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 are not 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 1945 through December 1958 in connection with the International Geophysical Year. The analyses were based on checked data on microcards prepared by the National Meteorological Center using the method of graphical analysis as a preliminary step, and were coordinated with similar maps for the remainder of the world. Together, they result 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 Additional National Geophysical Year World Weather Maps, Part I, Northern Hemisphere.

Data tabulations were added to the synoptic maps series beginning with the October 1945 issue. Except for two gaps, November and December 1945, and January 1946 through June 1955, these monthly data listings are complete and are available in published form through December 1963 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 the corresponding sea-level charts.

INTRODUCTION

This series of Northern Hemisphere Weather Maps, beginning with January 1899, is similar to the series which begins with maps for January 1946, and is produced by the Environment Canada. Each volume consists of Northern Hemisphere 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 surface reports for 1200 GMT for selected stations; radiosonde and rawinsonde reports for 0000 GMT and 1200 GMT for North America; and for the Atlantic and Pacific Ocean weather stations, and for stations outside Region IV for which data are available, including Greenland and the Caribbean; and radiosonde and rawinsonde reports for 0000 GMT for the remainder of the Northern Hemisphere; and upper wind reports for 0000 and 1800 GMT for Canada and a few additional stations.

SEA LEVEL MAPS

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 which have already been completed, or that are in the process of being completed.

Synoptic reports were plotted from every available source; special forms were punched out and published 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 radiosonde and rawinsonde reports from all available areas of the Northern Hemisphere.

An evaluation of the International Plotting Code model is used in plotting the maps. The positions of the elements in relation to the land and ship station circles have been printed on each map. Meteorological symbols and items of the stations plotted may be found in Part II, and a description of the elements plotted and/or listed in the WMO report publication No. 4, Table 4, Volume 3 in effect at the time of the observations.

ANALYSIS

In the analysis of the Northern Hemisphere sea-level charts, all structural features with well-established histories were retained until the data showed that frontal systems had taken place. In those cases, frontal analyses have been placed and the front has been dropped from the maps. Every effort has been made to carry all major frontal systems. Minor fronts were carried on the maps only when the data showed that they existed from day to day and the resulting weather was significant. Every effort was made to distinguish between a cold front and a polar front, both on land and over water. Great care was exercised to include all frontal boundaries causing significant weather change. However, it is physically beyond the scope of these reports to present in 24-hour intervals, to indicate in detail each secondary or swiftly redeveloped frontal system which may from time to time occur.

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

Easterly waves, westerly troughs, and shear lines were entered only when the data definitely supported these phenomena and interpreted them.

Instability or squall-lines were entered on the charts when the associated weather warranted them and after close study of 6-hourly intermediate charts, when warranted.

In areas of relatively sparse data, the sequence of weather reports was carefully studied to obtain the best possible selection. The analysts preparing these series of charts have had considerable experience with Northern Hemisphere charts and in maintaining continuity in 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 for 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 had 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 were prepared by generating a field at regular intervals, using Crayton's (1959) successive approximation technique which is based on a method developed by Berghoff and Diamond. The synoptic 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 to 500-millibar analysis. The use of the forecast maintains time-continuity of the major systems, and the use of the lower-level analyses and surface data to fit the "guess" field consists of point values at regular intervals on the base map.

The observations are used to adjust the gridpoint values of the "guess" field. The amount of the adjustment depends upon the distance from gridpoint to observation, the departure of the observed value from the "guess" value, the number of observations in the vicinity of the gridpoint, etc. The analysis is refined by several iterations through the "guess" field, so that the field is gradually brought to a satisfactory fit with the observational data. 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 inserts 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 made a 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 80 meters from July 1957 through December 1960, and at intervals of 100 meters from January 1961 on. Isotherms at 5°C, intervals were drawn as single dashed lines.

1. (a) U. S. Weather Bureau, Daily Synoptic Series Northern Hemisphere Weather Maps, Northern Hemisphere Sea Level Charts, January 1899 to June 1939, inclusive.

2. (a) U. S. Weather Bureau, Daily Synoptic Series Northern Hemisphere Weather Maps, Northern Hemisphere Sea Level and 500-Millibar Charts, December 1944 to September 1945, inclusive.

3. (b) Headquarters, Air Weather Service, AAF, Northern Hemisphere Historical Weather Maps, Northern Hemisphere Sea Level and 500-Millibar Charts, January 1945 to December 1948, inclusive.


7. (b) Environmental Science Services Administration, Daily Synoptic Series Northern Hemisphere Weather Maps, Northern Hemisphere Sea Level and 500-Millibar Charts, February 1960, et seq.


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


LIST OF SYMBOLS USED ON MAPS

SEALEVEL MAPS

SEALEVEL MAPS

500-MILLIBAR MAPS

Cold Front -- Surface

Cold Front Aloft

Warm Front -- Surface

Warm Front Aloft

Quasi-Stationary Front -- Surface

Occluded Front -- Surface

Frontogenesis, Resulting in the Formation of a Cold Front at the Surface

Frontogenesis, Resulting in the Formation of a Warm Front at the Surface

Cold Front at the Surface, Undergoing Frontolysis

Warm Front at the Surface, Undergoing Frontolysis

Quasi-Stationary Front at the Surface, Undergoing Frontolysis

Occluded Front at the Surface, Undergoing Frontolysis

Instability Line (Non-Frontal Line Along Which Squalls or Other Lines of Marked Instability Exist)

Trough Line

Interropical Convergence Zone

Bergert Contour

Notherm

1-2 Knot Wind

3-7 Knot Wind

10 Knot Wind

51 Knot Wind