Luzon with a well marked direction towards China.

Two telegrams from Manila.

"Manila, 24th October 1881, 4.25 p.m. — A Typhoon is raging to the NE. of Luzon, close to the coast; it appears to incline to the WNW."

"Manila, 25th October 1881, 8.30 a.m. — The Typhoon announced yesterday is going very slowly and, as the last, changes its direction frequently *through the hills of the island.*"

The hills in the North of Luzon have nothing to do with this, for such a violent whirwind would not be disturbed by such an obstable: the cause of its slowness and hesitations must be sought for elsewhere.

The Monsoon in the Strait of Formosa.

Tai-wan-foo. — Though a better view of the important phenomenon of the Monsoon be obtained at some distance in the offing and at a certain height, yet it is far from being unperceived on the coast. Thus at Tai-wan-foo (South-western coast of Formosa) we find the wind during October to blow between N. and NNW., usually fresh and often strong. That direction of the prevailing winds is imposed by the enormous mountain chain which runs all through the island from North to South and naturally affects the Monsoon whose normal direction is NE. At Tai-wan-foo those NNW. winds are very dry, and there was not a drop of rain during October.

Tamsui (North of Formosa). — Here there are no mountains to disturb the wind and therefore it blew steadily from NE. since October 17th. As I have already stated, it was on the 19th that the Monsoon got definitively settled on the opposite coast of China. At Tamsui its average force was 5 of Beaufort's scale (1).

(1) — At Tamsui and at Keelung those North-easterly winds have a remarkable effect which must not pass unnoticed and which gives to that Monsoon of the Northern coast of Formosa a special and almost unique character. Everywhere else the winter Monsoon can generally be called the *dry Monsoon* in opposition to the summer Monsoon which is the *wet Monsoon*. Now on the Northern coast of Formosa, though it be not exactly the reverse, yet it is certain that the time of the NE. Monsoon is emphatically the wet season. The following figures will show to what enormous extent this part of Formosa deviates from the common rule. Keelung lies about 25 miles East of Tamsui.

MONSOON region in Eastern ASIA.

Stations	Wind		Rain		
	Winter	Summer	Winter	Summer	Year
			in	in	in
Nikolajewsk	N 68° W	East	3.29	9.74	13.03
Newchwang	N 29 E	S 16° E	1.58	19.58	21.16
Peking	N 37 W	S 17 E	1.74	23.94	25.68
Zi-ka-wei	N 10 E	S 59 E	14.81	27.52	42.33
Nagasaki	N 7 W	S 11 W	12.26	35.45	47.71
Keelung	N 47 E	S 62 E	64.79	55.33	120.12
Hongkong	N 73 E	S 1 E	13.63	70.97	84.60
Manila	N 64 E	S 50 E	15.00	51.54	66.54

But, as I said before, it is at a distance from the coast, far from the causes which on land make the winds so variable, and particularly at a certain height above the sea level, that we can properly appreciate what that winter Monsoon is on the coast of China, though it may be, as I really think, blended with the North-easterly trade winds, here having a common direction with it.

Not to make this discussion too long, we shall only take the observations made during the last fortnight of October at the principal light-houses of the Strait of Formosa.

Fisher Island (Pescadores) : latit. 23°.33′-longit. 119°.28′-height 205 feet.

Previous to the 17th the wind tended to come to N. or NNE., but was variable. From the 17th, there was but one wind, NNE., blowing day and night without interruption and almost without variation of force, between 6 and 7, except on the 17th and on the 31st. During the period from the 25th to the 28th, when the Typhoon was raging South of Formosa, that same NNE. wind blew steadily with force 7. It rather lulled on the 30th, and on the next day fell to force 1, under the influence of the violent whirlwind which had just altered its direction.

Lamocks : latit. 23°.15′-longit. 117°.17′-height 241 feet.

At Fisher Island the proximity of the long and high mountain chain of Formosa caused the Monsoon to haul somewhat to the North. Here, at the West, near the Chinese coast, at the southern entrance of the Strait, the winds have very free access from the East and North-east and it is between these two directions that the prevailing winds kept up, being mostly from NE. and ENE.; so early as the 18th they had force 8, on the 21st they rose to 10, fell to 4 and 3 on the 27th oscillating now and then to N. and NNW. under the influence of the Typhoon; on the 31st rather changeable again.

Ockseu : latit. 24°.59′-longit. 119°.28′-height 286 feet.

Here, at the northern entrance of the Strait, there is nothing to interfere with the wind which consequently retains its full force. — Monsoon perfectly steady from NNE. On the 18th force 9; from the 19th to the 23rd force 10 without any intermission; then till the 29th force 9; on the 29th and 30th falling to 7 and 6, oscillating between NE. and NNE; on the 31st, blowing from N force 4.

Middle Dog : latit. 25°.58′-longit. 120°.2′-height 257 feet.

This is the northernmost of all the light-houses of this region. Monsoon perfectly steady NE. force 7-6. On the 31st wind oscillating between N. and ENE. force 2.

Such, I think, was the obstacle which was necessary and also sufficient to check our atmospheric whirlwind and fling it back to sea again. The persistency of this Typhoon in attempting to pass through the Strait in answer to the call that indraughted it, is not less remarkable than the mightiness of the huge aerial current established all along the coast of China and capable of overcoming such a terrible antagonist. There must have been

---

What at first sight appears a strange anomaly is easily explained. It is well konwn that, if a current of air come to strike a high mountain and be forced up along its side to pass over it, it will cool down on rising and the moisture it may contain will condense first in the shape of cloud and then into rain, so that when descending on the other side it will have been deprived of most of its moisture. And now with regard to the NE. wind prevailing at this season, Keelung and Tamsui are on the side of mountains against which the wind has to rise and consequently parts with its moisture on cooling, whereas Tai-wan-foo and Hongkong are on the opposite side.

From the 14th to the 18th October, at Tamsui, there were but two days without rain, the 15th and 16th, and the rainfall during that interval amounted to 17in54!

There is yet however another circumstance on the northern coast of Formosa to further that enormous production of rain in winter : it is namely that the NE. wind passes above and parallel to the great marine Japanese current or *Kurosiwo* whose temperature in winter still attains 70° : it precisely first touches the eastern coast of Formosa, then to bear NEward.

a great force of resistance on both sides to bring about such a protracted struggle. But how can we realize the fact of a comparatively small whirlwind coming from afar as indraughted towards a region of low pressure and having to cross a strong opposite current which, far from having any apparent tendency to obey that same call, on the contrary bars the passage of the whirlwind with all its might? This is, I confess, a serious difficulty against the hypothesis of a call towards central China. And yet we shall see hereafter that the Monsoon itself had to yield to that call and give rise towards the West to a whirlwind which afterwards was not without exerting some action upon our Typhoon after it had the worst of it near Formosa.

On this difficult point I shall venture the following explanation. The Monsoon, as well as the NE. trade wind which is blended with it, cannot have a very great depth: their great force at the level of the sea and at the inconsiderable height (200ft.) of the light-houses seems to prove that, at the same time as they must contract in order to pass through the narrow Formosa Strait, they are not free to expand upwards. Above then and at a great height, there must be another not less powerful current running in the opposite direction or nearly so, which current is nothing else than an equatorial current called Northward and towards central Asia to fill the place of the mass of air which during winter escapes unceasingly with the Monsoon and the trade winds. Now in this current our Typhoon may have had its head and it was probably with its help that it sought to force its way through the Southern entrance of the Strait of Formosa.

The Storm between Luzon and Formosa.

Wreck of the American ship NEW ERA (Captain Th. Sawyer).

"Left Hongkong for San Francisco with general cargo, on the 17th October, had nothing to report up to the 25th of the same month, when she experienced a strong gale. For two days were unable to take observations. At 4 p.m. of the 25th a hurricane came on from the NW., veering to WNW.; at 8 a.m. of the 26th we determined to set some sail, thinking we were free from the coasts, in order to put back to the North; but at 1 p.m. heavy breakers were observed ahead, and shortly afterwards the vessel struck some rocks, and bumped on them for about half an hour, until carried over by the force of the waves. The vessel was carried to the praya, some half a mile from the land, the situation of the vessel being about five miles to the West of Cape Bojeador; at 6 p.m. we lowered the lifeboat, but a heavy sea smashed it against the side of the ship, and the three men who had got into it were carried by the sea towards the West. No assistance could be given them. The rest of the crew remained lashed on the poop of the ship, so that the sea should not carry them overboard; at 8 a.m. of the 27th the vessel was split in two, and the masts fell, placing us in an awkward position, as we might have been killed by the debris which tossed around us. Fortunately we only suffered a few contused wounds, in which state we determined to jump into the water; and after struggling with the waves for about one hour and a half succeeded in landing where we found the three men above-mentioned, and the Captain was glad to see that all the crew were, by the grace of God, saved... On the following day the Governor of the place, D. Mariano Luna, arrived at the praya and took us to his residence in the village...".

Flood in the Province of Ilocos (Luzon).

According to the telegram from Manila, on October 24th the Typhoon was already raging in the provinces North of Luzon. Till the 28th there blew a furious Westerly wind accompanied with diluvian rains: it drove back the water of the rivers into the interior and on the North-western coast, near cape Bojeador, causing such a flood as had never been known; the Province of Ilocos, both North and South, was completely laid waste.

The persistency of those Westerly winds is a clear proof that the Typhoon continued on the North of Luzon as late as the 28th. Its first direction on the 24th and 25th was to WNW.; it came from the East and bore towards the North-eastern headland of Luzon. We have already seen on the 25th the *New Era* in the storm, near cape Bojeador, with violent winds from NW. turning to WNW. Once arrived close to the coast of Luzon, the Typhoon was precluded from going on; it had to keep in that region, rising slowly Northward towards the Southern cape of Formosa.

Wreck of the German Ship G. F. Müntz.

The floods of Ilocos and the wreck of the *New Era* were not enough for the fury of the Typhoon; there must yet be other disasters. Almost equally distant from Luzon and from Formosa there are two groups of islands belonging to the Philippines, viz. the Babuyanes islands close to Luzon on the North and the Bashee islands in the middle of the Strait that separates the two great islands. It was on one of those small islands, the *Batanes* or *Batang* island, that the German ship *G. F. Müntz*, capt. Hector Stenzel, was cast by the storm.

"The vessel left Hongkong on the 8th October, in ballast, bound for Astoria, province of Oregon in North America. All went well up to the 24th October, when she experienced strong wind from N., which was blowing with hurricane force, and tremendous sea, with an adverse current running. The vessel was in the midst of a typhoon on the 25th such as the Captain said he does not recollect having met during his thirty years experience as a sea-faring man. One of the crew was killed by the force of a wave which swept the deck. This state of things continuing, the ship stranded on the coast of the island of Batanes on the morning of the 26th, about 9 o'clock; the Captain, his wife and fourteen of the crew being saved, and the vessel was left lying upon a rocky bank. On the same day the crew tried to save the ship's papers and some of their clothing; a few natives came to the scene and offered them hospitality, and on perceiving that they were amicably disposed, the offer was gladly accepted... On the 29th the Captain presented himself to the Governor of the place, Sênor Gandullo Luque, to report the loss. . . .".

How the Typhoon cannot have come near the Strait of Formosa.

What we have just said of the fury of the Typhoon on the Northern coast of Luzon and on the Bashee islands proves clearly that it continued for a long time in that region, but does not give the direction it ultimately followed. The comparison of some series of observations will show us towards what quarter it must have made off, for it could not possibly long remain almost stationary.

Takow Harbour.

Latit. 22.° 36′ — Longit. 120.° 17′

Date	Hours	Barom.	Wind	Rain	Weather
		in			
Oct. 25th	9.30 A. M.	29.77			
	Noon	.73	NNE		Cloudy
	3.30 P. M.	.67			
,, 26th	9.30 A. M.	.70		in	
	Noon	.67	Variable	0.15	Cloudy
	3.30 P. M.	.60			
,, 27th	9.30 A. M.	.64			
	Noon	.62	NW	0.10	Overcast
	3.30 P. M.	.54			
,, 28th	9.30 A. M.	.58			
	Noon	.58	NNE	0.05	Cloudy
	3.30 P. M.	.55			
,, 29th	9.30 A. M.	.87			
	Noon	.86	NE	0.20	Overcast
	3.30 P. M.	.85			
,, 30th	9.30 A. M.	30.00			
	Noon	.00	NW		Cloudy
	3.30 P. M.	29.95			
,, 31st	9.30 A. M.	30.05			
	Noon	.03	NW		Fine
	3.30 P. M.	29.97			

Tai-wan-foo Harbour.

Latitude 22.° 58′ — Longitude 120.° 14′

Date	Hours	Barom.	Wind	Rain	Weather
		in			
Oct. 25th	8 A. M.	29.765	NNW light		Light wind and clear sky until. 1 p.m.— afterwads strong breeze—hazy weather.
	4 P. M.	.795	NW strong		
	8	.775	,,		
,, 26th	8 A. M.	.726	NNW fresh		Fresh NNW breeze with hazy weather throughout the day—moderate sea on bar.
	4 P. M.	.603	,,		
	8	.654	,,		
,, 27th	8 A. M.	.632	,, moder.		Moderate breeze with hazy weather all the day — heavy sea on the bar.
	4 P. M.	.566	,,		
	8	.609	,,		
,, 28th	8 A. M.	.652	,, strong		Strong breeze with hazy weather all the day — heavy sea on bar.
	4 P. M.	.596	,,	Nil	
	8	.674	,,		
,, 29th	8 A. M.	.853	,, fresh	Showers	Fresh breeze with showers of drizzling rain — moderate sea on bar.
	4 P. M.	.878	,,		
	8	.926	,,		
,, 30th	8 A. M.	30.028	,, light		Light wind and fine weather up to 3 p. m. — afterwards strong breeze — smooth water on bar.
	4 P. M.	29.975	,, strong		
	8	.996	,,		
,, 31st	8 A. M.	.891	,, moder.		Moderate breeze and fine weather all the day — smooth water on the bar.
	4 P. M.	.985	,,		
	8	30.011	,,		

On those two points of the South-western coast of Formosa, not far apart from each other, the barometer was already low on the 25th and still went sinking slowly till the morning of the 28th; then on that and the next day it rose very rapidly again: the Typhoon, after keeping for three days about Formosa, must have made off some way or other. On the 28th and 29th, the wind at Takow veered from NW. to NNE. and NE., whilst at Tai-wan-foo it blew from NNW. and got fresher: the flight of the Typhoon cannot therefore have been Westward; it must have been Eastward. And this is confirmed by the observations made at Fisher Island light-house (Pescadores). They give the barometric minimum in the night of the 27th-28th, which would be impossible if the whirlwind went Westward, since the light-house lies 38 or 40 miles to the left of the two harbours.

But more conclusive yet is a comparison of the observations made simultaneously at Fisher Island and Lamock light-houses, both almost on the same parallel and about 120 miles apart. The barometric minima were observed almost simultaneously on the 28th about 3 a.m.: $29^{in}.54$ at Fisher Island and $29^{in}.75$ at Lamock. The Monsoon wind was NNE. at Fisher Island and it retained its force (5-6) from the 25th to the 30th. At Lamock it was ENE. but the action of the Typhoon made it to turn on the 27th and 28th to NNE., to N., sometimes even to NW. and weakened it considerably (force 3-2); on the 29th the Monsoon took its regular course again (force 4-5) whilst the barometer rose, a proof that the Typhoon did not come to that quarter.

At Hongkong and Macao, barometric minimum also on the 27th: at Hongkong at 3 p.m. ($29^{in}.78$); at Macao at 4 p.m. ($29^{in}.81$) and the barometer then took to rising again. The Typhoon therefore is not to be sought for here.

At Tamsui in the North of Formosa, the NE. Monsoon, perfectly steady, gained strength between the 25th and the 2[illegible]th; on that day, noon, it had force 9 and the barometer must have had its minimum between 7 a.m. and noon: at 7 a.m. $29^{in}.659$ — at 1 p.m. $29^{in}.699$. Now if there were a whirlwind proceeding from the Southern headland of Formosa Eward or NEward, it would first naturally bring to the Northern coast of the island strong NE. winds which afterwards would turn to N; and this is precisely what took place at Tamsui when the Monsoon freshened and attained (on the 28th) to force 9, to abate afterwards. Besides, the barometric mi-

nimum seems to have taken place somewhat later than in the ports of the South-west coast, which circumstance agrees with the indications of the wind.

We are then sure that our Typhoon made away to ENE. It had come from ESE. and described an arc of a parabola whose apex lay between Luzon and Formosa, though it would seem that the second branch of the curve was not symmetrical with the first.

On October 28th, Capt. Th. Shaw of the SS. *Hoihow*, going to Shanghai, noticed in the Formosa Strait that, in spite of a strong breeze from NE., the heavy swell also from NE. he had had all the way, now fell rapidly. At noon, on emerging from the Strait, no swell—wind NE. 6; but on the 29th midnight there is an entry in the log-book of *Swell from the Eastward.* — We have here a sure indication of the presence of the Typhoon in the East.

The Typhoon in Japan. — Three whirlwinds at the same time.

The progress of the Typhoon had been exceedingly slow ever since its first appearance on October 24th, to the 28th when, after vainly attempting to penetrate into the Strait of Formosa, it came back towards the E. to the open sea. It first proceeded slowly, though the call Westward to which it obeyed was so much the stronger as the Monsoon which had just so firmly barred the entrance of the Strait, even began to lose some of its strength and yield to the preponderating influence which, under the present conditions of the atmosphere in central China, tended to turn the aerial currents from the sea to the continent : on the two last days of October the NE. wind lulled down rapidly; the high pressure collapsed and, on the 31st, a whirlwind which we shall soon follow, sprang up inland and ran, first Westward, then towards the North and North-east where we shall find it again under rather singular circumstances.

As for our Typhoon, there was but one way open for it, namely towards Japan where we know the atmospheric pressure to have been very low at the end of October, owing to one of the fragments of the "Humboldt" Typhoon which passed over that country from NW. to SE. Its progress was slow, but its velocity increased gradually (1). When it arrived near the Southern coast of Japan, the "Humboldt" Typhoon was already far away in the Pacific and, on the 3rd, very high pressures had settled over the Northern part of the Archipelago and as far as the coast of Siberia : (at Tokei, on the 3rd 9h p.m. : $30^{in}548$; at Wladivostock, on the 4th 8 a.m.: $30^{in}477$ according to the excellent observations of Capt. Anderson of the SS. *Appin* which were of great help to me in unravelling the apparent confusion resulting from several simultaneous whirlwinds). The Typhoon had to incline somewhat to the North to avoid those high pressures, which it did from the 3rd to the 5th; it now followed the lead of a first continental depression which came from the South-west over the North of China and Mongolia and seems to have been nothing else than a whirlwind detached from the Typhoon as early as October 25th, as we shall see hereafter. It went along the Southern coast of Niphon, on November 6th afternoon, caused a strong blow from E. (22.6 miles) at Tokei. In the evening of that same day, it turned round the Peninsula east of the Gulph of Yedo; on the 7th about midnight, it alighted on the island to the North of the Capital, crossed Niphon between Tokei and Niigata, passed over the sea of Japan and rose up Northward, all the time in the wake of the depression, though they got somewhat further apart in the Sea of Okotsk towards Kamtchatka or about Berhing's Straits.

(1) The British steamer *Tyne* (Capt. Hazard), after leaving Nagasaki in the evening of the 2nd, had first strong breeze from ENE. and heavy rain, then strong breeze from NW. with clear weather on the 4th and 5th : it was evidently our Typhoon.

A third Centre of depression from the West, very likely from the desert of Gobi, came to be indraughted behind the two depressions. On the 7th noon, it passed northward between Peking and Newchwang; on the 8th skirted along the coast of Siberia somewhat behind our Typhoon and made of for the Pacific through the Strait of Sungar between Niphon and Yesso. This third depression probably did not continue its course NEward; it must have inclined somewhat to the South on the 10th and 11th and have finally disappeared in the SE: for at Tokei the barometer fell again on the 10th and 11th, and on the 12th the wind passed from W. to NW. and N.

The lowest minimum observed at Tokei during all that period of atmospheric perturbation was $29^{in}.702$, on the 6th 3 p.m. On board the *Appin*, in the bay of Gamon, a little to the South of Wladivostock, the barometer sank still lower, viz. to $29^{in}.436$ on the 7th 7 a.m., which minimum was simultaneous with the passage of the Centre of the continental depression formed near the coast of China at the end of October. At that moment the wind was moderate and variable, because the Typhoon which had crossed Japan was just reaching the inner sea and was not far distant from the coast of Siberia: the winds it tended to bring out there were then naturally contrary to those of the depression passing in the West. There was a second minimum ($29^{in}.650$) for the *Appin* on the 8th between 5 and 6 a.m., chiefly due to the third depression coming from Northern Asia, which, on its passage near the western coast of Japan and rising up towards the North-east, caused a violent blow from SSW. (force 9) encountered by the *Appin* in latit. 41°.30′ by longit. 130°.0′. The Centre of the Typhoon was at that moment about 180 miles from the *Appin* in the NNE., and it was probably on account of that circumstance that the barometer sank less than in the first instance, though the wind was stronger.

In a case like this of several simultaneous perturbations which each and every one bring their influence to bear on the phenomena observed at the various stations, it is hardly possible to determine the tracks with unerring accuracy. In such complicated cases the winds are light and irregular and their indications cannot be received too cautiously; the barometer with its variations at the several stations is more to be depended on.

Splitting of the Typhoon at Formosa Point.

Course of this second whirlwind; its breaking up on the continent.

We have seen that when, on October 28th, the Typhoon had finally left the South Point of Formosa, the Monsoon abated and was superseded at several points of the coast, about Shanghai for instance, by very variable winds as to strength and direction. At the same time the barometer took to sinking. At Zi-ka-wei there was observed a first minimum ($30^{in}.003$) on the 28th 1 p.m.; a second ($30^{in}.058$) on the 31st 3 p.m.; a third ($30^{in}.071$) on November 3rd 4 a.m., and the barometer kept thus low to the 9th. As for the winds during this period, they were NE. and E. on October 27th; ENE. and NE. on the 28th; NW. and N. strong on the 29th; W. on the 30th; SSW. and S. on the 31st; SE. and E. on November 1st; variable on the 2nd. On the 3rd they began to haul to W. and WNW., where they settled till the evening of the 7th.

All this points to a very complicated system of whirlwinds which it is not easy to make out clearly. An attentive and minute comparison of our observations with the three-hourly observations made at the four light-houses of the mouth of the Yang-tze-kiang, also at Chinkiang, at Wuhu, at Ningpo and Hankow, together with the reports of several captains, have led me to the following conclusion: whilst the "Monsoon" Typhoon was battling with the Monsoon winds between Luzon and Formosa, there happened what we had already seen twice under similar circumstances, viz. the depression split up on approaching Formosa and the whirlwind thus formed rose Northward to seek an easier passage. Between the 25th and the 29th October, it ran up to the 33rd parallel,

causing on the way little storms all round its Centre, particularly with the winds between NE. and NW., as is natural at this period of the prevailing Monsoon. On October 30th the whirlwind turned to the W. and entered the continent. Descending first to the SW., then on the 31st to the S., it came to pass below Zi-ka-wei again, taking to the sea in the afternoon and soon turned to the North again on the coast East of Zi-ka-wei, its motion at the same time getting slower and slower. It would seem to have remained in the neighbourhood of Shanghai, somewhat to the North after November 2nd or 3rd, oscillating now to the right, now to the left until it vanished, for there can be discovered no trace of its escape any way.

But that is not all. On October 30th, whilst this whirlwind was descending on the West of Zi-ka-wei, there must have come off out of it another small whirlwind, which occasioned at Hankow a barometric minimum in the afternoon of the 31st and brought the winds, first to NW. 1, afterwards to ENE. 1 and to SSE. 2 on its passage, which then would seem to have been effected through the valley of the Yang-tze-kiang, but South of Hankow. This minimum at Hankow I do not ascribe to the same whirlwind which, at Zi-ka-wei on the same day and almost at the same hour, caused the barometer to sink even lower, the wind turning from SW. to S. and to E.: the way in which the wind varied simultaneously at the two places is incompatible with a single centre of depression. — Besides, I find in the observations of the catholic Missionaries at Song-show-chwang (1) (near Lan-chow, the capital of Kansu) the passage in the East, on November 4th about midnight, of a violent whirlwind bearing SW. to NE. A barometric minimum, the lowest in November, 622^{mm}9, took place on November 4th 4 a.m. and the wind on that day blew first NNE. 3 before noon; from 2h 30m p.m. on till late in the night, it was NNE. 7.

On the other hand at Tientsin the barometer was low (fall = 0^{in}.30) on the morning of the 6th; fresh NW. wind settling in the course of the day. — At Newchwang a marked minimum (fall = 0^{in}.58) at noon; wind settling very strong NNW. 7.

It would be easy, I think, to identify the whirlwind which passed below Hankow on October 31st with that which descended from the high table-land of Asia towards Mongolia and the Sea of Japan where we met it in the evening of November 7th effecting its junction with the Typhoon that had come to Japan from Formosa. And thus by a strange coincidence those two fragments of the same depression, after such different courses, would seem to have met again 13 or 14 days after parting. From the 1st to the 4th of November, the Hankow whirlwind seems to have continued to penetrate into the interior of China, probably in a westerly direction up the valley of the Yang-tze-kiang; to have begun turning Northward about longit. 110° and to have made for the North-east after passing Lan-chow. This track cannot however be taken unreservedly; but if the identity of the two whirlwinds could be borne out by a few observations between Hankow and Lan-chow, the Hankow whirlwind would then appear to have been the principal one of the two which we find West of Zi-ka-wei on October 30th and 31st, for the whirlwind which on the following days came to sport over the course of the Yang-tze-kiang possessed but little energy and was to vanish quickly.

I shall mention a last particular which seems to justify the importance given to the Hangkow and Lan-chow Typhoon; namely that on the coast of China between Wenchow and Ningpo, on the afternoon of October 31st and the morning of November 1st, the Chinese steamer *Yungning* (capt. Buchanan) only found a strong SE.

(1) That station is of great importance for us, being farthermost in the interior. It lies in latit. 36.° 7′ by longit. 103.° 56′, nearly 5000 ft. above the sea level and belongs to the great high Asiatic tableland.

breeze, pointing to an important Centre of depression in the West. Between Ningpo and Shanghai, from the 2nd noon to the 3rd 10 a.m., the winds were variable, with rain.

The 2nd continental depression. — It will be recollected that on November 8th a third Centre of depression made its appearance about the Siberian coast of the Japan Sea, and occasioned a pretty strong storm (wind SSW.) which the English steamer *Appin* went through. This depression came from the West and well may have been formed at the expense of the preceding one, for it was hardly noticed at Song-show (Kansu). It was on the contrary well marked at Si-wan-tze, another high station (3800 ft.) of the catholic Missionaries, in Mongolia, 68 miles to the NNE. of Peking. But here it got blended with another depression which came on almost immediately, so that there was but one minimum, viz. on the 8th about noon, the fall of the barometer being $0^{in}.51$ since the 4th; whilst at Newchwang there were two distinct minima: on the 7th shortly after noon and in the night of the 8th-9th.

We see from all this what a deep atmospheric perturbation was brought about by that "Monsoon" Typhoon all over China, Mongolia, Eastern Siberia, Japan and the surrounding seas. Obliged to yield to a more powerful antagonist, it divided its forces and turned all obstacles, thanks to the perturbation caused by its very struggle; one part reached the Centre of China and then took the shortest though not the easiest cut to join again the main body, which had proceeded slowly to another field.

Eighteenth Typhoon: 6th — 12th November 1881.

DETAILS OF THE TRACK UNKNOWN

The Monsoon in the China Sea.

The winter Monsoon, on becoming settled on the coast of China about the middle of October, worked a thorough change in the system of the winds and set a protecting barrier against the inroads of Typhoons: that of October 25th-28th once gone, it extended down to Luzon. From the first days of November, the polar winds lowered the temperature somewhat and caused the barometer to rise; consequently any depressions or whirlwinds which should yet have to make their appearance before the end of the year must necessarily be thrust towards the Southern part of the archipelago and be confined within the equatorial zone. But even here the NE. Monsoon extended down to the Equator. At the date of October 20th, the SS. *Keelung* (Capt. F. W. Schulze) sailing to Singapore had finally parted with it by 9° latit., though the swell it was raising farther North where it had its full strength continued lower down so far as 2° above the equator. But on leaving Singapore on the return voyage, on October 28th, the NE. winds appeared as settled winds so low as 2° and their force increased with the latitude; on the 31st, by 9° latit., they were of force 4.

There is therefore nothing to wonder at if a Typhoon emerging from the Philippine Archipelago should only make for the Southernmost part of the Indo-Chinese Peninsula, towards Saigon for instance, as one precisely did at the same date in 1880.

Course of the Typhoon in the China Sea.

I have no information in this respect beyond the brief indications given in the Manila paper *El Comercio* by the Director of the Observatory. On November 6th the barometer was sinking at Manila under the influence of a centre of depression formed in the South, near the Northern coast of Mindanao: it was a well defined Typhoon which penetrated into the China Sea along the parallel of 10° with a slight inclination to WSW. (?); it would seem to have passed close to Saigon about the 12th.

I only mention a second Typhoon supposed to have been raging in the China Sea from the 16th to the 20th of November. There is no reliable information to prove its reality.

DANUBE TYPHOON

Nineteenth Typhoon: 26th — 29th November 1881.

TRACK:

			Latitude	Longitude
November 26th	Midnight		9° 0′	127° 0′
27	,,	Philippines	11. 0	123. 15
28	,,		12. 30	117. 30
29	,,	China Sea	14. 0	110. 15

This Typhoon, notwithstanding the lateness of the season, was not inferior to any in violence. In laying out its track, I have made use of some interesting correspondence in the Manila *El Comercio* and of the report from the *SS. Danube* whose position during the storm was such as to leave no uncertainty about the course of the Typhoon from the Philippines.

The Typhoon in the Philippine Archipelago.

Mindanao. — According to a letter from a Missionary residing at Jabonga de la Laguna de Mainit (latit. 9°29′ - longit. 125°38′) the Typhoon would seem to have formed in that neighbourhood on November 26th; for the last four or five days there had been rain with winds variable in direction and force. On the 26th, wind often violent, passing rapidly from SW. to NE. On the afternoon a deluge of rain; at 5 p.m. a sudden calm; at 6 p.m. a furious wind springing up from ESE. and a diluvian rain : turned to SE. during the night - storm lulling gradually.

Cebu. — The S.S. *Sorsogon*, anchored in the harbour of Cebu (latit. 10° 30′ - longit. 124° 0′) had the following observations.

Steamer **Sorsogon**

at Cebu.

Date	Hours	Barom.	Wind	
		in		
November 26th	10 A. M.	30.10	N	freshening, rain.
	6 P. M.	.04	N	id id
	9	29.96	N	strong
	10	.94	N	hard
	11	.90	N	id
,, 27th	Midn.	.88	N	less hard
	1 A. M.	.85	NNE	strong —hard squalls
	2	.81	NE	id
	3	.86	E-S	id
	6	30.00	S-SW	id

Though the depression is inconsiderable, there is no doubting that the Centre passed near Cebu, somewhat to the South of the island, on the 27th about 2 a.m. It was bearing straight West or inclining slightly to Northwest.

On the other hand, the report of the Captain of the *S.S. Danube,* sailing up to Hongkong, shows the Typhoon to have run from the 10th to the 13th parallel between the 26th and the 29th November.

The Typhoon in the China Sea.

Steamer **Danube**

China Sea.

Date	Hours	Barom.	Wind	Remarks
		in		
November 28th	4 A. M.	30.10	N by E	Fresh and sea.
	6	—	N by W	,, ,, — set all fore and aft sail, ship steering NE ½ E.
	7	—	N by W	Increasing wind and sea, with thick rain.
	8	29.95	N by W	,, ,,
	9	—	N by W	Rapidly increasing wind and sea, took in fore and aft sail.
	10	.85	N by W	Engines dead slow, ship hove to on port tack.
	Noon	.80	N by W	Wind and sea increasing with heavy rain — Latitude 12° 34′ longitue 111° 30′.
	1 P. M.	.75	NNW	Blowing a heavy gale and increasing in violence.
	3	.65	NNW	
	4	.48	NNW	Blowing a most furious typhoon with a very heavy confused sea, heavy rain and
	5	.25	NNW	hail alternately.
	5.30	.00	NNW	A heavy sea broke over ship and carried away port life boat, after steering gear
	6	28.95	NNW	and various other things.
	6.30	.90	W	Wind veering to westward — from 5.30 to 9.30 p.m. we have the heaviest of
	7	.92	W	the typhoon.
	8	29.05	SW	
	9	.27	SW	
	10	.60	SW-S	Weather beginning to moderate.
,, 29th	Midn.	30.00	SE	Wind and sea rapidly going down.

The velocity of translation of the Typhoon increased gradually : it was considerable for the latitude, viz. about 14.5 miles on the average.

This might be the proper place to speak of the deep atmospheric perturbations which took place in the course of this month on Northern China and Japan, and caused real storms to be compared with the Typhoons we have been investigating; and those perturbations may have been connected in more than one way with the few Typhoons we met with on the China Sea in November. But observations are completely wanting between the North and the South and we should have nothing to go by but a certain resemblance with the tracks of previous Typhoons. On the other hand, if the two sets of phenomena are really of a different nature, the investigation of the northern storms would carry me beyond my subject which is a monography of the Typhoons properly so called, leaving out that peculiar class of whirlwinds which seem to belong specially to the North and to the colder season. I shall then confine myself to describing the last Typhoon of 1881, and bring this long discussion to a close.

Twentieth and last Typhoon: 9th — 14th December 1881.

I have not been able to get any information about this Typhoon beyond what concerns its passage over the Philippine Archipelago. It is worth noting that its course was very nearly the same as that of the "Elgin" Typhoon, the first of the season.

Albay (Luzon : latit. 13°.13′ - longit. 123°.40′).

A correspondent of *El comercio* gives some interesting particulars of the storm of December 10th and 11th at Albay, a harbour on the eastern coast of the South of Luzon. On the 10th in the morning, weather uncertain, a good breeze between NNW. and NW., barometer at 29^{in}.88 sinking; same wind all day with rain which stops after sunset, barometer 29^{in}.80. — All night of 10th-11th fresh wind from NW. At daybreak rain setting in again, barometer falling more rapidly; 8 a.m. storm already raging violently from WNW., barometer 29^{in}.82; 10 a.m. violent wind from W., diluvian rain, barometer : 29^{in}.69.—At noon hard squalls between W. and SW., barometer 29^{in}.61, rain continuing.—No change till 2 p.m.; wind then turning to S. without abating; barometer 29^{in}.53 5 p.m. barometer at minimum 29^{in}.45. 6 p.m., rises again. — 7 p.m. rain and wind abating rapidly. — 9 p.m. fresh wind from S., sky clearing up, barometer rising steadily. — On 21st at daybreak, fine weather. — 10 a.m.barometer : 29^{in}.92.

At Albay, during the storm, the S.S. *Francisco* dragged her anchors, and went to the coast but without any serious damage.—At Marinac, a ship reported as wrecked.—At Sorsogon two lorchas engaged in unloading the steamer *Gravina,* foundered with part of the cargo worth $ 10,000.

The variation of the winds at Albay, together with that of the barometer, leaves but little uncertainty as to the course of the Centre of the Typhoon. On the 10th of December and on the 11th till about 8 a.m., it rose from SE. to NW., skirting along the eastern coast of the Archipelago between latit. 10° and 14°. At Albay the winds were all the time strongly convergent (NNW.-NW.) whilst the Centre was approaching. On the 11th, about 8 a.m. the Centre lay to the E. of Albay (wind : WNW). At noon the violence of the W. and SW. winds, accompanied with diluvian rains, showed that the Centre had turned to the left and was about to cross the island as several of the preceding Typhoons had done but somewhat more Southward, close to Albay. In fact, the wind turned to S. at 2 p.m. and the barometric minimum did not take place before 5 p.m.: the wind then continued to blow in the direction of the Centre of the whirlwind and that complete convergence was kept up by the torrents of rain which fell uninterruptedly. It however diminished after the passage of the Centre whilst the Typhoon crossed the island, making for the China Sea.

Several of the preceding Typhoons underwent a singular deviation on reaching Luzon: the cause of this we think we discover in the fact of there being an area of low pressure in the new direction followed after the

deviation. The same happened with the present Typhoon under quite similar conditions. There must have been a centre of depression on the China Sea which probably extended to Cochinchina and to the kingdom of Annam : at least it is what appears likely from the observations made at Pakhoi on the northern coast of the Gulph of Tongking. We subjoin an abstract of the observations made at that time.

Date	Barom.	Therm.	Wind	Weather
	in	°		
December 4th	30.15	62.5	N 5	O. G.
5	.20	64.5	N 5	"
6	.23	69.0	N 5	B. C. G.
7	.22	69.5	NE 5	"
8	.17	64.5	NNE 5	O. G. P.
9	.17	67.0	N 5	B. C.
10	.06	69.5	ESE 4	"
11	.08	73.5	ESE 4	O. P. R.
12	.11	73.5	ESE 2	B. C.
13	.12	71.0	N 4	"
14	.11	66.0	N 6	O. G.
15	.17	55.5	N 6	O. M. D.
16	.25	56.5	N 7	O. G. M. P.
17	.36	57.0	N 6	B. C.
18	.37	51.5	N 5	"

The Monsoon here blew from N. and was pretty strong in the Gulph of Tongking. The considerable change it underwent on December 10th, 11th and 12th implies a considerable perturbation South of Pakhoi. The passage of the Typhoon was but scarcely indicated on the 14th by a slight fall of the barometer, after which the Northerly winds regained their ascendancy accompanied with very high pressures.

There being no ship, to my knowledge, to have met with this Typhoon at sea about the coast of Cochin-China, I cannot venture to say what course it followed after getting clear of the Philippines.

CONCLUSION.

We have at last completed the long investigation of the Typhoons of the past year. Let us now cast a glance at the ground we have gone over and endeavour to find out what link there may be between the phenomena and pave the way towards discovering their laws.

And first, if the tracks given for 1880 be compared with those now described, there appears a considerable difference in extent to the advantage of the latter. Not that, of all the Typhoons which in 1880 crossed the China Sea from East to West, there have been none to rise Northward, pass over Japan and disappear in the North Pacific. Far from it, and if in my first paper the tracks be generally cut short, it is only because the thought had not then occurred to me to seek how to connect those violent whirlwinds with the more harmless ones which, in summer, come from the interior of the continent and pass at the latitude of Shanghai or still higher. In spite of the gap which unfortunately exists for the interior of China in the series of observations I had at my disposal, I believe my identifying of the whirlwinds to be in the main well justified. And this will not be the least important result of these researches.

1/. The Typhoons of the China Sea then appear to be atmospheric whirlwinds or cyclones whose tracks approximate to parabolic curves whose apex is turned towards the West, and generally lies in the interior of China, between 25° and 30° latitude. A branch of the curve usually goes over the Archipelago of the Philippines, and the other over that of Japan; in other words the movement of translation generally takes place from South to North, the whirlwind withal inclining somewhat to the West during the first period and to the East during the second. The region where the Typhoons first appear is a zone comprised between the parallels of 10° and 17°. Some were found to spring up in the very Archipelago of the Philippines, but the greater number came from maritime regions farther East.

2/. Though the Typhoons may have been ever so violent at sea and just before taking to the land, once on shore they have always proved very moderate, so much so that their passage often went unheeded except by attentive observers. One only was an exception to this rule, the "Kiang-si" Typhoon which also showed other peculiarities, having followed a course all the reverse of that indicated above. Some Typhoons however, on coming to sea again recovered some of their first energy, though they remained far from what they had been before, both as regards depth of depression and force of wind.

3/. That loss of energy and decrease in the amount of the depression seems to arise from two causes: from the almost complete cessation, on the continent, of all condensation, consequent upon the suppression of those moist convergent currents which, at sea, supported the energy of the whirlwind; and from a weakening and scattering of the depression by the resistance of the numerous obstacles it meets on its way. Let us take for instance those whirlwinds which entered the continent by the way of Tongking and Cochin China. As they got farther and far-

ther into the interior of China, they had to rise gradually up to the high table-lands in the North-west and in the North, afterwards to come down again and make towards the Sea of Japan. The scaling of the numerous mountains standing in the way always occasioned, as we have seen, a splitting of the main whirlwind and sometimes even of the secondary ones.

4/. That action of a serious obstacle such as a mountain chain in the way of a whirlwind is still far more marked and effective in the case of a Typhoon revelling in its full power on the open sea. It then happens that two distinct real whirlwinds set up on either side and they are the more formidable as, in consequence of their proximity, there is a want of regularity in the winds and in the variations of the barometer, such as to perplex the most experienced mariner. We found amongst others a most curious instance of the kind in the "Pescadores-Chusan" Typhoon.

5/. In summer the atmospheric pressure is much lower over the interior of the continent of Asia and over China than on the coast and in the Siberia, and lower again on the coast than in the open sea. A maximum of pressure occurs in the middle of the Pacific and a minimum on the Okostk Sea and near Behring's Straits. These various conditions in the equilibrium of the atmosphere are precisely what determines the formation of Typhoons and their general course. They always move towards the nearest areas of lower pressure: thus they will go from sea to land, from the Philippines generally towards the coast of China, if there is no insuperable obstacle in the way; thence they will advance somewhat into the interior, but soon finding mountainous tracts which seem to form a barrier, they will turn towards the North of China in quest of pressures lower than on the Southern coast. They will then follow the general direction of the isobar lines which takes them over Japan into the North-Pacific.

6/. A curious fact, to which I have called attention whenever an opportunity has occurred, is this: the direction a Typhoon will take often appears as being induced by the position of the preceding Typhoon at the time. Typhoons seem as if to seek one another, which is the same as to say that a Typhoon, tending to move towards the areas of barometric minimum will make towards any place where a violent whirling motion lowers the pressure; also that a Typhoon, having just vanished or become scattered, will be likely to draw the next Typhoon to the same region.

7/. What has just been said, together with the instance of some of the whirlwinds whose formation on the coast of China we have witnessed, shows that those gyrating movements of the air often succeed high pressures, which are brought on by the collision of high currents of different directions and have the effect to check the rise of the lower moist currents: the winds then are light or null, the air exceedingly clear; at night the radiation of the earth is intense and the temperature falls, whilst by day time the sun shines brightly and the weather may be quite warm; with a few days of such weather, particularly at sea, the lower strata of the air may become overheated and absorb vapour of water: let then the instable equilibrium of the strata (1) be disturbed by any cause such as a slight rotating motion in the upper regions caused by the the various currents and gradually spread downwards, the moist air below will rise; condensations will soon take place and contribute to diminish the pressure already lowered by the very rotating motion thus furthering the rise of the warm moist air. On the

(1) In a perfectly constituted whirlwind on the march the instable equilibrium, which we take above as possible, does not really exist. There is a well established circulation of the air through the Centre between the upper and the lower regions, the wind being ascending at the Centre, diverging above and converging below, The cold dry air of the upper regions is unceasingly descending at the periphery of the whirlwind and, though naturally the sky be clear and the Solar radiation intense (as shown by the actinometer), the temperature, even by day time, is generally below mean.

other hand, the gyrating motion once set on, the air thrust out by the centrifugal force increases the pressure all round and forces the lower masses of air to rush with increased velocity towards the Centre; the condensations increase more and more, and the latent heat of the condensed vapour in expanding the air diminishes the pressure below. In this way the successive effects become causes in their turn; everything tends to accelerate rotating motion and to extend the circulation of the air far and wide, and a whirlwind is constituted. And now, if in a particular direction the air, better equipoised and submitted to other influences which tend to maintain high pressures, does not yield to the general impulse, whirlwind will move in the opposite direction or in that which offers the greatest facility for the outflow of the mass of air accumulated in the region of maximum pressure. An effect of the gyrating motion is to spread this maximum pressure on the circumference and thrust it out farther and farther as the whirlwind gets its development and expansion. But a result of that extension of the whirlwind and of that spreading out of the high pressures is that the gradients become less steep and the central depression less marked, the rotating motion slackens, the large local condensations come to an end as partial condensations take place everywhere, the original whirlwind finally collapses and gradually vanishes away. Such is the way we may imagine a Typhoon to originate, to get its development and come to an end.

8/. It follows from this, or rather from all our observations, that in the lower strata of the air the currents are partially centripetal or rather describe spiral curves more or less inclined on the radii, whilst in the upper regions they are divergent, as the cirri have shown on more than one occasion. It must then necessarily be admitted that the air rises when it is approaching the Centre where the pressure is lower and descends at the periphery of the whirlwind where it is highest.

9/. In the case of Typhoon going along with a well settled great aerial surface current, the direction of the winds at a distance ahead of the Centre seems to be divergent, but these winds belong properly to the main current and not to the Typhoon. The border of the Typhoon being reached, as clearly indicated by the maximum of the barometer, the winds begin gradually to feel the strong indraught towards the Centre and first get fresher or lighter as they are of the same or of the opposite direction with the normal winds of the whirlwind. But in the zone of greatest perturbation, the storm is pretty much alike on all sides. Behind, the winds are most commonly convergent.

10/. At the limit of a whirlwind, upon the track or close to it, the barometer is high; its variations, if any, are small. The weather is clear, the wind light, often variable; the mean temperature falls, the quantity of vapour in the air diminishes considerably. These various phenomena which have been called *Anticyclone* may be momentary if the whirlwind is coming towards the station where they are observed; otherwise they will be more or less persistent according to the direction taken by the whirlwind.

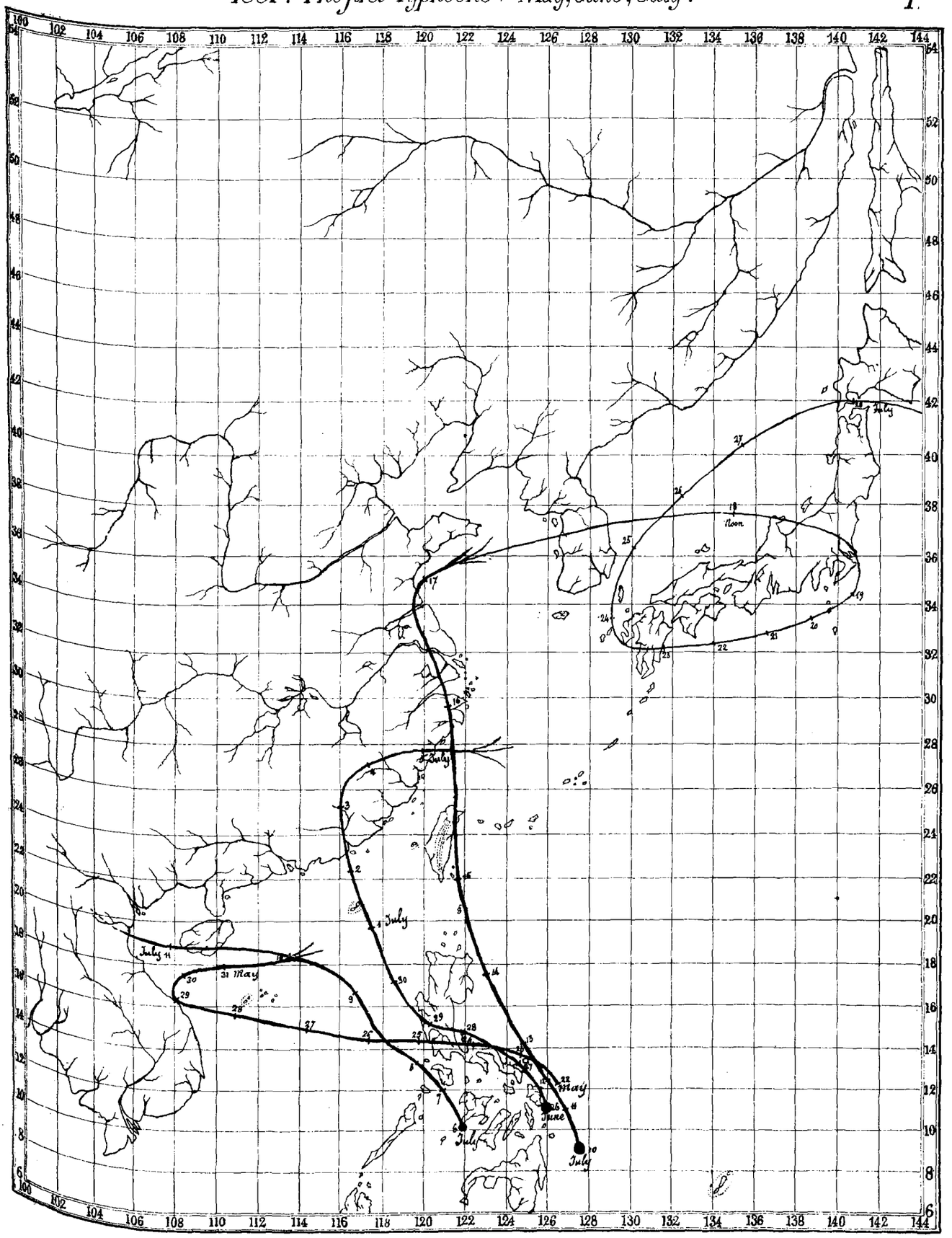
11/. If, taking the twenty Typhoons of 1881 together with the fourteen of 1880, we seek for any rule as to their direction in the different months, there does not come out anything definite to be given as a natural law. The most that can be said is that their tracks first make their appearance in the China Sea where also the last of them is to be seen. The tracks that present a great concavity looking eastward, those consequently whose first branch is most southerly and lies flattest on the parallels of latitude, seem to belong to the months of a moderate temperature, May, June, the end of September, October and November; for the pressures are comparatively low over the China Sea and Western China, and in the North over Japan and the Sea of Okotsk. During the warmer months, July, August and beginning of September, the curves described by the Typhoons are very open, for there

is a minimum pressure prevailing on the coast of Middle and Northern China; then is it that Shanghai and sometimes but more seldom, Chefoo, are exposed to such unpleasant visitations.

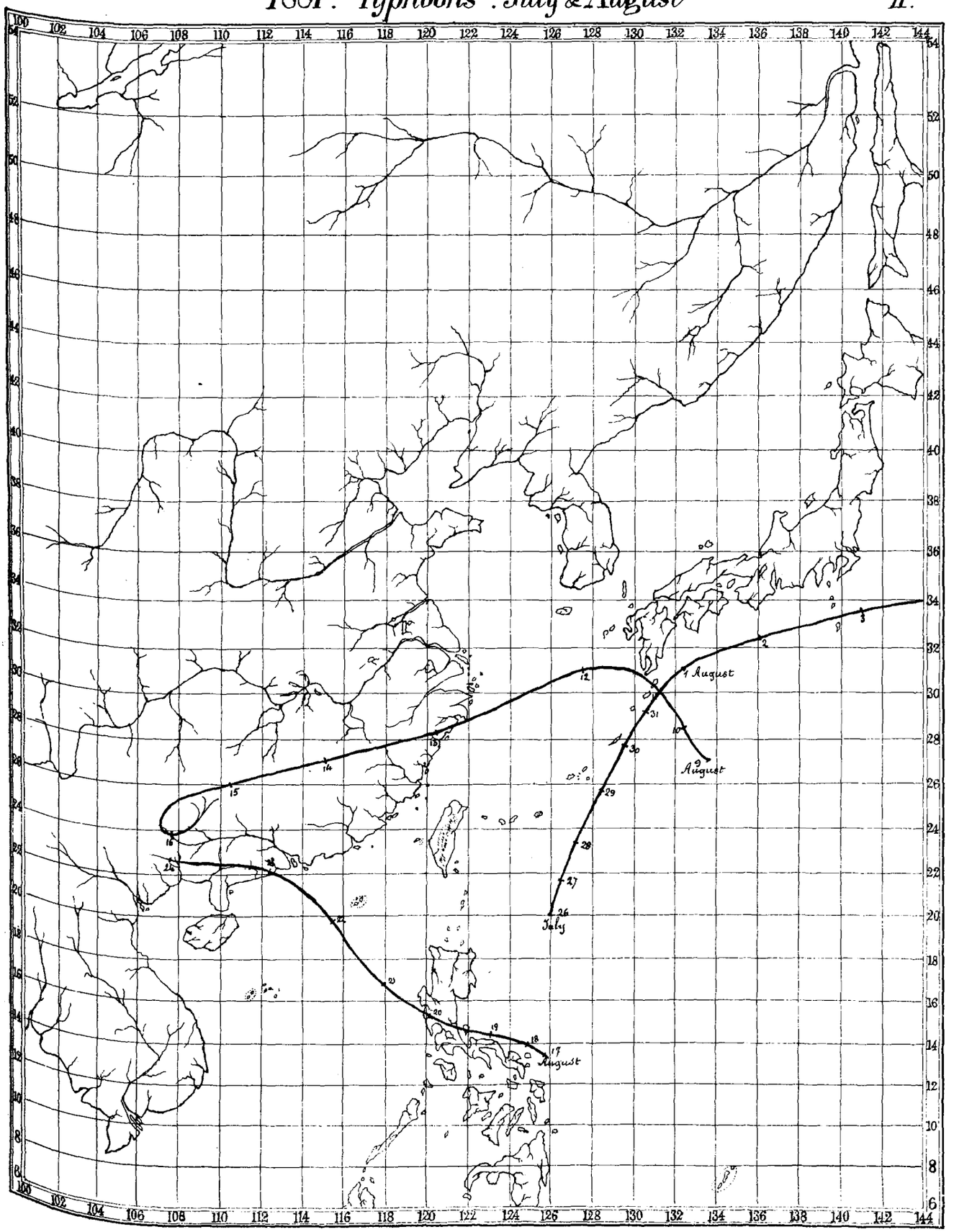
In Japan August and September make up the true Typhoon Season: during the other months they only come towards Japan at the end of a long course over China and are then really insignificant.

12/. Lastly, as soon as the NE. Monsoon has fairly come to an end in the China Sea, the Typhoon Season may be said to have set in and it will last as long as the summer Monsoon. When once the NE. winds have made their appearance on the coast of China in September, as a general rule there is no fear of Typhoons on that coast any more; their tracks are thrust away towards the South, and when the Monsoon has got well established down to the equator, as it happens in November or sometimes as late as December, they disappear entirely.

1881. The first Typhoons – May, June, July.

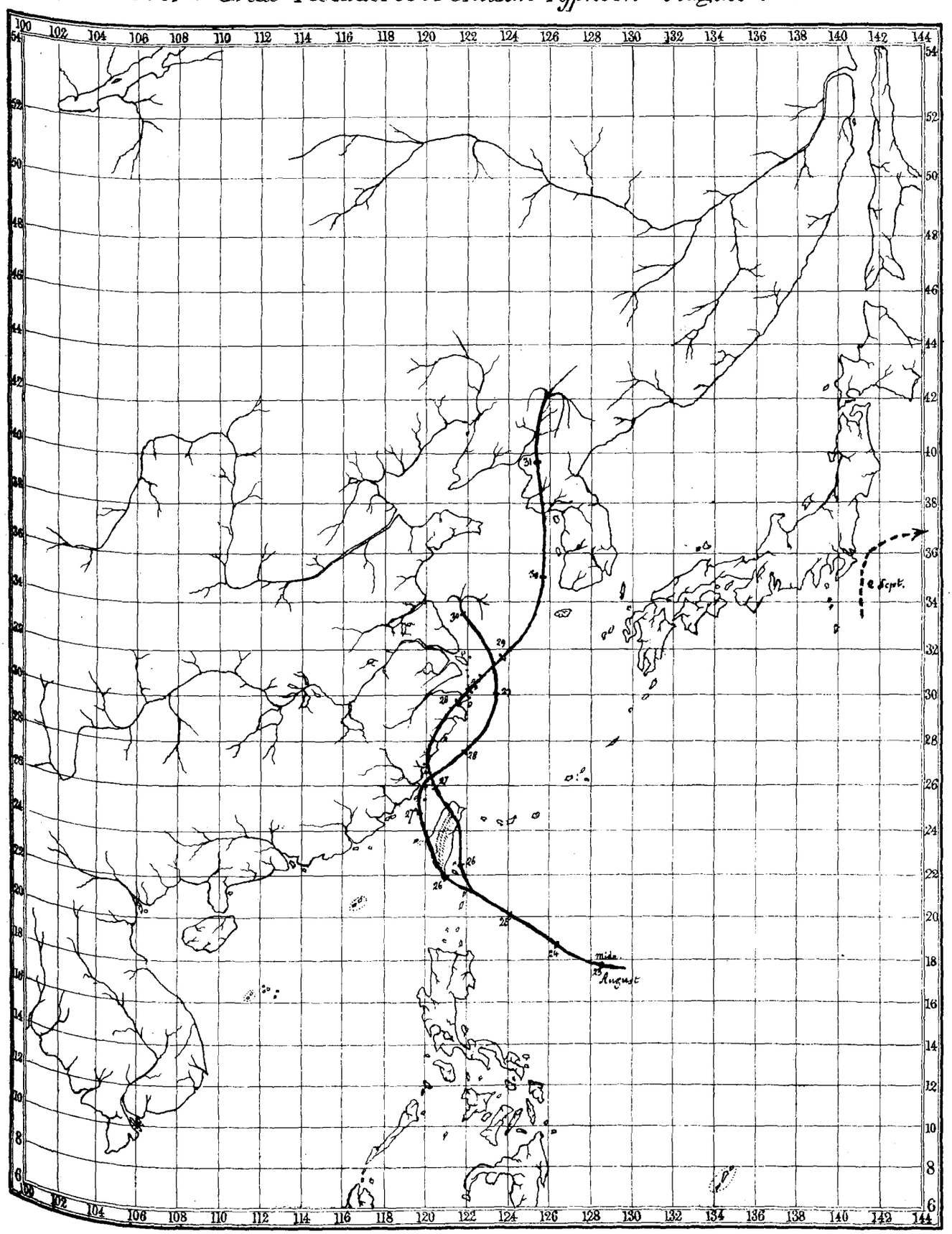


1881. Typhoons : July & August

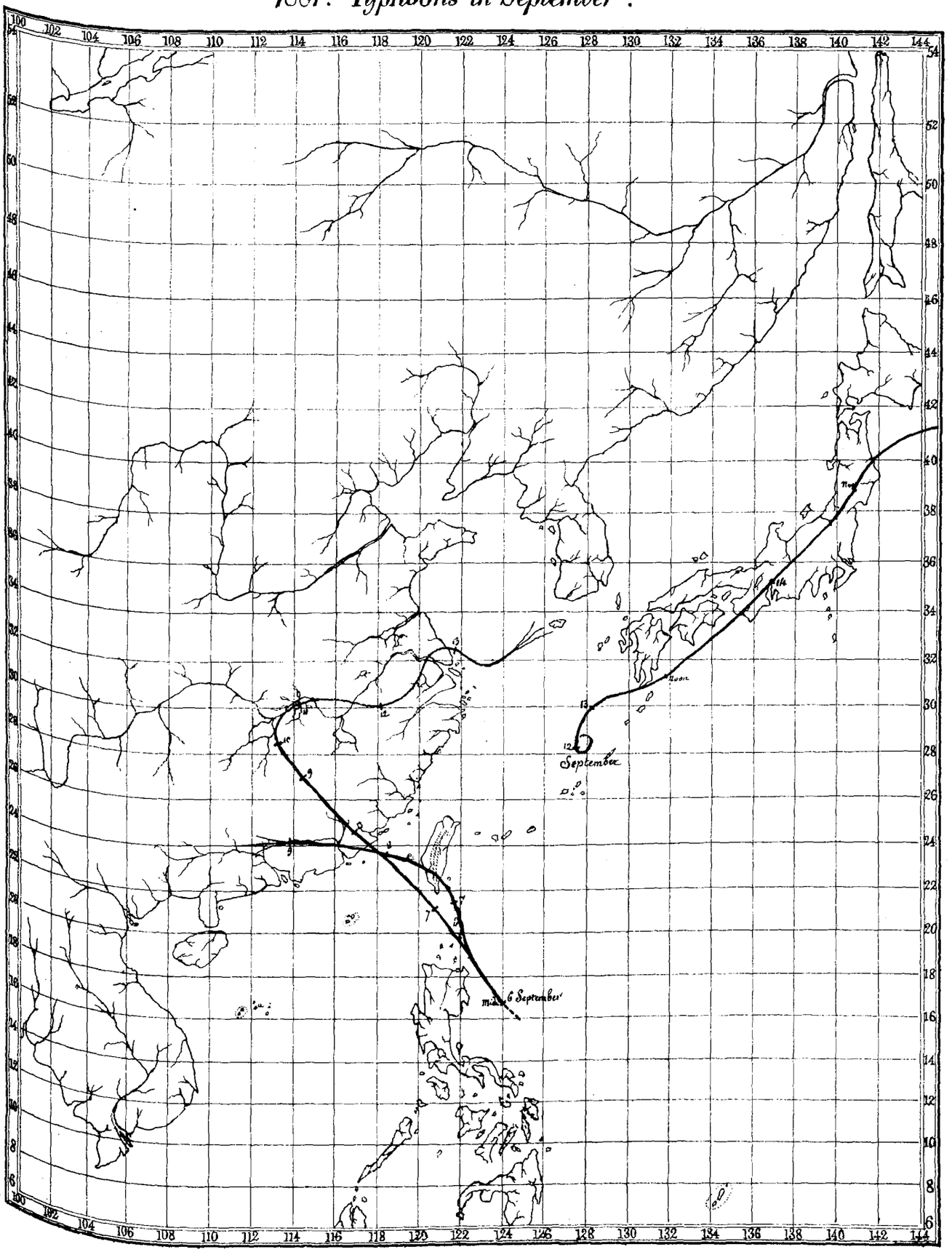


1881 - Great "Pescadores & Chusan" Typhoon - August 23d-31st

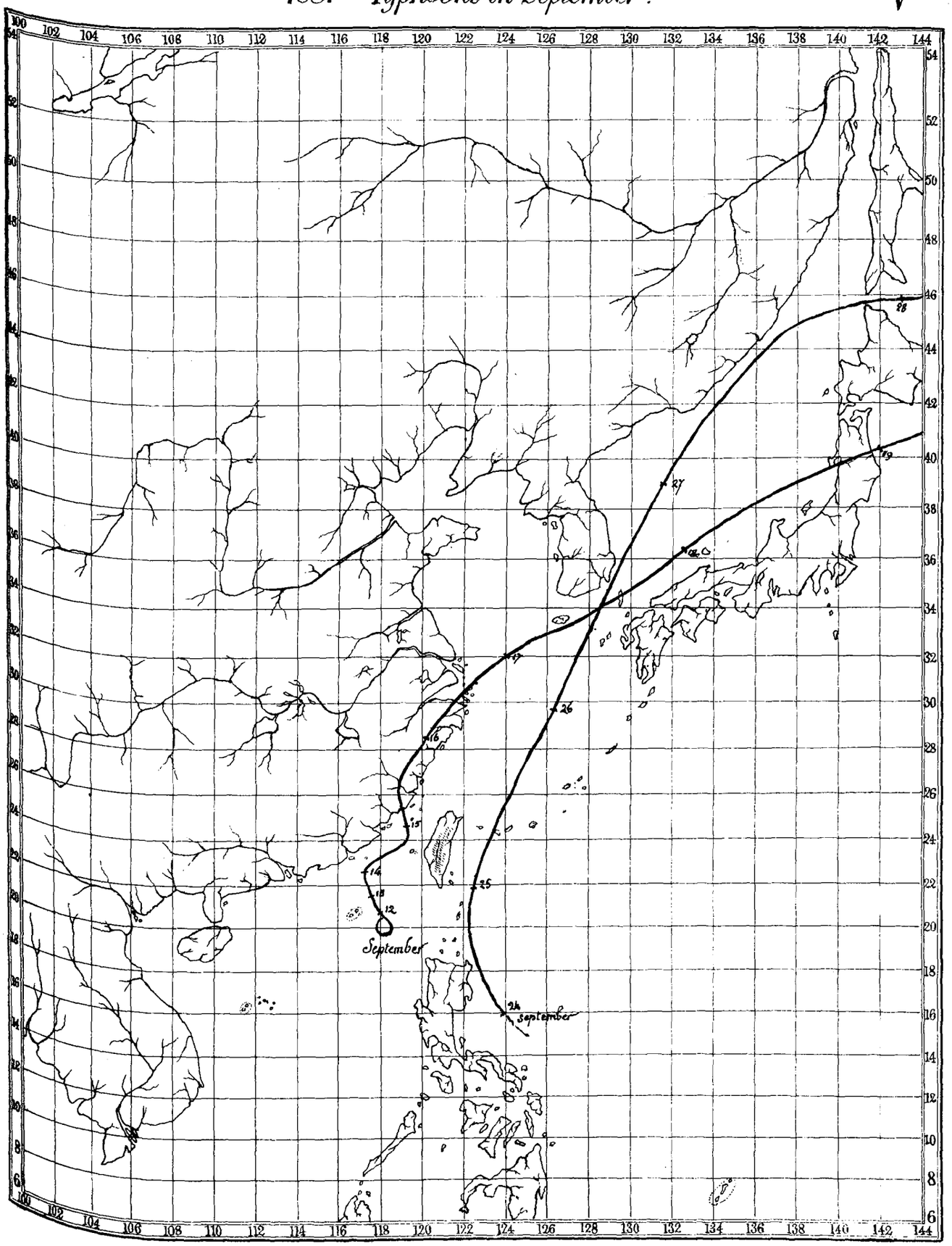
III.



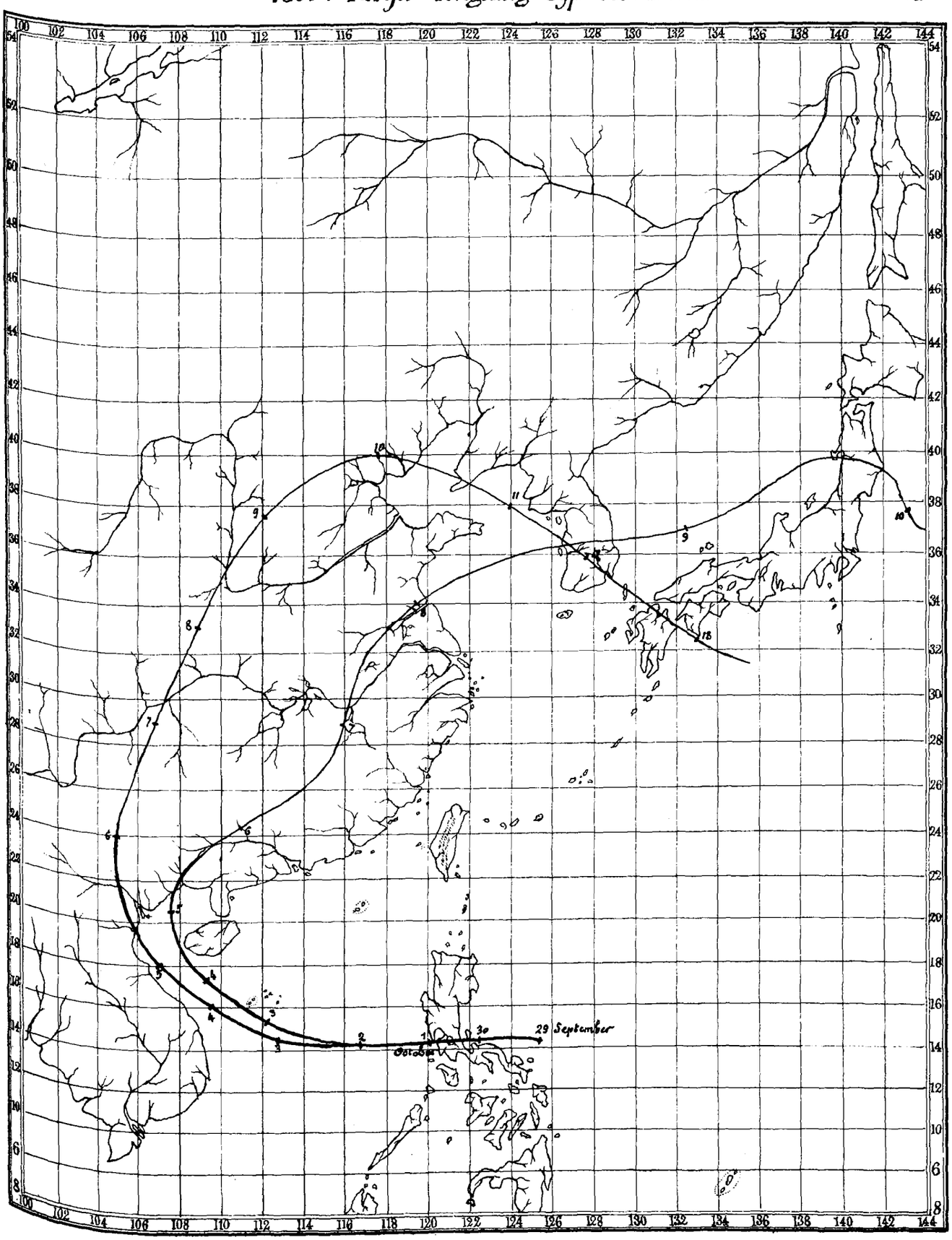
1881. Typhoons in September.



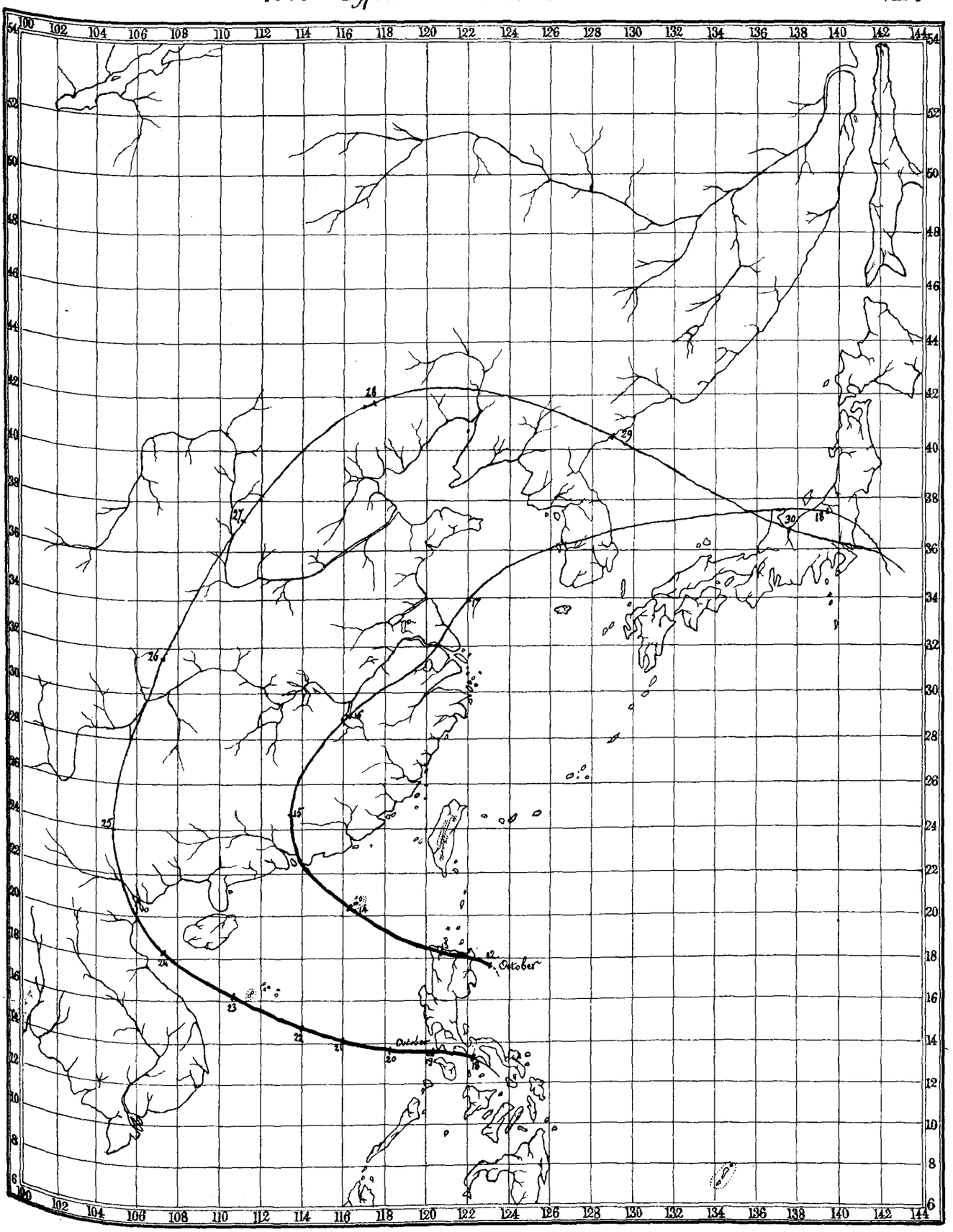
1881 *Typhoons in September.*



1881. Terrific "Tongking" Typhoon in October



1881. Typhoons in October. VII.



1881. "Monsoon" Typhoon & Typhoons in November

VIII.