SYNOPTIC WEATHER MAPS Part I

HISTORICAL BACKGROUND

The modern series of historical sea-level weather maps for the Northern Hemisphere begins with January 1899 and extends through June 1957. Upper-air maps of the 500-millibar pressure surface were added beginning with the month of December 1944 and extending through June 1957. A special series of sea-level and 500-millibar maps was prepared for the period July 1957 through December 1958 in connection with the International Geophysical Year. The analyses were based on checked data on microcards prepared by the World Meteorological Organization as a primary data source, and were coordinated with similar maps for the remainder of the world. Together, they resulted in a set of IGY World Weather Maps. The Northern Hemisphere sea-level and 500-millibar maps were published for this period under the title of ‘International Geophysical Year World Weather Maps, Part I, November 1956.'

Data tabulations were added to the synoptic maps series beginning with the October 1945 issue. Except for a few gaps, November and December 1945, and January 1954 through June 1955, these monthly data listings are complete and are available in published form through December 1965 and in the form of microfilm beginning with data for January 1964.

Beginning with January 1961, the 500-millibar charts were prepared from computer-analyzed charts produced at the National Meteorological Center, except for a few of the earlier issues for which machine-analyzed charts were not available. During the months of January through April 1961, isotherms were not included on the machine-analyzed charts, so they were added by reference to observations and comparisons with other hand-drawn charts.

INTRODUCTION

This series of Northern Hemisphere Weather Maps, beginning with January 1959, is similar to the series which begins with maps for January 1941, and is produced by the Environmental Science Service Administration. The Northern Hemisphere sea-level and 500-millibar maps for one month, there being one sea-level map and one 500-millibar map for each day at 1200 GMT.

Data tabulations of the following are also available: synoptic weather reports for 0000 GMT and 1200 GMT, selected stations' radiosonde and rawinsonde reports for 0000 GMT and 1200 GMT for North America (WMO Region IV), and for stations outside Region IV for which data are available, including Greenland and the North Pacific Ocean; report types and comment codes for 0000 GMT reports for the remainder of the Northern Hemisphere; and upper wind reports for 0000 GMT and 1200 and 1800 GMT for Canada and a few additional stations. 2

DATA

The sea-level maps in this series were prepared from data observed at or near 1200 GMT providing continuity with other series of Northern Hemisphere Weather Maps that have already been completed, or that are in the process of being completed. Synoptic reports were plotted from every available source, including special forms, Hattings, or punched cards furnished for this publication by cooperating National Meteorological Services; data and charts published by those Services; punched cards prepared by selected stations in the United States, and for the ocean weather stations; weather logs of commercial ships; and collections of radio and teletypewriter reports from all available areas of the Northern Hemisphere.

Abridged International Plotting Code model is used in plotting the maps. The positions of the elements in relation to the isobars and isotherms have been printed on each a series. More complete synoptic reports of the stations plotted may be found in Part II, and a description of the elements plotted and/or listed may be found in the WMO publication No. 9, TP. 4, Volume B in effect at the time of the observations.

ANALYSIS

In the analysis of the Northern Hemisphere sea-level charts, all frontal structures with weak or nonexistent fronts were retained until the day when fronts were able to be distinguished between a cold front and a polar trough, both over land and over water. Great care was exercised to include all frontal boundaries causing significant changes in pressure. However, it is physically beyond the scope of these charts, presented in 24-hour intervals, to show all synoptic weather, particularly if there has been no indication of a cold front or a polar trough. Therefore, it is physically beyond the scope of these charts, presented in 24-hour intervals, to show all synoptic weather, particularly if there has been no indication of a cold front or a polar trough. Therefore, these indications have been the major part of the analysis and have been represented in the most feasible fashion in accordance with the particular situation being analyzed.

Analyses of the sea-level and upper-air charts were aided by careful study of weather maps published by various National Meteorological Services, and by study of Intermediate charts prepared by the Weather Bureau's National Meteorological Center. The original observation forms of the weather reporting ships at sea, in addition to transoceanic flight reports, were available and used by the analysis unit as an aid to continuity.

Analyses in tropical areas are necessarily incomplete, in areas of few or no data a reasonable isobaric pattern has been carried for completeness in lieu of entering the mean position of the Inter tropical Convergence Zone for that particular time of year. Whenever available data made it possible to determine the position of the zone of convergence, that position was entered.

High pressure areas, cold fronts, and their branches were entered only when the data definitely supported these phenomena and intermediate charts confirmed them.

isotherms were entered on the charts when the associated weather warranted them and after close study of 6-hourly intermediate charts for the time.

In areas of relatively sparse data, the sequence of weather reports carefully considered and often checked against possible solutions. The analysts preparing these series of charts have had considerable experience in Northern Hemisphere analysis and in maintaining continuity to areas of sparse data coverage. With minor exceptions, in areas of few data, every attempt was made to check the data and the many sources of data accuracy and representativeness and then to analyze accordingly, with established mean patterns used only as a control factor.

500-MILLIBAR MAPS

DATA

The large amount of data available for these maps permitted a more detailed analysis than has been possible on maps in the early years of the series. All of the major circulation systems were shown together with a large percentage of the lesser systems which could be logically identified on consecutive maps.

ANALYSIS

The computer-produced 500-millibar charts from the National Meteorological Center have been objectively analyzed using Coreman's (1959) successive approximation technique. This is a method developed by Coreman and others (1959) in this analysis technique a given first approximation field is adjusted to fit the observations.

The first approximation (or "guess") for the 500-millibar analysis is a function of (a) the 12-hour forecast based on the previous 0000 GMT data, and (b) the analyses at the lower constant-pressure surfaces which are computed prior to the 500-millibar analysis.

The use of the forecast maintains time-continuity of the major systems, and the use of the lower-level analyzed parameters maintains vertical consistency. This "first-guess" field consists of points values at regular intervals on the basic field is generally brought to a satisfactory fit with the observations. The data are tested for errors during the analysis process, and the monitoring analyst decides whether to discard those data which failed the tests and insert information to correct errors.

Later refinements were made to each machine-analyzed chart before publication to eliminate detectable errors in analysis, and to smooth and adjust isolines which were found to be inconsistent with the corresponding sea level charts. Comparisons were also made with other hand-drawn 500-millibar charts, and inconsistencies resolved. These adjustments were made sufficiently long time after the map date to allow the use of late reports, when deemed advisable, and for close coordination with the sea-level charts which, themselves, were analyzed after receipt of the greatest possible number of reports.

Height contours were drawn as solid lines at intervals of 200 feet from the beginning of the series through June 1957, at intervals of 400 feet from July 1957 through December 1960, and at intervals of 200 feet from January 1961 on. Isotherms at 3°C intervals were drawn as single dashed lines.

1. (a) U.S. Weather Bureau, Daily Synoptic Series Historical Weather Maps, Northern Hemisphere Sea Level, January 1899 to June 1939, inclusive.
(b) U.S. Weather Bureau, Daily Synoptic Series Weather Maps, Northern Hemisphere Sea Level Charts, January 1899 to November 1944, inclusive.
(f) Environmental Science Services Administration, Daily Synoptic Weather Maps, Northern Hemisphere Sea Level and 500-Millibar Charts, February 1968, et seq.

(b) Environmental Science Services Administration, Daily Synoptic Weather Maps, Northern Hemisphere Sea Level and 500-Millibar Charts, October 1964, et seq.


LIST OF SYMBOLS USED ON MAPS

500-MILLIBAR MAPS

SEALEVEL MAPS

SEDGEFRONT -- SURFACE

COLD FRONT -- ALOFT

WARM FRONT -- ALOFT

EQUINOXIAL FRONT -- ALOFT

OCCCLUDED FRONT -- ALOFT

FRONTogenesis, RESULTING IN THE FORMATION OF A COLD FRONT AT THE SURFACE

FRONTogenesis, RESULTING IN THE FORMATION OF A WARM FRONT AT THE SURFACE

OCCCLUDED FRONT -- SURFACE

OCCCLUDED FRONT ALOFT

OCCCLUDED FRONT ALOFT

FRONTogenesis, RESULTING IN THE FORMATION OF A WARM FRONT AT THE SURFACE

500-MILLIBAR MAPS

HEIGHT CONTOUR

ISOTHERM

1-3 KNOT WIND

3-7 KNOT WIND

8 KNOT WIND

55 KNOT WIND

TROGH LINE

INTERTROPICAL CONVERGENCE ZONE

SEALEVEL MAPS

COLD FRONT -- SURFACE

COLD FRONT ALOFT

WARM FRONT -- ALOFT

WARM FRONT ALOFT

EQUINOXIAL FRONT -- ALOFT

OCCCLUDED FRONT -- ALOFT

FRONTogenesis, RESULTING IN THE FORMATION OF A COLD FRONT AT THE SURFACE

FRONTogenesis, RESULTING IN THE FORMATION OF A WARM FRONT AT THE SURFACE

The time of these observations changes from 1200 GMT for sea-level and 1500 GMT for 500-millibars, to 1200 GMT for both levels on June 1, 1957, unless otherwise indicated.

# Beginning with the maps for April 1, 1957, all observations are 1200 GMT except those for stations operated by Canada and the United States.