

# INTRODUCTION

This series of Northern Hemisphere Weather Maps begins with the maps for January 1949, and is produced by the United States Weather Bureau. Each volume of the series consists of Northern Hemisphere maps for one month, there being one sea-level map and one upper-air constant-pressure-surface (500 millibars) map for each day of the month, plus a complete set of the weather reports received for each of these maps.

## SEA-LEVEL MAPS

### DATA

The sea level maps in this series were prepared from data observed at or near 1230 GMT. In localities where weather observations are taken only once a day, 1230 GMT is the usual time of the observation. Thus the greatest number of data for the entire Northern Hemisphere has been made available. Furthermore, the use of 1230 GMT data provides continuity with other series of Northern Hemisphere Historical Weather Maps that have already been completed.<sup>1</sup> However, over the U.S.S.R., where 1230 GMT reports are not available, those for 1200 GMT were plotted.

Synoptic reports were plotted from every available source. Most reports were received via radio and teletype, but over areas where this coverage was inadequate other sources were used. Some of the Chinese reports, for example, were plotted from the data made available on the Japanese National Weather Maps.

Where applicable, the International Plotting Code models were used in plotting the maps. Station models for land and ship reports have been printed on each map and a complete description of the symbols used in these models will be found on the pages immediately preceding the data sheets.

Some stations in parts of the world such as Spain, North Africa, and India transmit station pressures instead of sea-level pressures. Occasionally, if the station is above 1,000 meters the pressure has been reduced to that level before transmission. The latter reports, reduced to sea-level, appear on the maps.

### ANALYSIS

In the analysis of the Northern Hemisphere sea-level synoptic charts, all frontal structures with well-established histories were retained until the data showed that frontolysis had taken place. In those cases, frontolysis has been shown 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 indicated that a minor front did exist and the resulting weather was significant. Every effort was made to distinguish 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 weather. However, it is physically beyond the scope of these charts, presented in 24-hour intervals, to indicate in detail each secondary or swiftly re-developed frontal system whose inception, growth, and full development may easily have taken place in the interval between maps. Representation of these features must necessarily be shown, in some cases, as merely an indication of what took place in the interim. These indications have been considered a major part of the analysis and have been represented in the most feasible fashion in accordance with the particular situation being analyzed.

Analysis of both the sea-level and upper-air charts was aided by a careful study of Swedish, Portuguese, Japanese and other published national maps; by a study of the 12-hourly sea-level and various upper level charts prepared by the Extended Forecast Section of the Weather Bureau, as well as a number of facsimile maps available to the analysts. The original observation forms of the weather reporting ships at sea, in addition to transocean flight reports were available and were 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 Intertropical 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.

In areas of relatively sparse data, the sequence of weather reports was carefully studied to obtain the best possible solution. The analysts preparing this series of charts have had considerable experience in Northern Hemisphere analysis 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

The maps for the 500-millibar surface have been included in this series for their value in portraying the upper-air patterns associated with sea-level systems.

### DATA

The map time of 0300 GMT was chosen because more data were available at that time than at 1500 GMT. Since the majority of radiosonde and pibal reports in East Africa, the Middle East, and India were taken for hours other than 0300 GMT, these off-time reports were included and labeled to indicate the observation time.

The large number of data available for this series permitted a more detailed analysis than had been possible on earlier series of a similar type. All of the major circulation systems were shown in this series together with a large percentage of the lesser systems which could be logically identified on successive maps. The regular reports were considered adequate for North America and Europe and fairly adequate for the Atlantic Ocean. It was necessary to make extrapolations of heights in other regions where observations were sparse.

### ANALYSIS

Each map was analyzed a sufficiently long time after the map date to allow the use of late reports and data received by mail. This procedure resulted in better continuity and consistency of analysis. The 1500 GMT upper-air maps were used as an aid to continuity.

Over the Asiatic Continent and the Pacific Ocean it was necessary to analyze vast areas with very few upper-air reports. Over Siberia extrapolated heights for several stations were often received in addition to data from the regularly reporting radiosonde stations. These extrapolated heights were plotted on the chart (with temperatures shown as missing) and used as an aid in analysis when continuity and

extrapolations from sea-level reports showed them to be reasonably correct. To supplement data over Asia, heights were extrapolated by building lapse rates from surface data. When performing these extrapolations, care was taken to consider the elevation of each station as well as reported weather, clouds, and the pressure pattern prevailing at the time of the observation.

Over ocean areas heights were extrapolated by using two limiting lapse rates which were found to include most of the situations encountered. These lapse rates are two-thirds of the dry adiabatic lapse rate (approximately the pseudo-adiabatic lapse rate) and one-half of the dry adiabatic lapse rate. Near the center of cyclones or in the polar air behind cyclones, lapse rates nearer the steeper limit were found to occur. In or near the center of anticyclones the lapse rates were nearer the more stable limit. Since these two limiting lapse rates usually give heights within 350 feet of each other, it was possible to arrive at a fairly accurate extrapolation when the sea-level synoptic situation indicated a lapse rate somewhere between the two limits. In the areas where upper-level data were sparse, upper-level temperatures were estimated by trajectory movements and extrapolation using continuity as a prime requisite.

Height contours were drawn as solid lines at intervals of 200 feet. Trough lines were represented by a double solid line. The positions of troughs were drawn to coincide generally with the points of lowest latitude reached by the contour lines or with the points of maximum cyclonic curvature. In many instances of migratory troughs imbedded in a stream flow with a definite northerly or southerly component, the trough lines were indicated as passing through points of maximum curvature, which are not necessarily points of minimum latitude. Isotherms at 5°C intervals were drawn as single dashed lines.

The initial trough line west of 0° longitude on the first day of each month was identified by the letter A at the bottom of the line. Proceeding westward, trough lines were labeled with succeeding letters. Trough lines on the first day of each month were identified with the same troughs on the last day of the preceding month by a letter at the top of each line. When a new trough developed from one already established, the prime symbol (') was used with the identifying letter of the original trough. When two troughs combined to make one, the new trough was labeled with the letters of the two original troughs separated by a + sign. Double letters were used after single alphabetical letters were exhausted. In analyzing the movement of these upper troughs, careful consideration was given to the relation of upper-air and sea level situations. Surface and upper-air analyses have been closely coordinated, particularly in areas where data were sparse, in order to insure that the final analysis would be the best possible in view of the limited data and would be completely consistent with the surface analysis.

- 1 (a) U. S. Weather Bureau, "Daily Synoptic Series, Historical Weather Maps, Northern Hemisphere Sea Level", January 1899 to June 1939 inclusive.
- (b) Headquarters, Air Weather Service, AAF, "Northern Hemisphere Historical Weather Maps, Sea Level and 500 Millibars", September 1945, et seq.