

## CHAPTER 10

### RESULTS OF THE WARTIME HISTORICAL AND NORMAL MAP PROGRAM

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The practically global extent of World War II created a need for world weather information more pronounced than in any former period. Insufficient knowledge of weather in remote places, inadequate data on diverse weather elements, and lack of information about conditions extending into the stratosphere, led to the initiation of many projects involving the plotting, analyzing, and drawing of thousands of weather maps and charts. This material proved to be valuable in providing guides to characteristic weather patterns which many meteorologists used in making difficult forecasts for military and transport operations in unfamiliar regions.

In November 1941, at the request of meteorologists of the Army Air Forces, U.S. Navy, and Weather Bureau, a project was started to analyze daily northern hemisphere sea-level maps for the 10-year period 1929-1939. The responsibility for producing the maps was assumed by the Weather Bureau. A unit of more than 100 map plotters was established in Washington, and an assembly line was set up for extracting the required data from thousands of regional weather maps and publications and plotting them on the northern hemisphere base maps. An analysis unit of 12 of the best available synoptic weather analysts was assembled at New York University, and the analyzed maps were then "polished" by a small crew of girls who soon became so expert with a contour pen that with one swift motion they could ink in a wavy isobar extending around the hemisphere. These maps when reduced photographically and printed became so useful that the series was extended to cover the 40-year period 1899-1939. The urgent demand for the maps made it necessary to finish the added 30-year series in a shorter time than it took to complete the first 10-year series. The plotting, analysis, and drafting staff became so large that at one period late in 1943 over 1,000 persons, including 60 Army officers, were employed. Since it was recognized that a series of historical maps based merely on sea-level conditions would not be sufficient to meet the demands of 3-dimensional weather analysis and forecasting, upper-air charts of many types and other specialized charts and summaries were prepared as part of the same general program.

The value of the charts goes far beyond their original military applications. By breathing life into a mass of inert data, the "frozen assets of meteorology" as Prof. Humphreys calls them, the project has provided an indispensable aid for future research and a key to the solution of peace-time operational problems. It is not intended that the so-called "normal" maps be considered as the final word. As new data are accumulated and as more extensive synoptic charts are drawn both for the surface and for upper levels in the atmosphere, it is hoped that a new set of normals will be constructed. As for the historical charts, it is earnestly desired that they be continued as an international meteorological undertaking and enlarged to portray the daily patterns of the state of the atmosphere over the world.

Most of these maps and charts are now available, and an attempt is made here to describe the type and content of each for the benefit of interested individuals and agencies. The material falls into three classes: (A) Daily Historical Weather Maps, (B) Normal Monthly Weather Maps, and (C) Miscellaneous Maps, Charts, and Tables.

#### A. DAILY HISTORICAL WEATHER MAPS

(For the most part, the data for these maps consist of reports from national meteorological services, ship reports, and information gathered from manuscript maps.)

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1. Northern Hemisphere, Sea Level: Consists of monthly volumes of daily synoptic weather maps for 1300Z for the period January 1, 1899-June 30, 1939, inclusive. Analyzed with the assistance of the meteorological staffs of New York University, California Institute of Technology, and University of California at Los Angeles. 486 volumes, size 13" x 13", most of them published during the Winter 1943-44.

(Northern Hemisphere, Sea Level and 500 mb, for October and November 1945 were published by Headquarters, Army Air Forces Weather Service, Washington, D.C. The October issue includes a complete set of teletype weather reports, surface and upper air, received for each map, listed by country, in the code form used by those countries at the time of the reports. Six more months are ready for printing. It is planned to continue this series indefinitely if possible.)

2. Northern Hemisphere, 3,000 Dynamic Meters: Consists of monthly volumes of 0900Z maps for each day from January 1, 1935 to December 31, 1940, and one 1200Z map for each day from October 1, 1932 to December 21, 1934. Basic data plotted are pressure, temperature, mixing ratio, wind direction, and wind speed at 3,000 dynamic meters. Analyzed with the assistance of the meteorological staffs of University of California at Los Angeles and Massachusetts Institute of Technology. 99 volumes, size 13" x 13", published January 1946.

3. North America, 10, 13, 16 km: Each volume contains twice-daily (1100 and 2300 EST) maps for a single month at a single level for the period 1940-1942. Analyzed with the assistance of the meteorological staff of University of Chicago. 108 volumes, 7-1/2" x 10". Published October 1945.

4. Southwest Pacific, Sea Level: Consists of monthly volumes of daily synoptic maps (0700, 120th East meridian time) for the period of 1932-1934, covering the area bounded by 70°E and 145°W longitude, and 30°N and 50°S latitude. Analyzed with the assistance of the meteorological staff of N.Y.U. 24 volumes, 8" x 13". Published August 1944. Unanalyzed maps available for 1935-37.

5. East Asia, Sea Level: Daily sea-level maps, plotted and analyzed for May, October, November, and December 1937, and March, April, and May 1938. Analyzed with the assistance of the meteorological staff of New York University. In addition, daily sea-level maps were plotted but not analyzed for March, June 1937; June 1935; April 1939. Maps extend approximately from 90°-155°E longitude and from 5°S to 55°N latitude. Unpublished. (Some of these maps were utilized in preparation of many special studies, such as the book "Weather and Climate of China," AAF Weather Div. Rept. 850, 2 vols., 1945, for sale by Supt. of Documents.)

### B. NORMAL MONTHLY WEATHER MAPS

1. Northern Hemisphere, Sea Level: Contains normal monthly and annual sea-level distribution of pressure as determined for the 40-1/2-year period (1899-1939) covered by the "Daily Historical Weather Maps, Northern Hemisphere, Sea Level" (A, 1 above). One volume size 13" x 13". Published April 1946. Tables are also available for constructing biweekly normal sea-level charts for the pressure distribution over the northern hemisphere.

2. Northern Hemisphere, Upper Levels: Contains pressure and temperature normals for each month at 10,000 feet, 20,000 feet, 10 km, 13 km, 16 km, and 19 km. List of extensive source material in preface. Analyzed with the assistance of the meteorological staff of N.Y.U. One volume, 13" x 13". Published in 1944.

3. Northern Hemisphere Isograms of Wind Speed and Stream Lines, Upper Levels: Contains isograms of wind speed and stream lines for Northern Hemisphere, one map for each month at each of the following levels: 10,000 feet, 20,000 feet, 10 km, 13 km, 16 km, and 19 km. Based on "Normal Monthly Weather Maps, Northern Hemisphere, Upper Levels" (B, 2 above). Analyzed with the assistance of the meteorological staff of N.Y.U. Unpublished.

4. Normal Contour Maps, Northern Hemisphere, 700 mb: Contains normal height contours and isotherms of the 700-mb surface for each month. Based on "Daily Historical Weather Maps, Northern Hemisphere, 3,000 Dynamic Meters" (A, 2 above). Unpublished.

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5. Normal Contour Maps, Northern Hemisphere, 500 mb: Contains normal height contours of 500-mb surface. Consists of three maps for each month, each map extending over a period of ten days. Based on "Normal Monthly Weather Maps, Northern Hemisphere, Upper Levels" (B, 2 above). Unpublished.

6. Normal Thickness between 700 and 1,000 mb, Northern Hemisphere: Consists of monthly maps of height differences between the 700-mb surface (taken from B, 3 above) and the 1,000-mb surface. Latter surface contours computed from Napier Shaw's normal sea-level pressure values. Unpublished.

7. Normal Vertical Cross Sections, Northern Hemisphere: Contains average vertical cross sections from the surface to a height of 19 km, and from 10°N to 70°N latitude, constructed along meridians spaced 20°, starting from Greenwich, by months. Displays (a) temperature and departure of density of dry air from standard atmosphere in grams per cubic meter; (b) N-S and E-W wind components; (c) altimeter correction in feet and lines of zero temperature anomaly. In addition, each map shows the terrain profile covered by the cross section. Based primarily on "Normal Monthly Weather Maps, Northern Hemisphere, Upper Levels" (B, 2 above). Analyzed with the assistance of the meteorological staff of N.Y.U. 648 charts, size 17" x 27". Unpublished.

### C. MISCELLANEOUS

1. Extreme Temperature Maps, Northern Hemisphere, Upper Levels: Contains isotherms of absolute maximum and absolute minimum temperature for each month and at each of the following levels: 10,000 feet, 20,000 feet, 10 km, 13 km, 16 km, and 19 km. In the back of the volume there are six maps showing the annual range of normal monthly temperature, one map for each level. Analyzed with the assistance of the meteorological staff of N.Y.U. One volume, 13" x 13". Published July 1945.

2. Five-Day Mean Pressure, Sea Level: Contains 5-day mean maps (2 maps per week) for period covering winter seasons of October 1932-June 1939, inclusive. Based on "Daily Historical Weather Maps, Northern Hemisphere, Sea Level" (A, 1 above). Project still in progress. Unpublished.

3. Five-Day Mean Pressure, 10,000 Feet: Contains 5-day mean maps (2 maps per week) for period covering winter seasons October 1932-June 1939. Based on "Daily Historical Weather Maps, Northern Hemisphere, 3,000 Dynamic Meters" (A, 2 above). Project still in progress. Unpublished.

4. Mean Monthly Pressure, Northern Hemisphere, Sea Level: Contains mean sea level pressure for each month for the period January 1899-June 1939, inclusive. In addition, each map carries the zonal index value for the particular map and a graph of the mean pressure at each latitude (pressure profile) as well as the monthly normal pressure at the same latitude. Based on "Daily Historical Weather Maps, Northern Hemisphere, Sea Level" (A, 1 above). Unpublished.

5. Mean Monthly Pressure, Northern Hemisphere, 10,000 Feet: Contains mean 10,000-ft pressure for each month for period October 1932-December 1940, inclusive. Based on "Daily Historical Weather Maps, Northern Hemisphere, 3,000 Dynamic Meters" (A, 2 above). Unpublished.

6. Normal Pressure and Tendencies for the United States: Data tabulated and summarized by Works Projects Administration, Fort Worth, Texas. Contains (a) four pressure tendency charts for each month for the hours 0100, 0700, 1300, and 1900 EST, each chart containing 3 maps (size 4-1/2" x 7") showing 3-, 6-, and 12-hourly tendencies; and (b) normal hourly station pressure charts (size 10" x 15") for each month for approximately 100 airport stations in the United States. Based on the 1931-1940 barograph trace charts for same stations. One volume. Published in 1943.

7. Normal Flying Weather for the United States: Cooperative project of Army and Weather Bureau; basic data tabulated and summarized by Works Projects Administration at New Orleans (1938-1939) and by Federal Works Agency, Work Projects Administration at New Orleans, New York, and Birmingham (1939-1943). Contains charts (size 4" x 7-1/2") of monthly, seasonal, and annual percentages of frequency of occurrence of various visibilities, ceiling heights, and of the general weather phenomena (fog, haze, smoke, precipitation, thunderstorms, etc.) at more than 300

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Weather Bureau Airport Stations. Based on hourly observations for the stations for periods ranging from three to fifteen years. One volume. Published in 1945.

8. Wind Frequency Distribution, North Atlantic Ocean, 6 and 10 km: Contains Baillie wind roses representing frequencies of wind direction and wind speed at 6 km and 10 km, one wind rose map for each month and at each of the two elevations. The second half of the publication contains a percentage frequency distribution of integrated wind components along and at right angles to the principal air routes across the North Atlantic. Based on 0400Z pressure maps for the 3-year period 1942-1944, plotted and analyzed especially for this project. One volume, 6-1/2" x 9". Published September 1945.

9. Wind Frequency Distribution, Northwest Pacific Ocean, 3, 6, and 10 km: Contains Baillie wind roses representing frequencies of wind direction and wind speed at each of the 3-, 6-, and 10-km levels for two-month periods. Based on "Daily Historical Weather Maps, Northern Hemisphere, Sea Level" (A, 1 above) for 1939-1940, "Wind Frequency Distribution, North Atlantic Ocean, 6 and 10 km." (C, 8 above), and pilot-balloon data for several Pacific Ocean stations. One volume, 8-1/2" x 12". Published July 1945.

10. Northern Hemisphere, Tracks of Pressure Centers, Jan. 1899-June 1939: Contains tracks of high and low pressure centers, giving successive positions at 24-hour intervals on a chart of the Northern Hemisphere. There are three charts per month for highs, and three charts per month for lows; each chart covers approximately a ten-day period. Based on "Daily Historical Weather Maps, Northern Hemisphere, Sea Level" (A, 1 above) for the period Jan. 1, 1899 to June 30, 1939. Analyzed with the assistance of the meteorological staff of N.Y.U. Unpublished. (A study of frequencies of highs and lows by 5-degree squares for the period 1929-38 was made by L. W. Sheridan, U.S. Weather Bureau, in 1945. Results of this study may be found in Transactions of the American Geophysical Union, vol. 26, Part I, August 1945.)

The unpublished material listed is still in manuscript form. However, in some instances photostat, photoprint, or microfilm copies are available. Requests for published or unpublished charts should be sent to Chief, U.S. Weather Bureau, Washington 25, D.C.