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. A complete set of the synoptic surface reports received for 1230 GMT and synoptic upper-air reports for 0300 GMT is included in Part II, under separate binding. For issues January 1949 through December 1951 both parts are bound under one cover.

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.[1] 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 Indian reports, for example, were plotted from data made available on the Indian Daily Weather Report.

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 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 various published national maps of foreign countries; by a study of intermediate charts prepared by the Weather Bureau and the U. S. Air Force, 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.

Easterly waves, westerly troughs, and shear lines were entered only when the data definitely supported these phenomena and intermediate charts confirmed 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 available.

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

Beginning with January 1, 1950 the time of the published 500-millibar map was changed from 0300 GMT to 1500 GMT. This was done primarily to make the sea-level and upper-level charts more nearly synoptic thus enhancing their usefulness to all users of the charts. In addition, in areas where sea-level data were adequate, but upper-air data sparse, an upper-air pattern reasonably consistent with the sea-level pressure field could be obtained with less difficulty by means of computed 500-millibar values and other known relationships between the two levels. To make both 0300 GMT and 1500 GMT upper-air data available, tabular data for 0300 GMT are included in each monthly publication in addition to the plotted and analyzed upper-air 500-millibar charts for 1500 GMT.

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 most of the Atlantic Ocean, but 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 0300 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 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 (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. As an aid in drawing isotherms over Eastern Asia, where data were very sparse, thermal winds were computed between 15 and 20 thousand feet for selected Indian and Russian stations which border on this area.

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 which are associated with definite air mass interactions at sea-level. 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 (or letters) 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.

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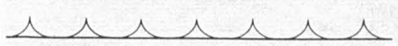
[1] (a) U. S. Weather Bureau, "Daily Synoptic Series Historical Weather Maps, Northern Hemisphere Sea Level", January 1899 to June 1939, inclusive.
(b) Headquarters, Air Weather Service, AAF, "Northern Hemisphere Historical Weather Maps, Sea Level and 500 Millibars", October 1945, et seq.

LIST OF SYMBOLS USED ON MAPS

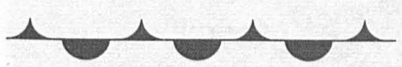
SEA-LEVEL MAPS


COLD FRONT -- SURFACE


COLD FRONT ALOFT

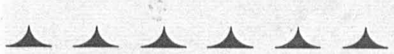

WARM FRONT -- SURFACE


WARM FRONT ALOFT


QUASI-STATIONARY FRONT -- SURFACE


OCCLUDED FRONT -- SURFACE


OCCLUDED 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

SEA-LEVEL MAPS


FRONTOGENESIS, RESULTING IN THE FORMATION OF A QUASI-STATIONARY FRONT AT THE SURFACE


COLD FRONT AT THE SURFACE, UNDERGOING FRONTOLYSIS

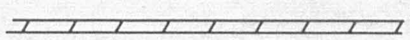

WARM FRONT AT THE SURFACE; UNDERGOING FRONTOLYSIS


QUASI-STATIONARY FRONT AT THE SURFACE, UNDERGOING FRONTOLYSIS

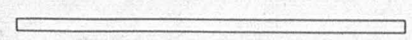

OCCLUDED FRONT AT THE SURFACE, UNDERGOING FRONTOLYSIS

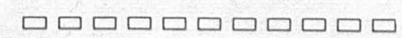
INSTABILITY LINE (NON-FRONTAL LINE ALONG WHICH SQUALLS OR OTHER EVIDENCES OF MARKED INSTABILITY EXIST)

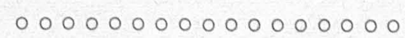
TROUGH LINE


INTERTROPICAL CONVERGENCE ZONE

500-MILLIBAR MAPS


CURRENT TROUGH POSITION


TROUGH POSITION 24 HOURS AGO


TROUGH POSITION 48 HOURS AGO

HEIGHT CONTOUR

ISOTHERMS

5 KNOT WIND

15 KNOT WIND

50 KNOT WIND