UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
Washington, D. C.

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MEMO

MEMORANDUM

TO: Area and State Climatologists, Substation Inspectors, Field Aides, WRPCs, River District Offices, and Area Engineers. (With copies to Regional Offices and First Order Stations for information)

FROM: Climatological Services Division

SUBJECT: Climatological Services Memorandum No. 50

CLIMATOLOGICAL SERVICES OF U. S. WEATHER BUREAU 1955

It has been our policy to use the Climatological Service Memoranda as means of interchange of ideas, plans and completed projects. Early this year the Advisory Committee on Climatology met in Washington. After the meeting it was decided that a summary of things reported would provide an excellent "status of climatology" report.

Attached hereto is the summary prepared in the Climatological Services Division. It is hoped that this Climatological Services Memorandum will serve as a useful tool to many in the field and will provide better understanding of our organization, procedures and plans.

for R. E. Spencer
H. E. Landsberg, Chief
Climatological Services Division

(CLIMATOLOGICAL SERVICES MEMORANDUM NO. 50)

WASHINGTON, D. C.
11-23-55

U. S. DEPARTMENT OF COMMERCE
WEATHER BUREAU

CLIMATOLOGICAL SERVICES

OF

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Introductory Note

At the request of the Chief of the Weather Bureau the National Academy, National Research Council, has established a Committee on Climatology. Advice to the Bureau on its climatological program is the aim of this Committee. Its membership, appointed by the National Research Council, is as follows:

1. T. F. Malone - Director
   Travelers Weather Research Center
2. W. A. Baum - Head
   Department of Meteorology
   Florida State University
3. P. E. Church - Executive Officer
   Department of Meteorology and Climatology
   University of Washington
4. A. O. Kuhn - Professor and Head
   Department of Agronomy
   University of Maryland
5. J. H. Longwell - Dean
   School of Agriculture
   University of Missouri

The Committee held its first meeting on April 28-29, 1955, at Suitland, Maryland. At that time members of the staff of the Climatological Services Division gave some informal talks on current activities of the division. This material seemed to be suitable for presentation to a wider circle. It appears, in slightly revised form, in this pamphlet.

I. Historical Background.

We can attribute to Thomas Jefferson the early recognition of a need for systematic records of the climate of the United States. His life-long interest in climatological work found only limited response in his own era. About a century after Jefferson published his first climatological notes a firm framework emerged for a survey of this most important natural resource of the country.

We can follow this development from a review in the "List of Climatological Records in the National Archives"* - although private records of United States weather had been kept for various lengths of time in a number of scattered localities, we read there that "No organized systems of taking meteorological observations were developed until agencies of the Federal Government interested themselves in the matter in the early part of the nineteenth century."

*List of Climatological Records in the National Archives, Washington: March 1942, The National Archives Special List No. 1.

Weather records were collected during the 19th Century by the Surgeon General's office, the General Land Office, the Smithsonian Institution, the Patent Office, and the Signal Corps of the Army. Finally the U. S. Weather Bureau was established in 1891 in the Department of Agriculture. This followed some twenty years of weather service rendered by the Office of the Chief Signal Officer of the U. S. Army. The new civilian Bureau inherited an operating system of work-processes along with the personnel, instruments, and a national network of stations and offices from the Signal Service. Reports of storms and effects of weather on crops, and a growing literature on weather and climate in general were part of the Signal Service inheritance.

Specific climatological objectives were outlined in the Surgeon General's order of 1817 which specifically relates the purposes of Army post weather observations to "medical topography ... prevalent regional complaints ... change of climate ... cultivation of soil ... density of population ..." Professor Joseph Henry's mid-century wish for "exhaustive studies of American climatology" remained a fond hope because it was the possibility of forecasting destructive storms on the sea coasts and Great Lakes that persuaded Congress to authorize the Weather Service from which the present Weather Bureau developed. The Act of October 1, 1890, creating the Weather Bureau, however, farsightedly included among the specific duties of its Chief "the taking of such meteorological observations as may be necessary to establish and record the climatic conditions in the United States."

The beginnings of a Climatological Service were already in operation on July 1, 1891 when the civilian Weather Bureau began its work. Over 2,000 stations were recording daily amounts of precipitation and maximum and minimum temperatures, and 180 more were observing atmospheric pressure, wind, clouds, and sunshine duration. Weekly reports were being published on the effects of weather on cotton and other crops. The published Annual Reports of the Chief Signal Officer and the Monthly Weather Review contained summaries, tabulations, and discussions of the nation's weather, pressure, temperature, precipitation, winds, atmospheric electricity, droughts, forest and prairie fires, sunspots, sandstorms, and other weather phenomena.

The public need for an agency to record and interpret the climates of the United States was recognized during the mid-1890's by establishment of the Climate and Crop Weather Division of the Weather Bureau. The Climatological Services Division is the direct descendent of this unit.

Industrial and agricultural developments have placed further emphasis in the last half-century on the demands for climatological information: a need for data and interpretations useful for planning of crops, housing, marketing, shipping, aviation, air conditioning, flood control, manufacturing, insuring against weather risk and many other agricultural and commercial aspects.

This survey summarizes the program and facilities of the Climatological Services Division as of spring 1955. It will show our present operations and some of our plans for the future.

II. Present Organization.

<u>The Climatological Services Division</u> is located in Suitland, Maryland. It is part of the Central Office of the Weather Bureau, Department of Commerce

(Washington 25, D. C.). There are four operating branches in the Division, each with three or four sections, (see organization chart at the end).

The Climatological Investigations Branch carries on developmental work in methodology and applications of climatic data. It is made up of 1) the Dynamic Climatology Section whose function is to study problems of aerological and synoptic climatology, microclimatology, and climatic trends; 2) the Bioclimatology Section which explores applications of climatology to plant, animal, and human life processes; 3) the Analytical Climatology Section which develops new procedures in statistical climatology and adapts machine and computer techniques to climatological problems; and 4) the Special Projects Section which handles special development programs.

The Climatic Field Service Branch handles all staff functions for the climatic field activities of the Weather Bureau through 1) its Field Programming Section which determines areal requirements for climatic observations, establishes bench-mark stations, and coordinates network operations, including staffing; 2) the Field Liaison Section which maintains operating contact with the National Weather Records Center, the three Weather Records Processing Centers, and climatic personnel at State and Territorial offices; and 3) the Climatic Documentation Section which determines methods and procedures for recording, processing, reproducing, and publishing climatic data.

The Climatic Advisory Branch handles the dissemination of climatic information to the general public and other government agencies. It consists of 1) the Domestic Area Section, which is responsible for supplying climatic information about the continental United States and territories, and which maintains service liaison with agricultural and commercial interests; 2) the Foreign Area Section which supplies United States users with climatic information about foreign land areas. It surveys foreign data and maintains liaison with foreign climatological services; and 3) the Marine Area Section which is responsible for furnishing all climatic information for ocean areas. It plans for care and use of all marine climatic data, and maintains liaison with maritime interests.

The National Weather Records Center (NWRC) is located physically at Asheville, North Carolina, but it operates as the fourth Branch of the Division. It furthers the interests of the National Weather Service and those of the specialized weather services operated by the military departments. The latter make use of NWRC as a common facility but maintain there, as necessary, units of their own. NWRC is the official agency designated by the National Archives as repository of all historical U. S. weather records. NWRC is responsible primarily for the assembly, quality control, mechanical processing and analysis, publication, and final storage of U. S. climatic records, and a fast-growing file of weather records around the world on land and sea. This includes everything recorded about weather, from the contents of widely scattered weather journals kept in the 18th century to the supervised daily entries being made now, at upwards of 12,000 observing stations in the U. S., some hundreds of which record not merely the familiar once-daily temperature and precipitation values but hourly observations of these and a dozen other elements, as well as upper-air soundings of wind, pressure, temperature and humidity. NWRC furnishes many information services and specialized analyses based on its vast collections.

Since 1947 the bulk of U. S. weather observations have been recorded on punch cards and processed by machines. The flexibility of this system has permitted many statistical summarizations and specialized studies. The still-growing demands already require 200 persons. Of these 70 percent are employed on reimbursable projects for other government agencies and private interests. The archive of weather data also provides the raw material for analyses performed by a large processing unit maintained at Asheville by the Air Weather Service for quality control of Air Force weather observations and climatological studies.

The Weather Records Processing Centers (WRPC) located at San Francisco, Kansas City, and Chattanooga serve the Western, Central and Eastern States, respectively. They receive and process the recorded surface data forms from about 12,000 weather observing stations (1st order Weather Bureau, CAA, Air Force, Navy, Cooperative). They handle accuracy check and quality control programs and prepare most of the printers' copy for various climatological data publications. Contact with the many thousand voluntary weather observers is part of the function of these Centers. Each of the Centers has a staff of 33 to 38 people. The territories they serve are shown in Fig. 1. The records of each station (about 3000-4000 in each WRPC area) are punched into cards and later shipped, with the original record forms, to the NWRC at Asheville for inclusion among the general climatological archives.

The Climatic Field Service is handled by Area and State Climatologists. Present plans call for five Area Climatologists in the continental United States. Fig. 2 shows their respective regions. As of August 1955 three positions have been filled. The Area Climatologists are members of the division's scientific staff. Their primary purpose is to furnish technical guidance to the State Climatologists and to handle larger regional problems. They also maintain contacts with regional private and government organizations. Work experience for these assignments has been gathered in the Central Area of the United States. In the past three years we have had an Area Climatologist stationed at Ames, Iowa. His work resulted in a number of special studies of climate-crop relations in the Middle West. It also led to a cooperative weather project with the North-Central group of Agricultural Experiment Stations. A comprehensive joint venture of placing weather data taken prior to 1947 on punched cards and their analysis is now under way.

The State Climatologists are responsible for climatological services within their respective States. This includes some routine duties (for example, preparation of a weekly weather and crop bulletin for the State, collection of reports on severe storms, writing of climatological narratives to accompany data summaries). They cooperate with Agricultural Experiment Stations on studies of relations between climate and crops, irrigation problems, influence of climate on pests, etc. They encourage the use of climatological data for industrial, engineering, and commercial applications in their States and help State agencies, where appropriate, with climatological problems.

III. Station Networks for Climatological Needs.

The networks of observing stations which yield weather information useful for climatological purposes comprise (in 1955) between 12,000 and 15,000 localities in the U. S. proper, Alaska, Hawaii, and the Caribbean. Several hundred of these stations are maintained primarily for other reasons (i. e. 271 First Order* and large numbers of Fruit-Frost, Corn & Wheat, and Fire-Weather stations). But about 5,000 of them are the basic climatic network. They take one observation each day of precipitation and maximum and minimum temperature and keep notes on the occurrence of frosts, thunderstorms, and other weather events. Internally we designate these permanent climatological stations manned by cooperative volunteer observers as the "a" network. Other substations used for the river and flood forecast work comprise the "b" (hydrologic) network. In addition, there are a number of "c" stations which are maintained for public information and similar general purposes. Fig. 3 shows the combined networks for one State, as an example. The basic climatological network (a) above is shown in Fig. 4 for comparison.

*The so-called First Order stations used to be called "commissioned" stations. The First Order station is the oldest kind of Weather Bureau station. It is operated by one or more professional salaried employees. It is usually located in a sizeable community and maintained primarily to serve public needs for meteorological service. Among the tasks of these stations are observations (sometimes 24 a day), dissemination of forecasts and weather warnings, weather information for the press, radio and television.

Continuity in climatic records is very important. Therefore, stations of three networks are maintained with a minimum of changes. These three networks are 1) the "a" substation network discussed in the preceding paragraph and shown for Kansas in Fig. 4, 2) the 24-hour climatic network, chiefly of First Order stations with long records, marked by few alterations in instrumental exposures, and 3) the Climatic Bench-Mark network of long-record temperature-precipitation stations. These climatically representative stations were chosen (during 1955) specifically for continuity value and prospective permanence. The Bench-Mark network is discussed in a subsequent paragraph.

The 24-hour Climatic Network of 179 First Order Weather Bureau and Civil Aeronautics Administration stations is shown in Fig. 5. With few exceptions, these stations record each hour a complete surface weather observation. This includes wet- and dry-bulb temperatures, dewpoint, relative humidity, sky cover, cloud types with height and direction of movement, wind direction and speed, gustiness, atmospheric pressure and tendency, ceiling, visibility, present weather. Although less numerous than those of the basic "a" network these 24-hour stations represent a fairly uniform national grid. They add to the data obtained by the "a" network in important ways: they provide dependable records of important climatic elements not observed at the "a" stations, and supply data about the diurnal variation of temperature, wind, cloudiness, and other weather characteristics.

The Climatic Bench-Mark Network is not yet finally defined. It has as its primary purpose the maintenence of a few stations in perpetuity in order to keep watch on climatic changes. The number of stations considered necessary for this purpose is at least 25 and preferably 50 for the United States. Strict criteria of location, past record, freedom from environmental influence or change, prospective continuity have so far been satisfactorily met by the histories, locations, and records of something over thirty currently operating stations in the continental United States. Twenty-six of these are shown in Fig. 6, which is a planning chart for this network as of October 1, 1955. Other details are that these stations will be located for the most part on property owned by Federal or State governments or Public Institutions (e. g. in National Parks, at Experiment Stations, or on the campuses of Universities) where supervision of the observing program, unbroken continuity of instrument exposure, assurance of record-accuracy, and freedom from molestation are fairly well assured. We hope that the number of these stations can be raised to about 50 in the near future. It is planned to add to the basic instruments for measuring precipitation and temperatures, equipment for other observations, (e. g. wind, solar radiation, soil moisture, soil temperature.

Upper-Air Stations. The history of the observation, processing, analysis, and publication of climatic data for the upper-air closely parallels the history of developing air traffic. However, 19th century climatologists already clearly recognized the importance of this part of atmospheric climate. The lack of workable data precluded anything like the study and evaluation of the forces in the third dimension. With the development of aviation demands for information about the upper levels of the atmosphere multiplied. Instruments and methods were developed to obtain better data from the higher layers of the air. Fig. 7, Upper Air Sounding Network, illustrates the growth and changes in the Weather Bureau's technique of upper-air measurements. Kite observations preceded regular aircraft operations and continued until they were displaced by the airplane-observations (APOBS) of the 1920's. They consisted of mechanically recorded data on temperature, barometric pressure, relative humidity, and wind velocity to heights of about 3,000 meters. They were the chief data for early theoretical work on atmospheric structure. They proved the very great importance of upper-air information, at all levels, for explanation and prediction of the weather.

The expansion of aviation required regular weather information for safety and economy of operations. This led to the beginning of scheduled APOBS, in which an improved meteorograph (for automatically recording humidity, pressure, and temperature) was carried aloft in airplanes to heights of 4 to 5 kilometers. In many ways these APOBS were superior to the kite observations, but there were also bad limitations. They had to be made near localities with airport facilities. When the weather was hazardous, but most interesting to meteorologists because of high winds, icing, low clouds, the flights were often cancelled.

The number of APOB stations increased to 30 by 1937. In that year radiosondes were adopted as the upper-air recording instruments (for temperature, humidity, and pressure) and the first two radiosonde stations were established. In the next few years the APOBS were discontinued altogether. The military services established scores of radiosonde stations as aids in wartime aviation activities in the United States and abroad. At the same time the number of such stations operated by the Weather Bureau for civilian aviation, weather forecasting, and research needs steadily increased. By 1955 the number of radiosonde stations operated by the Weather Bureau and military services exceeded 150. Wartime needs and restrictions began to relax and basic facilities of the National Weather Service were consolidated in the Weather Bureau for the U. S. and its territories. Fig. 8 shows the complete radiosonde-rawinsonde network. The rawinsonde includes wind direction and speed as well as temperature, pressure, and humidity.

In addition to the elements of air-pressure, humidity, and temperature discussed above, observations of cloud base and upper level winds have also improved greatly with the progress of aviation. The heights of cloud bases were measured by ceiling balloons in earlier years. Now, this is done with greater accuracy by timing the passage of the reflected ceilometer light-beam to and from the cloud base. The cost of the ceilometer has so far prevented their placement at all stations, so that the ceiling balloons are still widely used.

For upper-level wind observations of speed and direction, pilot balloons (pibals), followed by theodolite and plotted (azimuth and elevation angles at 1-minute intervals) progressively throughout the observation, have been used since the beginning of the Weather Bureau winds-aloft program in 1917. Since 1917 wind observations have increased from 5 to 290 observing points. The value of these data, both in furthering knowledge of the atmosphere's behavior and in guiding the establishment of lines and levels for air commerce, is incalculable. Of late, similar information has become of vital concern in planning for Civil Defense against the dangers of fall-out from nuclear blasts.

Plans for Specialized Observations. It is evident from some of the foregoing that the basic daily temperature and precipitation readings taken at the unpaid climatological substations were practically the only observations made to serve primarily climatological needs. The observations of other elements - e. g. surface wind, sunshine, clouds, humidity, etc. - were made mainly to serve forecasting and other purposes. Any value the observations might have for climatology was secondary and coincidental.

In effect, we have had a fairly good coverage (2,000-12,000 stations) for 60 to 80 years of temperature and precipitation values for the 3,000,000 square miles of the U. S. proper.

However, for the numerous other elements that make up the climate we have had for the same area and time-period only from 200 to 300 predominantly urban observing stations. For some purposes (related primarily to forecasting practices and local interests) this number and kind of observing points has served more or less satisfactorily. For many other needs where local influences of topography or environment, for instance, might distort the natural measures of weather or where a small-scale survey required a greater density of registering points, neither the number nor the type of these stations has been sufficient.

How to correct this deficiency is both an important and complex problem. Agriculture needs more information on temperature, humidity, wind, radiation in the lower layers of the atmosphere and on temperature and moisture in the soil. Engineering, now reaching into all corners of the country with housing and highway construction, stream regulation, heating and air conditioning, has ever increasing requirements for local climatological information. Heating and cooling load, water supply and drainage, health and recreation all depend on climatic factors. The question of how best to get data for these purposes also includes questions of how many observing points are needed, whether the number per thousand square miles should be the same for the Great Plains as for the Rocky Mountain States, how this number compares for Arizona and Alabama, for the Pacific Coast and the Great Basin.

Besides this general question of the spread and density of stations-for-climate there is also the question of instrumentation. Specific items, at present very much alive in this question, are a bimetallic maximum-minimum thermometer, a recording precipitation gage, a sub-station wind recorder, a recording hygrothermograph. Also, automatic recorders for isolated island and mountain stations are under development; plans for microclimatic observations (probably at State or Federal Experiment stations) are part of the larger plan for expanded cooperative work with other agencies in agriculture, and exploratory work is well under way in a program for gathering much-needed data on soil-moisture, subsurface temperatures, evaporation, and evapotranspiration.

Because the only means of meeting many requirements for climatic data is through finely detailed micro-climatic observations, while for others the values obtained in the regular network are sufficient, plans for a way to serve both needs are under consideration. One favored idea is to establish in significant areas mobile observing units to pin down the relations between micro- and ordinary climatic observations by correlating a short-period micro-record made by the mobile station with records from stations in the macro-network. This should provide guidance for more specific interpretations than is now possible without micro-observing facilities or data.

IV. Present Practices in Climatological Data Processing.

After observations have served their immediate operational uses in weather intelligence and forecasting, they have in the past been subjected to three major treatments. First, they were checked and edited, both to assure the quality of the observational program and to avoid inclusion of gross errors in the climatological record. Secondly, they were summarized and prepared for publication in current monthly and annual bulletins. Thirdly, they were stored, organized and catalogued for use in long-term climatic studies and research analyses.

Prior to 1948, these three actions were conducted in a loosely organized fashion at several hundred stations, and all too often lack of funds, indifference, or pressures of other work led to neglect of the program.

In 1948, however, with the establishment of the Weather Records Processing Centers (WRPC), the previously diffuse processing of climatological data was drawn together, standardized, and streamlined into an integrated procedure which operates on a current basis and uses modern punched card processing techniques.

In this program the observational records from more than 10,000 observing points now flow directly into the WRPC's. There the data for all cooperative stations are transcribed currently to punched cards. At the several hundred First Order stations observers punch their own cards and mail them weekly to the WRPC. The cards are immediately put through a variety of machine runs which screen all elements of the data for reasonableness, flagging entries that fall outside tolerances established by the meteorologist. Observational specialists then edit the flagged entries in detail, and correct the errors disclosed by this editing. It is thus possible, within a time lag of a few weeks at most, to keep observing stations fully informed about the quality of their observing programs and records.

After editing the punched card record, the WRPC's prepare the data for current publication in monthly and annual state and local Climatological Data bulletins. Punched-card machine methods are used throughout this process, even to the preparation of final printer's copy on punched card tabulators. This machine-prepared copy is then assembled, photographically reduced, and printed on high-speed offset presses at the National Weather Records Center (NWRC) in Asheville, N. C.

When the routine is completed at the WRPC, the data and punched cards are shipped to the National Weather Records Center where they become part of the centralized weather records library. Long-term climatological summaries and analyses of the data for research programs are carried on at the NWRC. A wide array of punched card data processing and computing machines is used there, including a variety of electronic digital computers which are capable of performing the most sophisticated statistical and mathematical operations on the data.

The unexploited potential of the climatic archives is immeasureable. Production of long-term data tabulations is presently restricted by financial limitations, but plans for greater use are in the making.

Development Work in Progress and Planned. Problems in servicing and processing climatological data, by no means completely solved, have in one sense even been aggravated by the accelerating advances in automatic data-handling and processing techniques. An example of this is the need for reduction of the growing mountain of perishable punched card records to a more efficient size, more permanent record-medium, and lower storage and maintenance costs.

In cooperation with the Bureau of Standards and the Census Bureau,and co-sponsored by Air Force and Navy weather agencies, equipment is now being developed that will enable us to reduce our punched card library to microfilm, with automatic future recall of the data whenever and in whatever form required. The Census Bureau is building, to Weather Bureau specifications, a punched-card-feeding microfilm camera that will microfilm 500 cards per minute, placing approximately 14,000 card images on a 100 ft. roll of 16 mm film. With this camera our entire present card library, jammed into 30,000 sq. ft. of floor space, could be housed in less than 300 sq. ft. of microfilm files. (If the present rate of accumulation is maintained, the presently allotted 30,000 sq. ft. of library space would be adequate for the next 1,000 years!)

This reduction of punched cards to microfilm as a medium for machine processing will become practical by the development of a Film Optical Scanning Device for Input to Computers called FOSDIC, a prototype of which is now being built by the Bureau of Standards to Weather Bureau specifications. FOSDIC is a high-speed automatic means for reading the microfilm of punched cards. It employs the flying spot of an electron gun to scan the image of a punched card projected onto the screen of a cathode ray tube similar to the picture tube in a TV set. The prototype FOSDIC will scan the microfilm for selection of desired microframes at a rate of between 3,000 and 6,000 frames per minute, and will read the data from the selected frames into a card-punching machine, for re-creation of the punched card record. Subsequent models will serve as direct input to high-speed electronic computers, or as input to conversion of the data to other high-speed media, such as magnetic tape.

The reduction of the ever-growing volume of original meteorological observations forms another problem in data handling. In the past, attempts have been made to utilize standard microfilm techniques, but this has not been entirely satisfactory because it is impossible to organize data on film in a manner sufficiently versatile for their utilization in varied types of technical investigations.

The obvious solution is to develop a unitized type of micro-record similar to the micro-card but one which will provide a negative film copy at a cost comparable to standard microfilm. Such negative film could be used in the preparation of inexpensive positive (paper) copy which could be used with standard micro-card viewers. The plan is to attach a document-feeding mechanism to a standard 70 mm microfilm camera and place several small images across the 70 mm film, resulting in a film negative similar to a micro-card.

In accordance with the Federal Records Act of 1950 the Weather Bureau has established a disposal program which, in general, provides for destruction of original recorder charts after 5 years, if microphotographic copy has been prepared. Similarly it provides for destruction of manuscript observational records after 30 years if microphotographic copy has been prepared.

V. Routine Publications.

The processing and storing of weather data for future reference represent the conservation part of our job. In addition we have a responsibility to disseminate the information. The number of people and purposes requiring climatological data is so great, and the variety of uses so wide, that the problem of publication will perhaps never be solved to the satisfaction of everybody. The program now in effect has been shaped by three-quarters of a century's experience with public needs and protests combined with Weather Bureau capacities and limitations. It can only serve to make the basic data available on a broad scale, rather than serve specific applications. Even so a casual examination of the publications might suggest that the Climatological Data and the Weekly Weather and Crop Bulletin are purposely intended to serve non-urban and agricultural interests, that the Local Climatological Data is meant to please large cities, and that its Supplement favors aviation; but a closer look at these publications will show that each actually reflects the motive to serve as many users as well as possible.

The Weekly Weather and Crop Bulletin is usually published each Tuesday at noon. It carries information of particular interest to agriculture. Crop data are collected in cooperation with the Agricultural Marketing Service of the Department of Agriculture and State agricultural agencies and are combined with descriptions of concurrent weather. The section "Weather of the Week" is presented along with special discussions of the effects of weather on crops and farm activities. In season, small grains, pastures, corn, cotton, soybeans and other crops are discussed separately. Weekly temperature and precipitation and monthly heating degree-day data are given in chart or tabular form. Near the 1st and 15th of the month the monthly Weather Outlook of the Extended Forecast Section is included, and in the first issue of each month charts of total precipitation for the previous month and departures from normal are given. When farm activities are at their peak, a written summary of conditions in each State is included covering the status of crops and the weather effects. Special articles of general interest to agriculture, such as droughts, are written from time to time, and charts and tabulations of current importance are also included. During the spring, ice conditions on the Great Lakes are discussed prior to opening of the shipping season.

The Local Climatological Data (Fig. 9) publication is prepared monthly for about 300 cities in the United States and for representative territorial stations. This publication includes daily climatological information and summaries for the month. Also included, where available, are hourly precipitation data. Brief summary tables of averages, departures, and extremes of temperature, precipitation barometric pressure and heating degree-days are also included.

A monthly Supplement to the Local Climatological Data (Fig. 10) is published for stations where 24-hourly observations are taken each day. The supplement contains seven basic tables as follows:

a. Temperature and Wind Speed-Relative Humidity Occurrences (hourly observations).

b. Wind Direction and Speed Occurrences.
c. Hourly and Daily Occurrences of Precipitation Amounts.
d. Ceiling-Visibility Occurrences (hourly observations).
e. Hourly Occurrences of Sky Cover, Wind, and Relative Humidity.
f. Hourly Temperatures.
g. 6-hourly Observations of Sky Cover, Psychrometric Data and Wind.

For stations issuing the Local Climatological Data, an annual issue, Local Climatological Data with Comparative Data, contains a brief description of the general climate of the locality and a station history. One table shows data recorded for the past year - monthly totals, averages, and in some cases extremes of the elements of temperature, precipitation, relative humidity, wind, sunshine and degree-days. In addition, there is a table of normals, means, and extremes of the same elements for the period of record. Tables of average monthly and annual temperature, precipitation, degree days and snowfall cover the period of record since the beginning of this century.

For each State a periodical Climatological Data is issued. It covers observations from all regular networks. The monthly issue contains daily maximum and minimum temperatures, daily precipitation, snowfall and snow on the ground, evaporation and wind (where available) in addition to a weather summary for the month, comparative data, and monthly summaries. The annual issue contains monthly and annual averages and departures from normal of temperature, precipitation, evaporation and total wind movement as well as a general weather summary for the year and a table of extremes and freeze data.

Climatological Data, National Summary contains pressure, temperature, precipitation and wind data for selected U. S. stations. There is a general summary of weather conditions over the country. Special articles describe hurricanes, unusual weather, and river and flood conditions. Also included is a table showing the place, time, character and estimated damage of all reported severe storms. Average monthly radiosonde and pilot-balloon data are presented in tabular form; so are solar radiation data. Fifteen charts of the United States graphically portray temperatures, precipitation, snowfall, sky cover, percentages of sunshine, tracks of cyclones and anti-cyclones, solar radiation and monthly average upper air winds and heights. The annual issue presents summaries of all these data for the year and includes information on excessive rainfalls, hurricane tracks, and tornado paths.

Climatic Data for Northern Hemisphere and World. For research and as an historical record, the value of a series of maps which show the continuity and the developments and actions of weather over the largest possible area has been obvious for a long time to everybody concerned with the study of meteorology and the history of weather. The first successful attempt to do something about it was launched in 1873 by the Chief Signal Officer of the Army, before the Weather Bureau was established, and on July 1, 1875, with the United States defraying all expenses, the daily issue of the "International Bulletin of Simultaneous Reports" began in Washington. By 1878, with the cooperation of other countries, it became possible to start a series of daily international weather charts covering the Northern Hemisphere principally. This series continued through 1887.

By 1891, when the Weather Bureau was established, this series had stopped, and thereafter was not resumed for half a century. There were probably several reasons for this, including two wars and the beginning of another, but the most compelling reason was the lack of sufficient money to gather and publish the material. In 1941, however, with aviation established as a major war weapon, and with demands for world-weather knowledge critically increased, the Army, Navy, and Weather Bureau joined forces to produce the first ten years of a series of analyzed Historical Northern Hemisphere maps. Thanks to the help of the Air Force this historical series was extended back to 1899, and carried forward. It is now a series of synoptic surface and 500-mb charts and listings of data for the entire Northern Hemisphere for 1230 Greenwich Mean Time. It is prepared by a special section at the National Weather Records Center in Asheville. In the post-war period it was jointly supported by the Weather Bureau, Navy, and Air Force.* Because of their proved value in many fields, the "Data Listings" are soon to be published as a daily bulletin containing all available upper air observations over North America. In order to cover more fully the meteorology of extreme weather conditions (hurricanes, for example) it is planned to publish many more surface and special data associated with critical weather periods and events.

VI. Special Service Programs.

Upper Air Summaries. Up to about 1950, the best summaries of winds over the United States appeared in the Weather Bureau's 1941 Airways Meteorological Atlas. This contained upper-level wind data for 58 stations in the Continental United States. The bulk of these observations were for 500-, 1000-, 3000-, and 5000-meter elevations. Above these levels the data were extremely biased towards lower-speed and fair-weather winds. The reason for this was that the summaries were all based on pilot-balloon observations, which became very selective in high winds and foul weather.

With the development of aircraft capable of flight in almost all types of weather, the need for better summaries became increasingly acute. The advent of jet aircraft, with requirements for flight at higher elevations, made new data imperative. This is how theneeds were met:

The Weather Bureau, under Navy sponsorship, produced 3 volumes of wind data from 111 stations ranging from Korea across the Pacific, the United States and the Atlantic to the coast of Europe, including data to heights of 40,000 feet based primarily on rawin observations. Bias at higher elevations was eliminated by geostrophically scaling winds for missing observations, with the effect of including as many values at 40,000 feet as at lower elevations. Wind aid values for aircraft flying in any of the 16 cardinal directions were computed for each observation by a new method and presented in frequency distributions. Summaries showing the percentage probability of any given amount of wind aid or retardation were shown by seasons for various routes.

In 1945 the Weather Bureau published the "Upper Air Average Values of Temperature, Pressure, and Relative Humidity over the United States and Alaska". These values were based on only 4 years of data however. We are now preparing a revision of this publication which, in addition to averages based on 10 years of data, will contain extremes, standard deviations, and density values for all standard upper air levels.

*Note: Responsibility for this publication was assumed completely by the Weather Bureau on July 1, 1955. Henceforth the issue will be as nearly current as practicable, and earlier gaps left in the series because of irregular financial support will be closed as rapidly as funds become available.

Agreements reached by the World Meteorological Organization (WMO) have led to an international exchange of climatological data. Mean monthly values of surface temperature, humidity, rainfall, and of upper air height, temperature and humdiity at standard pressure levels, have been furnished as promptly as possible by most countries of the World for publication early the following month in the Weather Bureau's bulletin Climatic Data for the World. As a result of action by the Second Congress of WMO in 1955, the World Meteorological Organization will henceforth formally sponsor this publication, which will continue to be issued by the Weather Bureau. These arrangements are expected to pave the way for collection of basic data for such world-wide summaries as appeared earlier in Clayton's "World Weather Records".

Climatological Atlas. For a long time there has been a need for a modern presentation of U. S. climate. Kincer's contribution to the "Atlas of American Agriculture" in the 1920's was splendid for agricultural purposes. Considering the geography that makes this country extremely rich in climatic diversity - three sea coasts, mountain ranges, plains, inland lakes, deserts, forested lands - and considering also the almost limitless uses the people have for climatic information, the need for up-to-date climatic charts becomes obvious.

This is a large undertaking. It requires climatologists, statisticians, business-machine operators, and draftsmen to do the work, which takes a great deal of money. Also, anything less than half a century of reliable records would be insufficient for dependable conclusions about trends, normals, and some other details of climatic dynamics. Only in the last decade or so, enough of the right kind of data have become available for a modern Climatic Atlas of the U. S.

Considerable progress has been made on production of a great National Atlas of the U. S. Basic plans have been prepared by the Earth Sciences Division of the National Research Council - National Academy of Sciences. This Atlas, designed to present all significant material on geography and resources of the country, is to be in loose-leaf form with a standardized format. The Weather Bureau will cooperate by issuing, from time to time, new climatological charts to become part of this Atlas. A copy of the first chart in the series is shown in Figure 11.

Data Surveys of Foreign Stations and regions are accomplished by the Foreign Areas Section. The Data Survey Unit of this Section, maintained to survey and annotate weather data for foreign areas for use by civilian and military agencies, has the support of the Air Weather Service, the Navy, and Army. Basic surveys for particular areas of the world, compilations on particular weather elements, basic data in the available literature or climatic summaries applicable to specified porblems are prepared. A continuing annotation of periodicals for information on foreign climates is maintained. Finally, special projects, based on collections of world-wide data resulting from these surveys, are undertaken. An example of this type of work is the recent World Sunshine Map, Fig. 12. The various foreign aid programs of the government often require climatological information, which is being provided as far as possible. Increased travel, international air traffic, marketing of U. S. products abroad have increased demands for foreign climatic data. There is urgent need to expand this service for the benefit of U. S. industry and commerce.

Marine and Ocean Projects. The marine climatological work concentrates on services to civilian and military maritime interests of the Government. The climatic material for the United States Coast and Geodetic Survey publication "Coast Pilots", the U. S. Navy Hydrographic Office "Sailing Directions" and "Pilot Charts" are a primary job. Other routine work includes climatological data for foreign surveys, and data for cases in Admiralty courts; also articles on marine climatology for Hydrographic Office Pilot Chart map backs, the "Hydrographic Bulletin" and for the Weather Bureau "Climatological Data" monthly and annual national summaries. All this requires continuous liaison with other government offices concerned with marine climatological problems. The outstanding work now in preparation is a six volume Marine Atlas sponsored by the U. S. Navy. Most of the work on this is done at the National Weather Records Center, Asheville, North Carolina. Fig. 13 illustrates the handling of marine climatological data.

Working Fund Arrangements. The unique data collection in possession of the Weather Bureau gives a peculiar responsibility. This is a monopoly, equally valuable to scholars and operators in the meteorological field, which calls for considerable administrative wisdom. We have to steer a course between avaricious concealment of the treasure and careless dispersal. It seems best to perform centrally as many services as possible at NWRC on a strict, business-like cost-reimbursement basis. In this way data, tabulations, and analyses can be made available at extremely low cost to other agencies, industrial consumers, private meteorological consultants, and research workers. Our motto is prompt and efficient service. Nearly half of our overall effort in climatology is carried on under working fund arrangements. Among our primary customers are the U. S. Navy (Aerology and Hydrographic Office), U. S. Army (Corps of Engineers, Signal Corps), TVA, Forest Service and many other government agencies. A legion of private firms have larger or smaller work agreements with us. It is natural that we would like to serve climatological and meteorological research more and better than we were able to in the past. Wherever possible, research data are given priority treatment.

Investigations. An operating service is prone to be satisfied with furnishing answers to questions placed before it and to discharge its routine duties competently. But there is always the danger that its work becomes stereotyped. The best guard against this occupational hazard of bureaucracy is excursions toward the frontiers of knowledge. In applied climatology a great deal remains to be done, and hence, efforts by all our professional personnel toward improvements of theory, practice, and techniques of climatology are encouraged. Among the small projects under way are climatological guides for major cities, study of presentations of the agriculturally important droughts, wind aids on air routes, and hurricane track trends. This is not an exhaustive list but an indication of our interest in contributing to the development of the science of climatology.

VII. Outlook.

The preceding presentation should leave no impression of smug satisfaction with our program. Rather it is an account of where the climatological work in the Weather Bureau now stands. We have plans for the future. Some are mere hopes, others are well along toward fulfillment.

Most important in our plans is the establishment of full-time positions of State climatologists where these are not now in existence. These jobs are intended to furnish better climatological service in all parts of the country.

Close cooperation with State agencies, land-grant colleges, agricultural experiment stations is envisaged. The duties of the State climatologists, in addition to the routine work on weather and crop bulletins, severe storm reports, and descriptive climatological summaries for the State, include analytical and developmental work. Particularly, attention will be devoted to use of climatological data for general agricultural purposes, irrigation, water supply problems, recreation, industrial and urban development planning in the State.

In fulfillment of the legal responsibility of the Weather Bureau adequately to describe the Climate of the United States, its territories and possessions, a series of climatological summaries is planned. These will comprise the climatography of the U. S. Multi-year compilations of tables of climatic data for first-order and substations are the first step. A comprehensive revision and publication of long-term records (as a sequel to the old Bulletin W) is planned for the next decade. The same basic data are to serve for new climatological maps of the country. These, as mentioned above, will become part of the National Atlas.

With progress in the establishment of Bench-mark stations there will be an analysis of the older records in search of climatic trends.

Better documentation practices for old and new climatic data and improved techniques of processing and storing will remain one of our most important aims. In this respect we feel keenly the need for active participation in development work directed toward new approaches to climatological problems by use of specially adapted machines, computers, reproduction equipment.

We hope to explore, preferably cooperatively with colleges and universities, the potentialities of synoptic climatology. We are conscious of the valuable "feed-back" mechanism inherent in climatic material for the forecaster. In addition, there are new avenues of applying climatology to problems of plant and animal life, and human health and well-being. We hope to make some useful contributions in these fields.

KEY PERSONNEL IN CLIMATOLOGY

Climatological Services Division - Washington, D. C.

Chief of Division - Helmut E. Landsberg
Asst. Chief of Division - Robin E. Spencer
Analytical Climatology Section - Julius F. Bosen
Dynamic Climatology Section - Benjamin Ratner
Bioclimatology Section - L. Dean Bark
Special Projects Section - Earl C. Thom
Field Liaison Section - Claude K. Vestal
Field Programming Section - Joseph H. Hagarty
Climatic Documentation Section - Harold B. Harshbarger
Marine Area Section - William H. Haggard
Domestic Area Section - Robert W. Schloemer
Foreign Area Section - Joseph W. Berry

Weather Records Processing Centers

Chattanooga, Tennessee
Supervising Climatologist - V. D. Steves
1st Assistant - H. L. Lippmann
Kansas City, Missouri
Supervising Climatologist - G. E. Stegall
1st Assistant - L. A. Schaal
San Francisco, California
Supervising Climatologist - H. C. Steffan
1st Assistant - H. E. Torbitt

National Weather Records Center - Asheville, North Carolina

Director - Leslie Smith
Project Engineering Section - Raymond L. Joiner
Harold L. Crutcher
William M. McMurray
Norman L. Canfield
Henry L. Bent
Program Operations Section - Sherman M. Brewster
Climatological Information Services Section - Robert R. Dickson
Records Service Section - Lawrence M. Dye

NORTHEASTERN AREA

Northeastern Area Climatologist - WBO, New York City - James K. McGuire

Location of Full-time State Climatologists

New England - WBO, Boston, Massachusetts - Paul Kangieser

Location of Acting State Climatologists

Delaware - Weather Bureau Airport Station, Baltimore
Maryland - Weather Bureau Airport Station, Baltimore
New Jersey - Weather Bureau Office, Trenton
New York - Weather Bureau Office, Albany
Pennsylvania - Weather Bureau Airport Station, Harrisburg
West Virginia - Weather Bureau Office, Parkersburg

SOUTHEASTERN AREA

Southeastern Area Climatologist - Vacant

Location of Full-time State Climatologists

Georgia - University of Georgia, Athens, Horace S. Carter
South Carolina - Weather Bureau Airport Station, Columbia, Nathan Kronberg
West Indies & Caribbean - Weather Bureau Office, San Juan, P. R., David Smedley

Location of Acting State Climatologists

Alabama - Weather Bureau Airport Station, Montgomery
Arkansas - Weather Bureau Airport Station, Little Rock
Florida - Weather Bureau Office, Jacksonville
Kentucky - Weather Bureau Airport Station, Louisville
Louisiana - Weather Bureau Office, New Orleans
Mississippi - Weather Bureau Office, New Orleans
North Carolina - Weather Bureau Airport Station, Raleigh
Oklahoma - Weather Bureau Airport Station, Oklahoma City
Tennessee - Weather Bureau Airport Station, Nashville
Virginia - Weather Bureau Airport Station, Richmond

CENTRAL AREA

Central Area Climatologist - Ames, Iowa - Gerald L. Barger

Location of Full-time State Climatologists

Illinois - 601-1/2 E. Springfield Ave. Champaign, Paul F. Sutton
Iowa - Weather Bureau Office, Des Moines, C. R. Elford
Kansas - Weather Bureau Airport Station, Topeka, A. D. Robb
Ohio - Weather Bureau Office, Columbus, L. T. Pierce
South Dakota - Weather Bureau Office, Huron, William T. Hodge

Location of Acting State Climatologists

Indiana - Weather Bureau Airport Station, Indianapolis
Michigan - Weather Bureau Office, East Lansing
Minnesota - Weather Bureau Office, Minneapolis
Missouri - Weather Bureau Office, Columbia
Nebraska - Weather Bureau Office, Lincoln
North Dakota - Weather Bureau Airport Station, Bismarck
Wisconsin - Weather Bureau Airport Station, Madison

NORTHWESTERN AREA

Northwestern Area Climatologist - Seattle, Washington - M. D. Magnuson

Location of Full-time State Climatologists

Alaska - Regional Office, Anchorage - C. E. Watson
California - Weather Bureau Office, San Francisco - R. F. Dale
Oregon - Weather Bureau Office, Portland - G. Sternes
Trust Territories - Weather Bureau Office, Honolulu - D. I. Blumenstock
Hawaii - Weather Bureau Office, Honolulu - W. F. Feldwisch
Washington - Weather Bureau Office, Seattle - E. Phillips

Location of Acting State Climatologists

Idaho - Weather Bureau Airport Station, Boise
Montana - Weather Bureau Office, Helena
Wyoming - Weather Bureau Airport Station, Cheyenne

SOUTHWESTERN AREA

Southwestern Area Climatologist - Vacant

Location of Full-time State Climatologists

Nevada - Weather Bureau Office, Salt Lake City - Vacant
New Mexico - Weather Bureau Airport Station, Albuquerque - George Von Eschen
Utah - Weather Bureau Office, Salt Lake City - Vacant

Location of Acting State Climatologists

Arizona - Weather Bureau Airport Station, Phoenix
Colorado - Weather Bureau Office, Denver
Texas - Weather Bureau Office, Houston

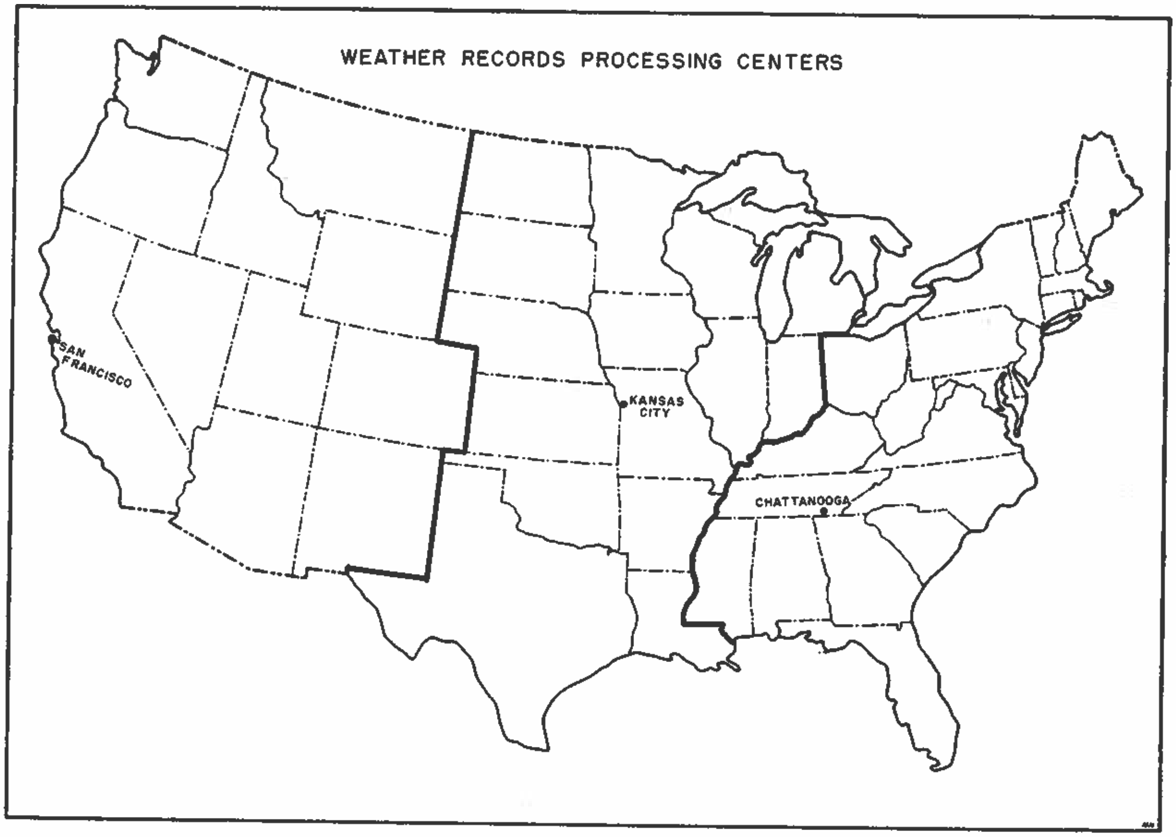

WEATHER RECORDS PROCESSING CENTERS
SAN FRANCISCO
KANSAS CITY
CHATTANOOGA

Fig. 1

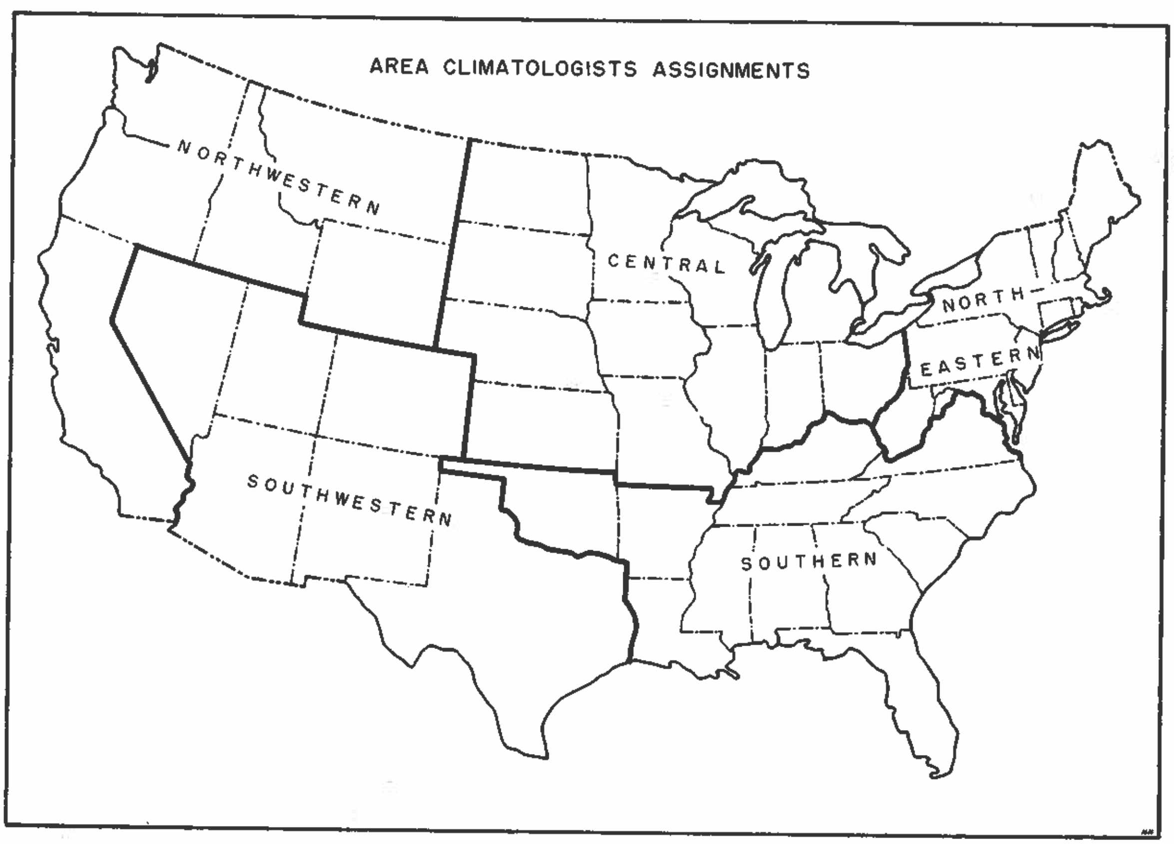
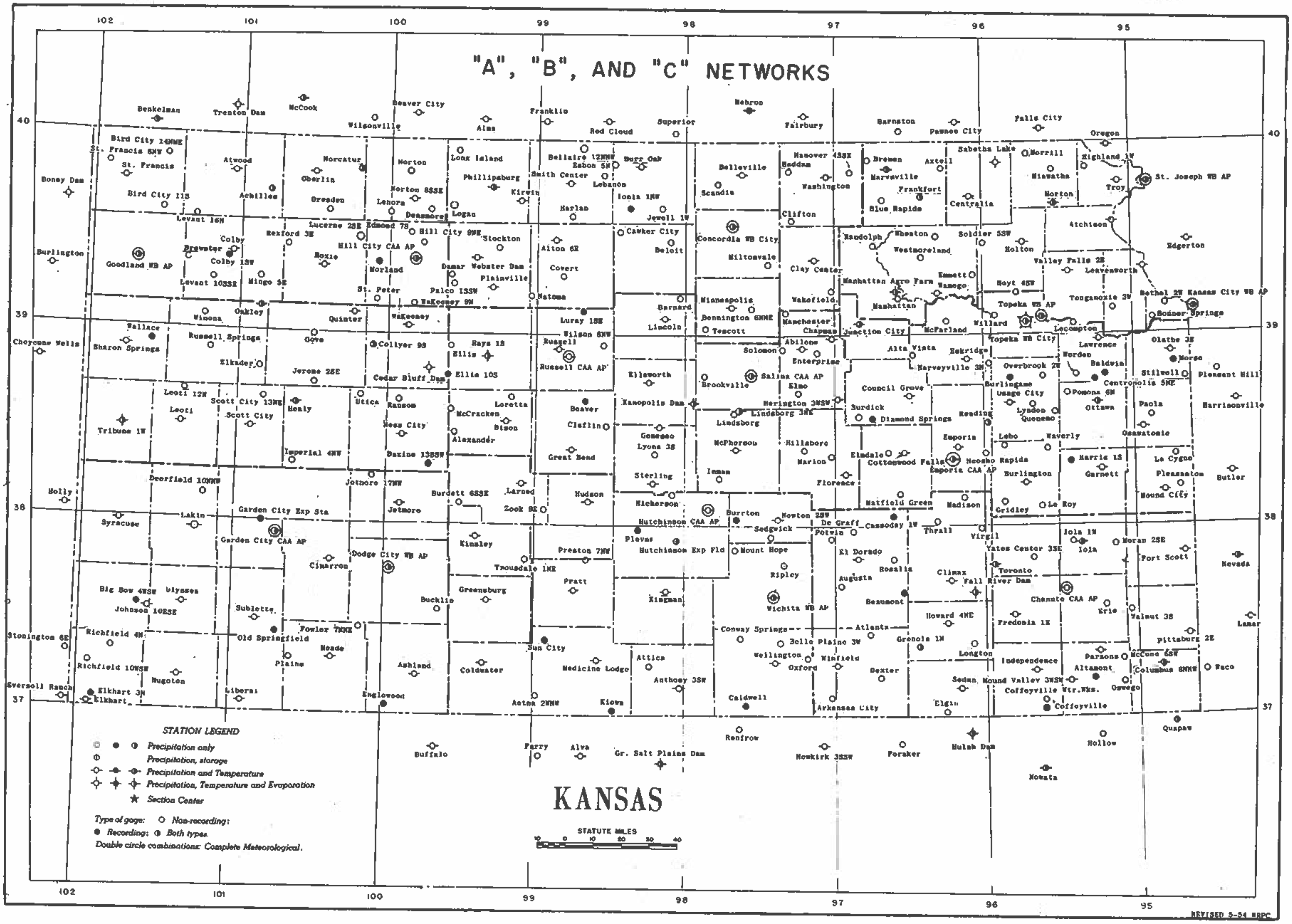

AREA CLIMATOLOGISTS ASSIGNMENTS
NORTHWESTERN
CENTRAL
NORTH-EASTERN
SOUTHWESTERN
SOUTHERN

Fig. 2



"A", "B", AND "C" NETWORKS
KANSAS
STATUTE MILES
STATION LEGEND
Precipitation only
Precipitation, storage
Precipitation and Temperature
Precipitation, Temperature and Evaporation
Section Center
Type of gage: Non-recording; Recording; Both types.
Double circle combinations: Complete Meteorological.
REVISED 5-54 WRPC
Benkelman
Trenton Dam
McCook
Beaver City
Wilsonville
Franklin
Red Cloud
Superior
Hebron
Fairbury
Barnston
Pawnee City
Falls City
Oregon
St. Joseph WB AP
Edgerton
Bird City 14NNE
St. Francis
Bonny Dam
Atwood
Oberlin
Norton
Phillipsburg
Belleville
Washington
Marysville
Hiawatha
Troy
Atchison
Goodland WB AP
Colby
Hill City CAA AP
Stockton
Concordia WB City
Manhattan
Topeka WB AP
Kansas City WB AP
Cheyenne Wells
Wallace
Russell CAA AP
Salina CAA AP
Lawrence
Olathe 3E
Tribune 1W
Scott City
Ellis
Hays 1S
Great Bend
McPherson
Emporia
Ottawa
Paola
Holly
Syracuse
Garden City CAA AP
Dodge City WB AP
Larned
Hutchinson CAA AP
Wichita WB AP
Chanute CAA AP
Iola
Fort Scott
Nevada
Lamar
Richfield 4N
Elkhart
Liberal
Meade
Ashland
Coldwater
Medicine Lodge
Kiowa
Caldwell
Arkansas City
Coffeyville
Independence
Parsons
Pittsburg 2E
Buffalo
Alva
Gr. Salt Plains Dam
Renfrow
Newkirk 3SSW
Foraker
Hulah Dam
Hollow
Nowata
Quapaw

Fig. 3

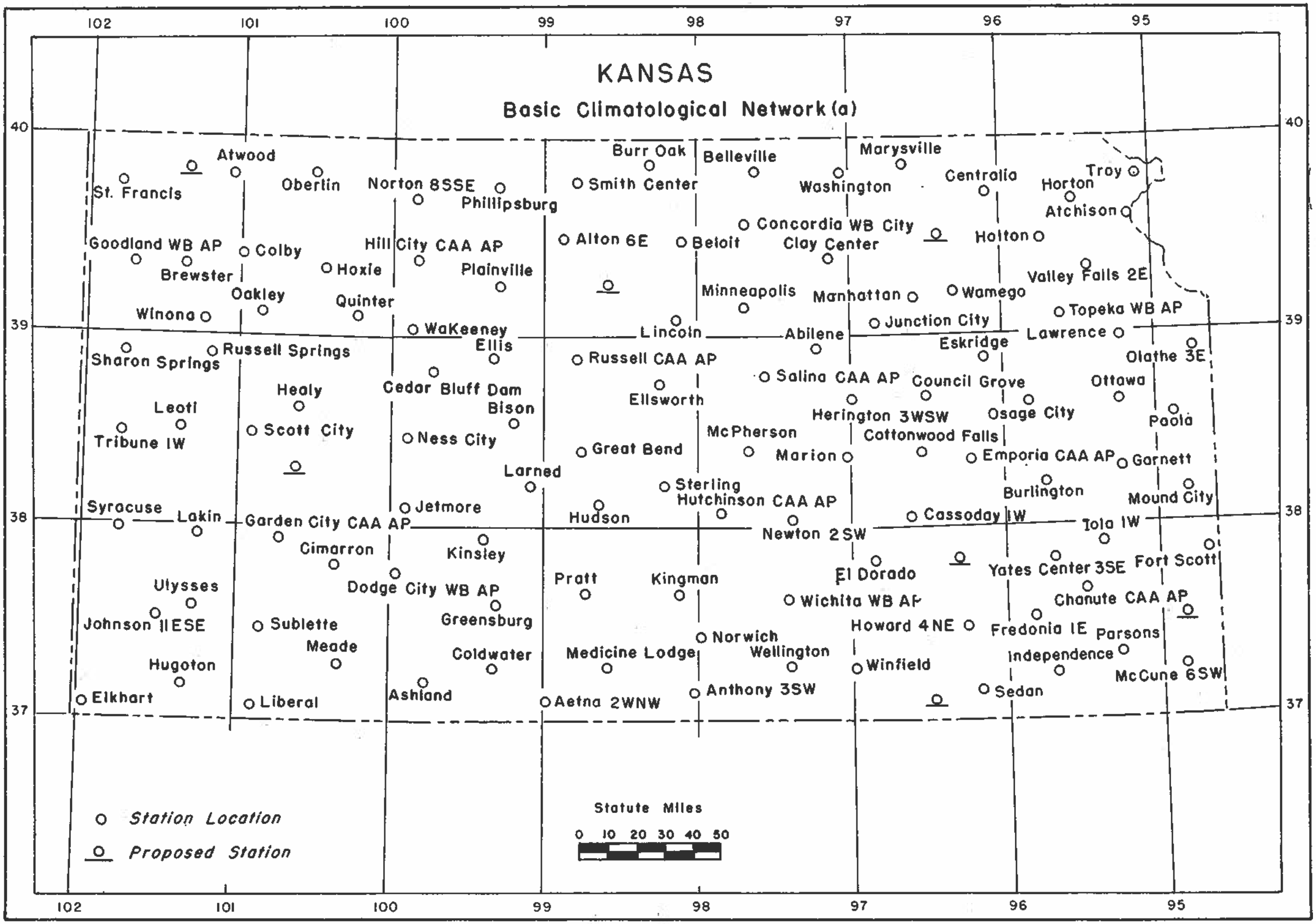

KANSAS
Basic Climatological Network (a)
St. Francis
Atwood
Oberlin
Norton 8SSE
Phillipsburg
Smith Center
Burr Oak
Belleville
Washington
Marysville
Centralia
Horton
Troy
Atchison
Goodland WB AP
Colby
Brewster
Hoxie
Hill City CAA AP
Plainville
Alton 6E
Beloit
Concordia WB City
Clay Center
Holton
Valley Falls 2E
Oakley
Quinter
Minneapolis
Manhattan
Wamego
Topeka WB AP
Winona
WaKeeney
Ellis
Lincoln
Abilene
Junction City
Lawrence
Eskridge
Sharon Springs
Russell Springs
Russell CAA AP
Salina CAA AP
Council Grove
Olathe 3E
Ottawa
Healy
Cedar Bluff Dam
Ellsworth
Herington 3WSW
Osage City
Leoti
Bison
McPherson
Cottonwood Falls
Paola
Tribune 1W
Scott City
Ness City
Great Bend
Marion
Emporia CAA AP
Garnett
Larned
Sterling
Hutchinson CAA AP
Burlington
Mound City
Syracuse
Lakin
Garden City CAA AP
Jetmore
Hudson
Newton 2SW
Cassoday 1W
Iola 1W
Cimarron
Kinsley
El Dorado
Yates Center 3SE
Fort Scott
Ulysses
Dodge City WB AP
Pratt
Kingman
Wichita WB AP
Chanute CAA AP
Johnson 11ESE
Sublette
Greensburg
Howard 4NE
Fredonia 1E
Parsons
Meade
Coldwater
Medicine Lodge
Norwich
Wellington
Independence
Hugoton
Winfield
McCune 6SW
Elkhart
Liberal
Ashland
Aetna 2WNW
Anthony 3SW
Sedan
Station Location
Proposed Station
Statute Miles
0 10 20 30 40 50
102
101
100
99
98
97
96
95
40
39
38
37

Fig. 4

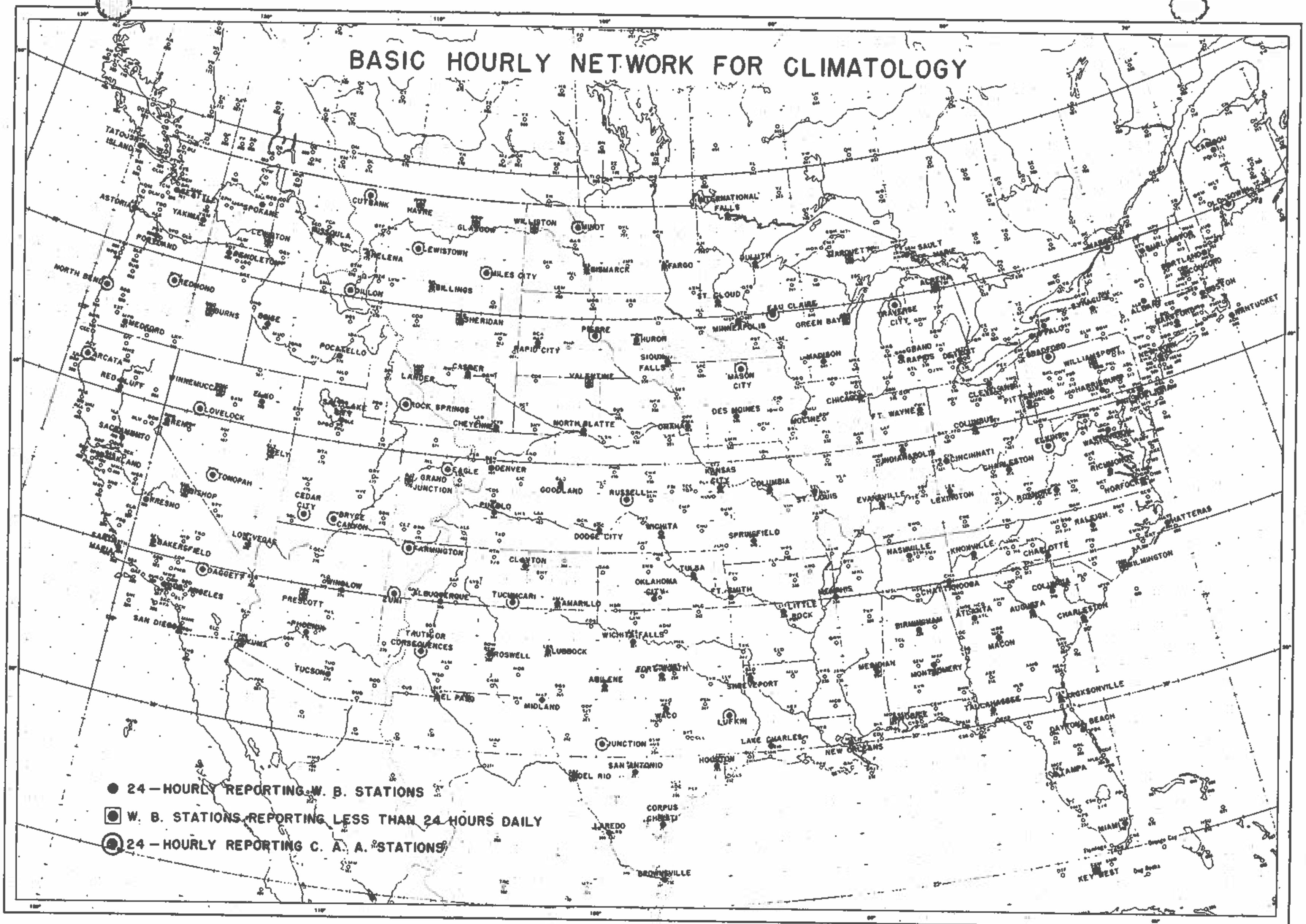

BASIC HOURLY NETWORK FOR CLIMATOLOGY
24 — HOURLY REPORTING W. B. STATIONS
W. B. STATIONS REPORTING LESS THAN 24 HOURS DAILY
24 — HOURLY REPORTING C. A. A. STATIONS

FIG. 5

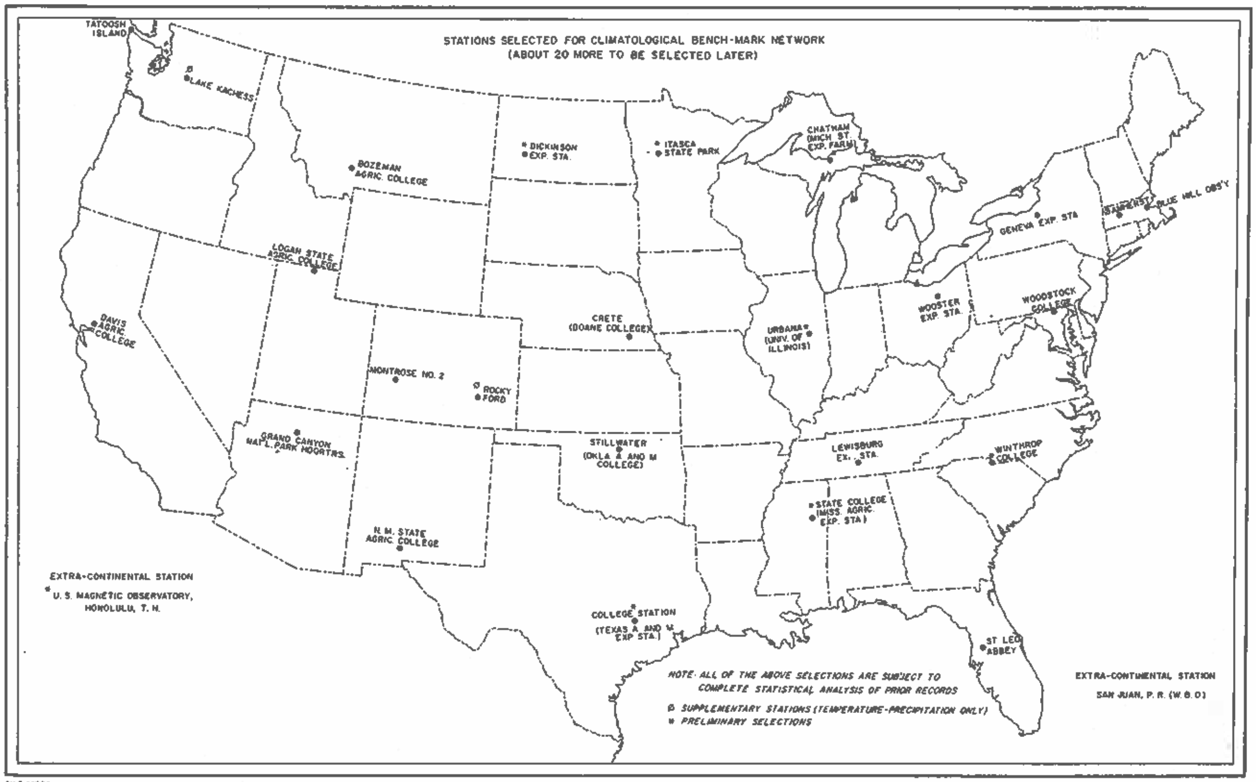
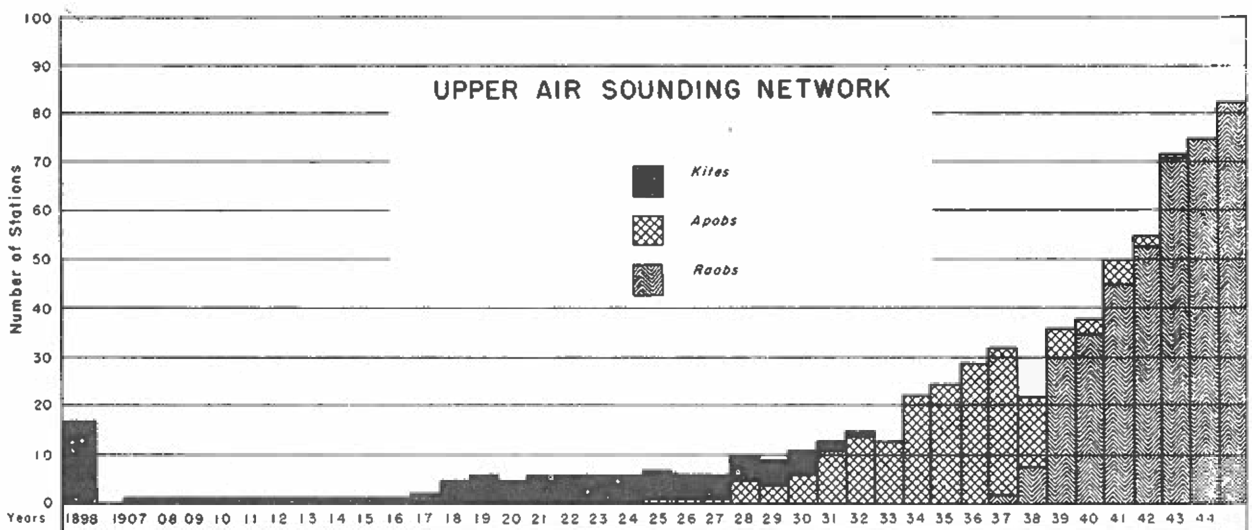


Fig. 6



Number of Stations

Years	1898		1907	08	09	10	11	12	13	14	15	16	17	18	19	20
Raobs																
Apobs																
Kites	17		1	1	1	1	1	1	1	1	1	1	2	5	6	5

Years	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Raobs																	2	8	30	35	45	53	71	[illegible]
Apobs					1	1	1	5	4	6	11	14	13	22	24	29	30	14	6	3	5	2	1	
Kites	6	6	6	6	6	5	5	5	5	5	2	1												

Fig. 7

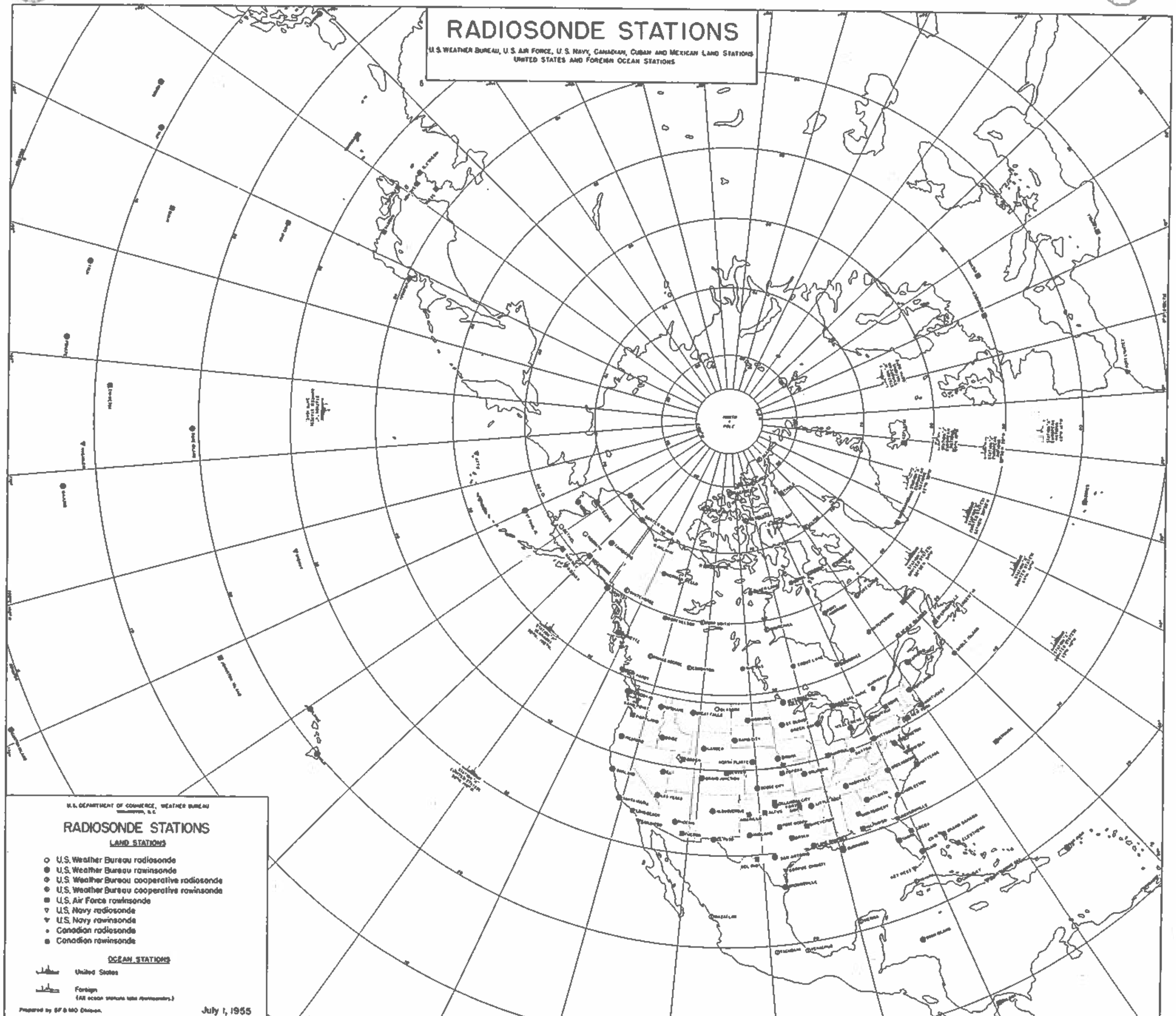

RADIOSONDE STATIONS
U.S. WEATHER BUREAU, U.S. AIR FORCE, U.S. NAVY, CANADIAN, CUBAN AND MEXICAN LAND STATIONS
UNITED STATES AND FOREIGN OCEAN STATIONS
NORTH POLE
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
RADIOSONDE STATIONS
LAND STATIONS
U.S. Weather Bureau radiosonde
U.S. Weather Bureau rawinsonde
U.S. Weather Bureau cooperative radiosonde
U.S. Weather Bureau cooperative rawinsonde
U.S. Air Force rawinsonde
U.S. Navy radiosonde
U.S. Navy rawinsonde
Canadian radiosonde
Canadian rawinsonde
OCEAN STATIONS
United States
Foreign
July 1, 1955

Fig. 8

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

LOCAL CLIMATOLOGICAL DATA

ATLANTA, GEORGIA (Municipal Airport) APRIL 1955

Latitude 33 ° 39 ′ N. Longitude 84 ° 25 ′ W. Elevation (ground) 975 ft. Eastern Standard time used

Date 1	Temperature (°F) Maximum 2	Minimum 3	Average 4	Departure from normal 5	Degree days (base 65°) 6	Precipitation Total (Water equivalent) (In.) 7	Snow, Sleet, Hail (In.) 8	Snow, Sleet, Hail or Ice on ground at 7:30 AM (In.) 9	Wind Prevailing direction 10	Average speed (m. p. h.) 11	Fastest mile Speed (m. p. h.) 12	Direction 13
1	74	44	59	+ 2	6	0	0	0	SSW	5.9	17	S
2	65	51	58	0	7	.46	T	0	SE	8.9	29	W
3	75	51	63	+ 5	2	T	0	0	NW	7.6	16	NW
4	80	52	66	+ 8	0	0	0	0	SE	3.1	13	SE
5	65	57	61	+ 2	4	.17	0	0	ESE	7.4	17	E
6	79	57	68	+ 9	0	.70	0	0	SW	10.0	34	W
7	66	50	58	- 1	7	.60	0	0	NW	14.3	29	NW
8	67	42	55	- 5	10	0	0	0	NNW	5.5	17	N
9	68	47	58	-2	7	0	0	0	SE	4.9	16	SE
10	60	55	58	- 2	7	.45	0	0	ESE	9.2	17	SE
11	76	59	68	+ 7	0	.10	0	0	SE	13.1	24	SE
12	79	56	68	+ 7	0	0	0	0	SE	9.8	24	SE
13	75	57	66	+ 5	0	1.32	0	0	SE	13.0	35	NW
14	76	58	67	+ 5	0	.03	0	0	SE	11.4	25	SE
15	80	55	68	+ 6	0	0	0	0	W	9.2	20	NW
16	85	59	72	+10	0	0	0	0	NW	7.5	17	NW
17	87	58	73	+11	0	0	0	0	SE	2.6	10	S
18	86	60	73	+10	0	0	0	0	S	6.9	18	SE
19	85	62	74	+11	0	0	0	0	SW	10.8	31	SW
20	83	63	73	+10	0	0	0	0	SW	9.3	19	SW
21	75	60	68	+ 5	0	.43	0	0	SW	12.3	32	NW
22	82	58	70	+ 6	0	0	0	0	SW	6.0	17	W
23	84	59	72	+ 8	0	.05	0	0	SSW	12.0	26*	SW*
24	85	67	76	+12	0	T	0	0	SW	22.6	50	SW
25	75	55	65	+ 1	0	0	0	0	NW	17.8	33	NW
26	70	54	62	- 3	3	0	0	0	NW	18.4	32	N
27	76	47	62	- 3	3	0	0	0	NW	5.6	15	NW
28	79	50	65	0	0	0	0	0	NW	7.9	18	NW
29	82	56	69	+ 4	0	0	0	0	NW	12.8	23	NW
30	83	55	69	+ 3	0	0	0	0	NNW	10.8	25	NW
31												
Sum	2302	1654	—	—	—	4.31	T	—	—	296.6	—	—
Avg.	76.7	55.1	—	—	—	—	—	—	—	9.9	Fastest	Dir.
Misc.										Misc.	50	SW

Date	Sunshine Total (hours and minutes) 14	Percent of possible 15	Sky cover Sunrise to sunset (tenths) 16	Midnight to midnight (tenths) 17	Thunderstorm or distant lightning 18	Weather restricting visibility to ½ mile or less 19	20	21	22	23	Date 24
1	9:00	72	8	6							1
2	0:28	4	9	9	T	RWA					2
3	11:17	89	2	4							3
4	12:30	99	1	1							4
5	0:00	0	10	9							5
6	2:25	29	10	10	TDL						6
7	10:08	79	4	5	DL						7
8	12:47	100	0	1							8
9	7:40	60	8	6							9
10	0:00	0	10	10							10
11	7:17	56	6	6							11
12	6:30	50	8	8		F					12
13	0:07	1	10	10	T						13
14	7:11	55	7	6							14
15	13:01	100	4	3							15
16	13:04	100	2	1							16
17	13:06	100	0	0							17
18	13:07	100	9	6							18
19	12:03	92	8	6							19
20	7:04	55	9	8							20
21	5:08	39	9	5	T						21
22	13:15	100	3	3							22
23	11:12	84	8	9	TDL						23
24	8:36	65	8	7							24
25	13:20	100	0	2							25
26	10:11	76	5	5							26
27	12:22	92	4	3							27
28	9:45	73	6	5							28
29	13:27	100	0	1							29
30	13:29	100	0	0							30
31											31
Sum	269:30	—	168	155	—	—					Sum
Avg.	Possible	%	5.6	5.2	—	—					Avg.
Misc.	390:56	69	—	—	—	—					Misc.

T in columns 7, 8, and 9 indicates amount too small to measure.

TEMPERATURE: (°F)
Average monthly 65.9
Departure from normal +4.2
Highest 87 on 17
Lowest 42 on 8
Number of days with —
Max. 32° or below 0
Max. 90° or above 0
Min. 32° or below 0
Min. 0° or below 0

HEATING DEGREE DAYS (base 65°):
Total this month 56
Departure from normal -77
Seasonal total (since July 1) 2751
Seasonal departure from normal -55

BAROMETRIC PRESSURE (In.)
Avg. station (elev. 1173 feet, m.s.l.) 28.751
Highest sea level 30.36 on 9
Lowest sea level 29.49 on 24

PRECIPITATION: (In.)
Total for the month 4.31
Departure from normal -0.11
Greatest in 24 hours 1.35 on 13-14
Snow, Sleet and Hail —
Total for the month T
Greatest in 24 hours T on 2
Greatest depth on ground 0 on -
Dates of — Hail 2
Sleet 0 Glaze 0

Symbols used in columns 18-19
A = Hail
BS = Blowing snow
DL = Distant lightning
D = Dust
E = Sleet
F = Fog
H = Haze
K = Smoke
L = Drizzle
N = Sand
R = Rain
S = Snow
T = Thunderstorm
ZL = Freezing drizzle
ZR = Freezing rain

Two weeks ending April 10th after the freeze, the trees showed very little signs of rebudding. Three weeks ending April 17th, about 50% of the trees were budding and leafing rapidly. Four weeks ending April 24th, about 95% of the trees had leaves. Some trees, however, were just beginning to rebud while others still have small leaves and sparse.
There were no light frosts during the month. No new record temperatures were established. *Estimated

HOURLY PRECIPITATION

Date	A. M. Hour ending at 1	2	3	4	5	6	7	8	9	10	11	12	P. M. Hour ending at 1	2	3	4	5	6	7	8	9	10	11	12	Date
1																									1
2	T	T	.01	.01	.02	.01	.03	T	T					T	T	.05	.33	T		T				T	2
3	T	T																							3
4																									4
5									T	T	.03	.02	.09	.03	T	T									5
6				T	T																	.68	.02	T	6
7	.15	.15	.08	.02	.08	.11	.01																		7
8																									8
9																									9
10				T	T		T		T	T		T	T	.03	.03	.02	.08	.09	.07	.02	.02	.02	.02	.05	10
11	T	T	.02	.03	T	T	.02	.03																	11
12																									12
13														.09	.10	.08	.08	.14	.05	.03	.20	.19	.21	.15	13
14	.02	.01	T																						14
15																									15
16																									16
17																									17
18																									18
19																									19
20																									20
21												.39	.04												21
22																									22
23		.05																							23
24			T	T			T								T										24
25																									25
26																									26
27																									27
28																									28
29																									29
30																									30
31																									31

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NWRC, Asheville, N. C. --- 5/4/55 --- 250

Fig. 9

Supplement
(Based on one month's record)

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

LOCAL CLIMATOLOGICAL DATA

EASTERN STANDARD TIME

ATLANTA, GA.
MUNICIPAL AIRPORT
MAY 1955

A — TEMPERATURE AND WIND SPEED—RELATIVE HUMIDITY OCCURRENCES (HOURLY OBSERVATIONS):

WIND	0-4 M.P.H.						5-14 M.P.H.						15-24 M.P.H.						25 M.P.H. AND OVER						TOTAL OBS.
REL. HUMID. / TEMP. (°F)	Under 30	30-49%	50-69%	70-79%	80-89%	90-100%	Under 30	30-49%	50-69%	70-79%	80-89%	90-100%	Under 30	30-49%	50-69%	70-79%	80-89%	90-100%	Under 30	30-49%	50-69%	70-79%	80-89%	90-100%	
94/90		2						2																	4
89/85	7	2					13	24	8				1	6											61
84/80	9	6	2				12	20	27	3	1		2	3	10										95
79/75	5	9	17	1	2	1	8	14	20	11	8		1	1	10	2									110
74/70		12	13	13	10	5	2	25	8	7	27	18		3	3	6	3	1							156
69/65		13	6	8	11	24		15	18	3	28	53		3	2	2	8	4							198
64/60		1	13		2	16		4	9	2	8	39					1	4							99
59/55			5					1	5		6	4													21

B — WIND DIRECTION AND SPEED OCCURRENCES:

DIRECTION	0-3	4-7	8-12	13-18	19-24	25-31	32-38	39-46	47 OVER	TOTAL	AV. SPEED
	HOURLY OBSERVATIONS OF WIND SPEED (IN MILES PER HOUR)										
N	9	10	4	1						24	9.6
NNE	3	1								4	3.5
NE	8	16	14	7	1					46	7.9
ENE	7	10	12	11						40	9.2
E	18	10	29	11	2					70	8.6
ESE	6	7	19	2						34	8.1
SE	6	10	17	6	1					40	8.7
SSE	3	3	10	11	1					28	10.9
S	16	13	12	4	1					46	6.7
SSW	5	3	17	11	5					41	11.3
SW	8	16	26	11	7					68	10.1
WSW	4	7	9	4	2					26	9.3
W	6	9	38	6	1					60	8.4
WNW	2	6	20	4	1					33	9.3
NW	5	12	62	20	1					100	10.2
NNW	6	11	15	4						36	8.1
CALM	48									48	
TOTAL	160	144	304	113	23					744	8.5

C — HOURLY AND DAILY OCCURRENCES OF PRECIPITATION AMOUNTS:

FREQUENCY OF OCCURRENCE FOR EACH HOUR OF THE DAY (A.M. HOUR ENDING AT 1–11, NOON; P.M. HOUR ENDING AT 1–11, MID)

INTENSITIES	AM 1	2	3	4	5	6	7	8	9	10	11	NOON	PM 1	2	3	4	5	6	7	8	9	10	11	MID	MID TO MID	INTENSITIES
TRACE	2	1	1	2	3	3	1	2		2	4	1	4	1	1	2					1	1			3	TRACE
.01 IN.			1	1		1	1	1											1						0	.01 IN.
.02 TO .09 IN.							1	1	2					1				2	2	1	1	1			4	.02 TO .09 IN.
.10 TO .24 IN.												1	1							1			1	1	1	.10 TO .24 IN.
.25 TO .49 IN.																	1	1						1	2	.25 TO .49 IN.
.50 TO .99 IN.																									2	.50 TO .99 IN.
1.00 TO 1.99 IN.																									0	1.00 TO 1.99 IN.
2.00 IN. AND OVER																									0	2.00 IN. AND OVER
TOTAL	2	1	2	3	3	4	3	4	2	2	4	2	5	2	1	2	1	3	3	2	2	2	1	2	12	TOTAL

D — CEILING—VISIBILITY OCCURRENCES (HOURLY OBSERVATIONS):

VISIBILITY (MILES)	CEILING (FEET): 0	100-300	[illegible]	[illegible]	1000-1900	2000-2900	3000-4900	5000-9500	OVER 9500	TOT.
0 TO ¼										
5/16 TO ⅜	1									1
½ TO ¾		1								1
1 TO 2½		2	5			1				8
3 TO 6		1	15	24	6	2		9	6	63
7 TO 15			1	33	28	13	36	44	516	671
20 TO 30										
35 OR MORE										
TOTAL	1	4	21	57	34	16	36	53	522	744

E — HOURLY OCCURRENCES OF SKY COVER, WIND, AND RELATIVE HUMIDITY:

HOUR OF DAY	CLOUDS (SCALE 0-10) 0-3	4-7	8-10	WIND SPEED (MPH) 0	1-3	4-7	8-12	13-18	19-24	25-30	OVER 30	RELATIVE HUMIDITY (%) 0-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-100	HOUR OF DAY
00	19	5	7	3	5	5	16	2						2	6	2	2	2	7	10	00
01	18	4	9	4	7	5	11	2	2					2	5	3		3	8	10	01
02	19	2	10	3	7	7	10	3	1					1	5	3	2	1	7	12	02
03	15	4	12	4	8	6	10	3							6	2	3	1	5	14	03
04	16	1	14	2	9	5	13	2							2	7	1	3	4	14	04
05	14	4	13	2	9	10	7	3							1	5	4	2	4	15	05
06	11	3	17	1	8	5	14	3							1	6	3	1	6	14	06
07	11	5	15	2	5	7	16	1							3	4	2	3	6	13	07
08	11	5	15		2	10	13	6						2	5	2	4	2	5	11	08
09	10	5	16		4	6	15	6					1	3	5	4	3	3	6	6	09
10	11	6	14	1	3	5	14	7	1				3	5	3	4	3	3	8	2	10
11	10	7	14	2	2	6	11	7	3				4	4	5	4	4	6	2	2	11
12	9	7	15	1	5	7	9	7	2				5	6	4	3	5	3	3	2	12
13	7	11	13		2	6	13	7	3				7	4	6	4	5	1	2	2	13
14	6	11	14	1	2	4	12	7	5			1	6	4	7	7	2	2	2		14
15	4	11	16	1	4	5	11	6	4			2	5	5	3	12		2	2		15
16	4	14	13	1	3	6	9	11	1			2	5	6	3	9		3	3		16
17	6	10	15	1	3	3	14	9	1			1	6	4	4	7	3	2	4		17
18	7	7	17	1	2	3	20	5					7	2	6	3	4	1	5	3	18
19	8	5	18	1	3	8	17	2					4	3	6	3	3	2	6	4	19
20	12	8	11	3	4	8	15	1					1	5	3	5	3	3	3	8	20
21	13	9	9	5	3	8	11	4						4	2	7	2	2	6	8	21
22	19	4	8	2	7	8	12	2						3	3	4	3	4	4	10	22
23	20	2	9	5	5	3	11	7						3	4	4	1	3	7	9	23
	280	150	314	48	112	144	304	113	23			6	54	68	98	114	62	58	115	169	

F — HOURLY TEMPERATURES (ABOUT 20 MINUTES AFTER THE HOUR)

DAY OF MO.	MID.	1 A.M.	2 A.M.	3 A.M.	4 A.M.	5 A.M.	6 A.M.	7 A.M.	8 A.M.	9 A.M.	10 A.M.	11 A.M.	NOON	1 P.M.	2 P.M.	3 P.M.	4 P.M.	5 P.M.	6 P.M.	7 P.M.	8 P.M.	9 P.M.	10 P.M.	11 P.M.	DAY OF MO.
1	67	66	64	61	60	58	57	60	67	70	74	78	78	82	82	82	83	82	80	76	73	71	70	70	1
2	69	66	64	61	59	57	56	59	63	67	71	72	75	75	79	79	79	78	78	75	71	68	65	64	2
3	63	61	60	59	60	57	58	61	69	70	73	76	78	80	81	81	81	81	80	78	73	71	70	69	3
4	67	68	66	67	65	61	65	69	73	78	82	85	86	87	88	88	89	88	86	82	78	76	73	71	4
5	71	71	70	69	67	66	66	68	74	78	81	83	86	88	89	88	86	86	84	82	78	76	74	72	5
6	70	69	68	66	64	62	61	67	72	75	77	79	84	84	86	85	86	85	83	80	77	76	75	72	6
7	71	69	67	69	69	67	67	68	71	74	78	82	84	86	87	87	86	86	83	80	79	75	72	74	7
8	72	70	68	68	68	68	67	70	76	80	83	84	85	84	87	86	85	84	81	79	77	73	71	70	8
9	67	65	63	61	60	58	57	61	67	72	74	78	80	83	84	86	86	86	85	82	77	73	74	72	9
10	69	69	68	66	64	64	64	67	72	77	83	86	90	90	89	90	90	89	87	84	80	80	78	76	10
11	73	72	70	71	71	68	67	72	76	80	84	85	87	87	88	89	88	87	85	82	80	78	78	78	11
12	73	72	72	73	72	69	70	71	74	77	79	81	83	86	87	82	70	74	73	70	68	67	66	66	12
13	66	65	65	66	66	66	67	68	69	70	74	77	76	75	79	81	79	71	68	69	66	66	67	67	13
14	66	65	65	64	64	64	65	66	68	71	76	78	80	82	81	84	84	83	81	79	76	74	71	69	14
15	70	67	65	66	66	66	65	65	64	63	64	66	65	67	69	69	69	65	64	65	63	62	62	62	15
16	62	62	62	62	62	62	61	62	63	64	65	69	67	68	67	67	68	68	66	64	63	63	63	63	16
17	62	62	61	61	61	61	61	61	64	65	68	72	73	73	77	76	76	78	77	75	72	69	67	65	17
18	64	64	62	63	62	61	62	62	62	65	66	70	70	73	79	77	77	76	75	73	70	68	67	66	18
19	65	64	63	61	62	63	63	63	65	66	68	72	75	77	80	79	80	80	78	77	75	72	70	69	19
20	69	67	67	69	64	65	63	65	71	74	78	80	79	81	81	80	79	78	75	65	64	64	65	66	20
21	67	67	68	68	68	68	69	69	70	71	70	69	67	66	69	70	71	73	73	72	70	70	68	68	21
22	68	68	68	68	68	68	68	69	70	71	72	73	74	71	75	76	75	74	72	72	70	69	68	68	22
23	67	66	67	67	68	67	67	68	70	73	76	75	82	84	87	84	80	82	79	78	74	73	71	72	23
24	71	72	68	68	69	68	67	67	67	68	75	78	81	81	83	84	83	80	66	65	63	65	66	64	24
25	64	64	63	64	65	63	63	65	68	72	75	78	82	82	83	85	86	85	82	80	77	76	73	72	25
26	72	71	70	72	70	68	69	69	71	76	75	76	88	88	89	88	86	86	84	82	79	76	75	72	26
27	72	72	70	69	69	68	70	72	76	78	82	81	81	82	81	83	83	84	82	81	79	76	76	74	27
28	72	72	71	72	71	67	68	73	76	80	82	85	85	86	86	87	89	89	84	81	79	77	76	74	28
29	73	72	71	70	69	69	69	68	70	71	74	73	72	73	75	78	79	78	71	71	69	68	67	65	29
30	63	62	62	61	59	59	60	61	65	68	70	69	70	70	70	70	68	70	66	67	68	63	62	61	30
31	59	58	57	56	56	55	56	59	63	66	69	70	72	73	75	79	76	75	73	72	68	66	65	64	31

G — 6-HOURLY OBSERVATIONS OF SKY COVER, PRESSURE, PSYCHROMETRIC DATA, AND WIND:

DAY OF MO.	HOUR (LOCAL TIME)	SKY COVER (IN TENTHS)	STATION PRESS. (IN.)	DRY BULB (°F)	WET BULB (°F)	REL. HUM. %	DEW PT. (°F)	WIND DIR.	WIND SPEED
1	01	0	29.07	66	52	39	40	NE	12
2	01	0	29.05	66	52	37	39	E	20
3	01	0	29.15	61	52	56	45	E	2
4	01	0	29.09	68	56	47	47	C	
5	01	0	28.99	71	58	45	48	NW	14
6	01	6	28.97	69	57	47	48	NW	12
7	01	3	28.94	69	56	41	45	NNW	2
8	01	0	28.92	70	59	51	51	W	2
9	01	0	29.01	65	57	58	50	NW	8
10	01	8	29.09	69	57	46	48	ENE	2
11	01	1	29.08	72	65	70	62	NNW	2
12	01	6	29.07	72	65	71	62	C	
13	01	10	29.02	65	64	97	64	E	9
14	01	4	28.92	65	64	95	63	SW	2
15	01	8	28.89	67	63	81	61	NNE	7
16	01	10	29.01	62	61	95	61	E	9
17	01	10	28.90	62	62	99	61	ENE	6
18	01	0	28.88	64	62	89	61	C	
19	01	0	28.98	64	63	96	63	ESE	6
20	01	0	28.93	67	64	84	62	SE	5
21	01	10	28.91	67	67	98	67	SE	10
22	01	10	28.97	68	67	94	67	SSE	13
23	01	8	29.03	66	65	96	65	S	5
24	01	9	29.00	72	66	73	63	SW	22
25	01	5	28.94	64	63	98	63	SW	12
26	01	0	28.95	71	69	93	69	C	
27	01	0	29.00	72	70	89	69	SW	8
28	01	0	29.05	72	69	89	68	S	2
29	01	0	28.99	72	69	84	67	SSW	12
30	01	2	28.91	62	59	85	58	W	8
31	01	0	28.99	58	56	86	54	NW	12
	01	4	28.99	67	62	75	58	E	7

DAY OF MO.	HOUR (LOCAL TIME)	SKY COVER (IN TENTHS)	STATION PRESS. (IN.)	DRY BULB (°F)	WET BULB (°F)	REL. HUM. %	DEW PT. (°F)	WIND DIR.	WIND SPEED
1	07	0	29.11	60	51	55	44	NW	8
2	07	0	29.15	59	50	54	42	NE	8
3	07	2	29.20	61	52	56	45	C	
4	07	3	29.12	69	56	49	47	NW	5
5	07	1	29.02	68	60	63	55	NW	12
6	07	1	29.01	67	55	47	46	NNW	6
7	07	10	29.00	68	56	45	46	E	6
8	07	3	28.95	70	60	56	54	WNW	9
9	07	3	29.11	61	53	61	47	NNW	3
10	07	6	29.14	67	61	71	57	E	2
11	07	9	29.13	72	65	71	62	WNW	2
12	07	10	29.10	71	66	77	63	C	
13	07	10	29.02	68	67	95	66	SE	3
14	07	7	28.95	66	64	94	64	W	5
15	07	10	28.98	65	63	89	61	ENE	16
16	07	10	29.03	62	62	98	61	E	12
17	07	10	28.93	61	61	98	61	NE	10
18	07	7	28.99	62	60	90	59	ENE	12
19	07	10	29.01	63	62	95	62	SE	8
20	07	6	28.98	65	64	92	63	ESE	5
21	07	10	28.93	69	68	97	68	ESE	9
22	07	10	28.99	69	68	97	68	SSE	12
23	07	10	29.07	68	67	97	67	S	2
24	07	9	29.02	67	65	92	65	W	9
25	07	4	28.94	65	64	95	64	W	12
26	07	10	28.98	69	69	100	69	SW	12
27	07	8	29.04	72	69	88	68	W	5
28	07	0	29.09	73	70	88	69	SW	5
29	07	10	29.02	68	65	85	63	SSW	12
30	07	2	28.96	61	58	81	55	WNW	10
31	07	0	29.04	59	56	83	54	NW	12
	07	6	29.03	66	62	79	59	NW	7

DAY OF MO.	HOUR (LOCAL TIME)	SKY COVER (IN TENTHS)	STATION PRESS. (IN.)	DRY BULB (°F)	WET BULB (°F)	REL. HUM. %	DEW PT. (°F)	WIND DIR.	WIND SPEED
1	13	0	29.05	82	58	21	39	NNW	7
2	13	2	29.14	75	56	28	40	ENE	9
3	13	0	29.17	80	59	27	43	ENE	6
4	13	7	29.06	87	62	23	45	WNW	13
5	13	8	28.97	88	68	37	58	NW	9
6	13	3	28.99	84	60	22	41	NNW	5
7	13	7	28.96	86	62	24	45	S	2
8	13	7	28.96	84	67	42	58	NW	12
9	13	3	29.09	83	60	25	44	SE	5
10	13	9	29.10	90	69	36	59	SW	10
11	13	10	29.09	87	65	30	52	WNW	12
12	13	10	29.05	86	69	42	60	SSE	9
13	13	9	28.96	75	67	68	63	SW	12
14	13	9	28.90	82	67	47	59	NW	14
15	13	10	29.00	67	63	94	62	ENE	12
16	13	10	28.96	69	65	83	63	SE	12
17	13	7	28.91	73	64	62	59	NE	5
18	13	4	29.00	73	65	67	61	E	17
19	13	4	29.00	77	67	59	62	NE	2
20	13	10	28.94	81	67	49	60	ESE	17
21	13	10	28.95	66	66	99	66	E	8
22	13	10	29.01	71	70	94	69	SSE	12
23	13	4	29.05	84	72	55	66	W	8
24	13	8	28.96	81	72	64	68	SSW	20
25	13	6	28.93	82	71	58	66	W	9
26	13	4	29.01	83	75	69	72	SE	7
27	13	0	29.07	82	71	59	66	S	14
28	13	4	29.06	86	69	41	59	SW	21
29	13	10	28.97	73	67	74	65	WSW	21
30	13	6	28.94	70	58	47	49	NW	14
31	13	0	29.04	73	58	38	46	NNW	16
	13	6	29.01	79	65	51	57	NW	11

DAY OF MO.	HOUR (LOCAL TIME)	SKY COVER (IN TENTHS)	STATION PRESS. (IN.)	DRY BULB (°F)	WET BULB (°F)	REL. HUM. %	DEW PT. (°F)	WIND DIR.	WIND SPEED
1	19	0	28.98	76	59	24	36	NW	18
2	19	7	29.09	75	57	32	43	ENE	5
3	19	2	29.09	78	60	35	48	S	3
4	19	8	29.00	82	61	28	46	NW	6
5	19	8	28.91	82	66	43	57	NW	8
6	19	8	28.95	80	60	29	45	NW	10
7	19	2	28.91	80	62	35	50	SSW	5
8	19	8	28.94	79	65	46	56	NW	12
9	19	8	29.06	82	59	23	40	C	
10	19	9	29.06	84	68	44	59	W	5
11	19	8	29.05	82	66	43	57	N	7
12	19	9	29.00	70	66	82	64	E	12
13	19	8	28.91	69	66	83	64	SW	5
14	19	8	28.87	79	65	46	56	NW	3
15	19	10	29.02	65	62	88	61	ENE	17
16	19	8	28.93	64	62	87	60	ENE	12
17	19	2	28.87	75	65	59	60	NNW	5
18	19	2	28.93	73	65	66	61	E	8
19	19	6	28.92	77	66	55	59	SE	2
20	19	10	28.92	65	64	96	64	ESE	12
21	19	10	28.92	72	70	90	69	ESE	9
22	19	10	28.98	72	69	89	68	S	6
23	19	10	29.00	78	74	84	72	S	12
24	19	10	28.94	65	65	97	64	SW	12
25	19	7	28.91	80	73	74	71	SW	8
26	19	5	28.96	82	75	73	72	SSE	8
27	19	2	29.04	81	71	60	66	S	9
28	19	4	29.04	81	72	63	67	WSW	12
29	19	10	28.91	71	70	94	69	WSW	8
30	19	3	28.97	67	58	56	51	NW	12
31	19	1	29.04	72	60	48	51	NW	12
	19	7	28.97	75	65	60	58	NW	8

Station pressure in Table G obtained from barometer at 976 feet above mean sea level.

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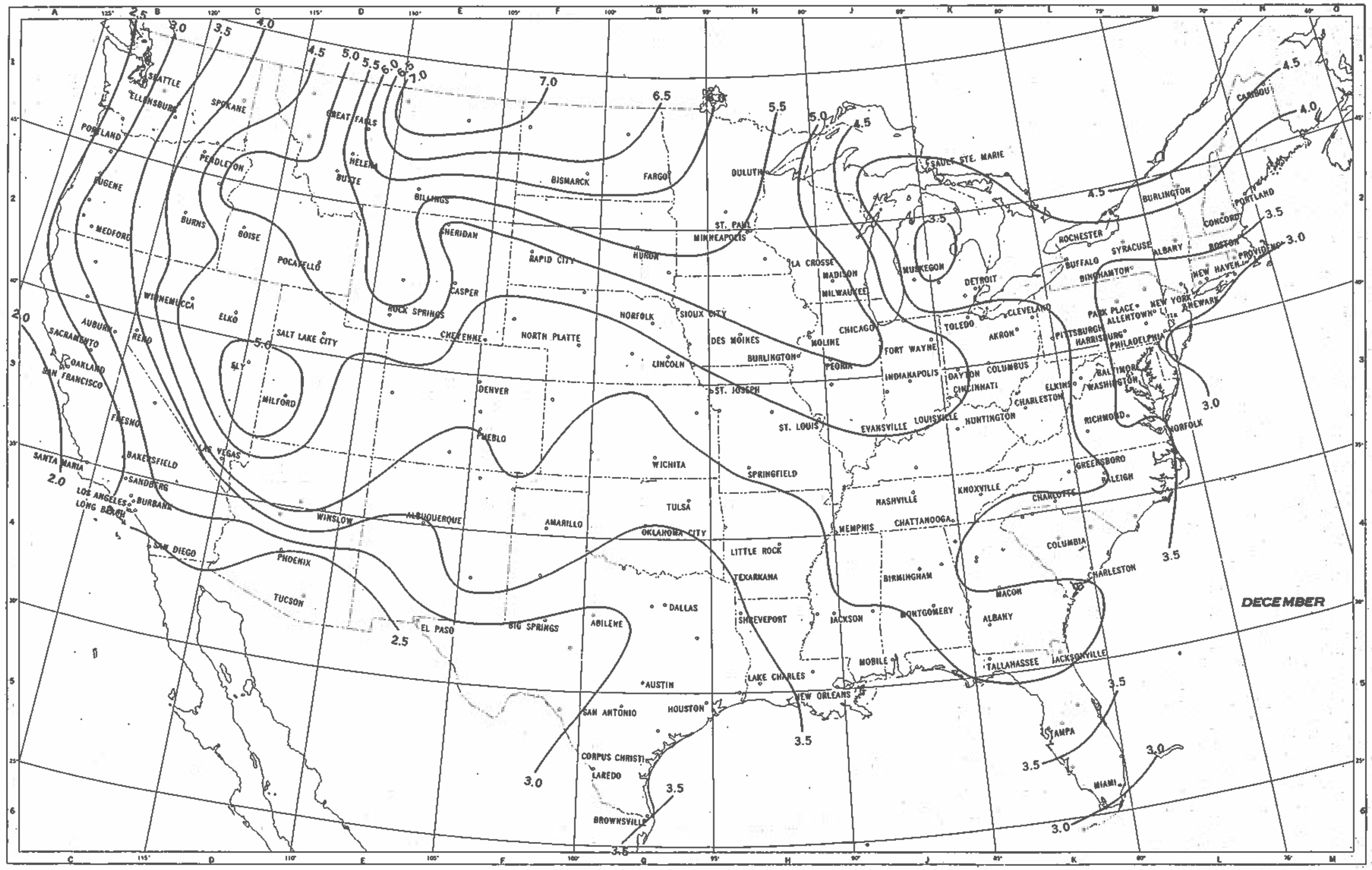
WWRC, Asheville, N. C. --- 6/22/55 --- 225

Fig. 10

UNITED STATES
DEPARTMENT OF COMMERCE
WEATHER BUREAU

STANDARD DEVIATION OF MONTHLY AVERAGE TEMPERATURE DEGREES F

SHEET OF THE NATIONAL ATLAS
OF THE
UNITED STATES



Base map by United States Weather Bureau
Climatic analysis by H. C. S. Thom

SCALE 1:10,000,000

ALBERS CONICAL EQUAL PROJECTION—STANDARD PARALLELS 29° AND 45°

Fig. 11

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STANDARD DEVIATION OF
MONTHLY AVERAGE TEMPERATURE
LIBRARY OF CONGRESS-G3701.C82
DEWEY DECIMAL-551.52:917.3

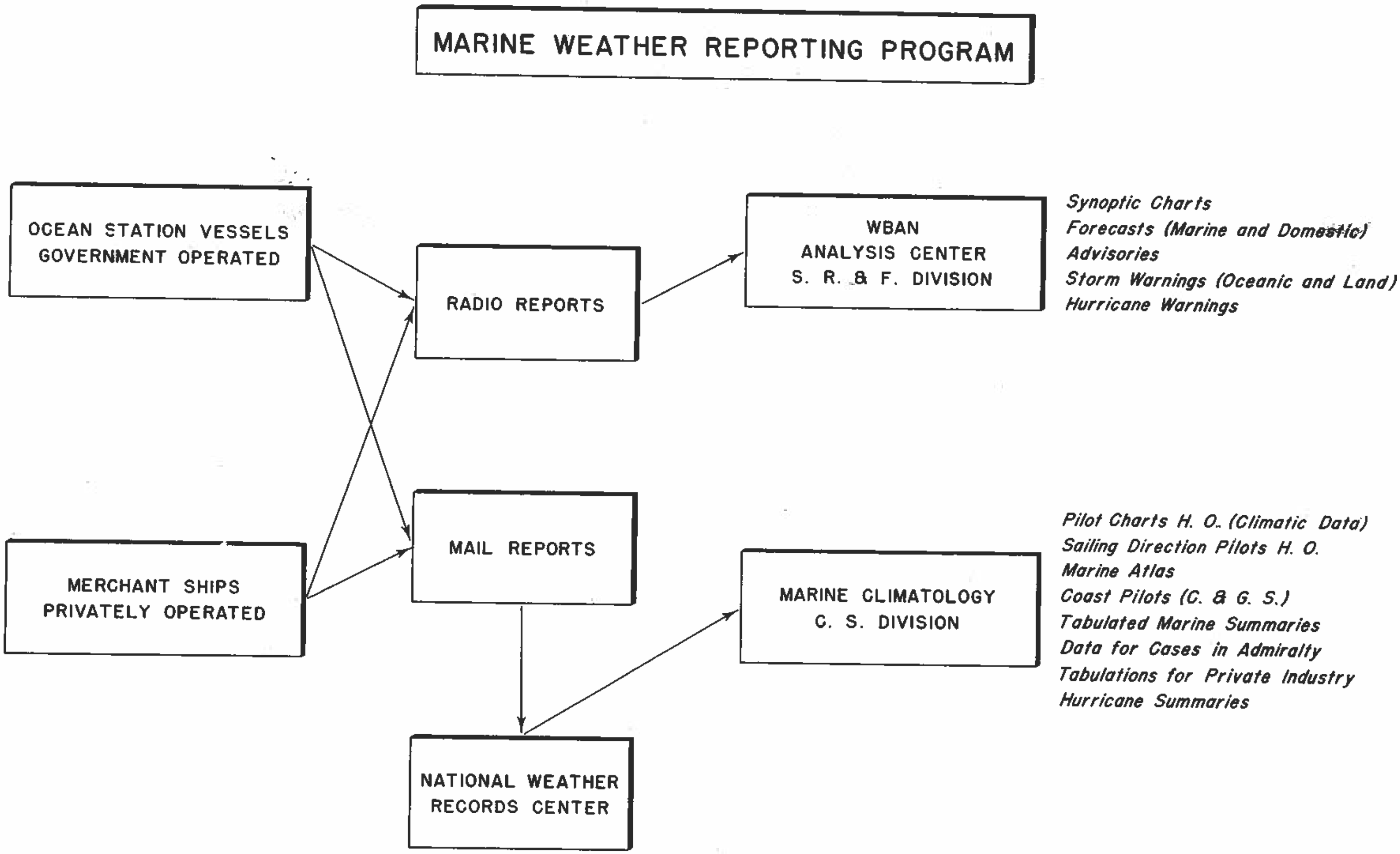
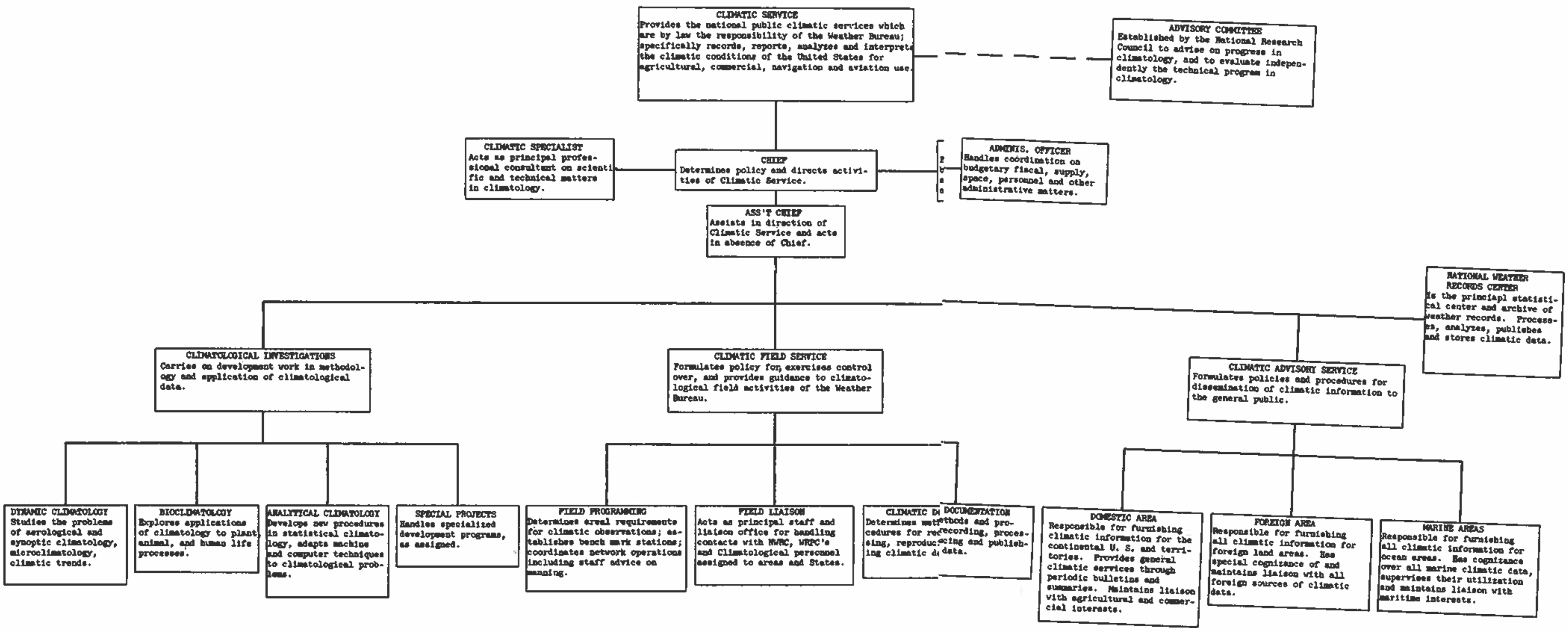

MARINE WEATHER REPORTING PROGRAM
OCEAN STATION VESSELS
GOVERNMENT OPERATED
MERCHANT SHIPS
PRIVATELY OPERATED
RADIO REPORTS
MAIL REPORTS
NATIONAL WEATHER
RECORDS CENTER
WBAN
ANALYSIS CENTER
S. R. & F. DIVISION
MARINE CLIMATOLOGY
C. S. DIVISION
Synoptic Charts
Forecasts (Marine and Domestic)
Advisories
Storm Warnings (Oceanic and Land)
Hurricane Warnings
Pilot Charts H. O. (Climatic Data)
Sailing Direction Pilots H. O.
Marine Atlas
Coast Pilots (C. & G. S.)
Tabulated Marine Summaries
Data for Cases in Admiralty
Tabulations for Private Industry
Hurricane Summaries

Fig. 13

CLIMATOLOGICAL SERVICES DIVISION ON

ORGANIZATION CHART



TOTAL HOURS OF SUNSHINE
(ANNUAL)

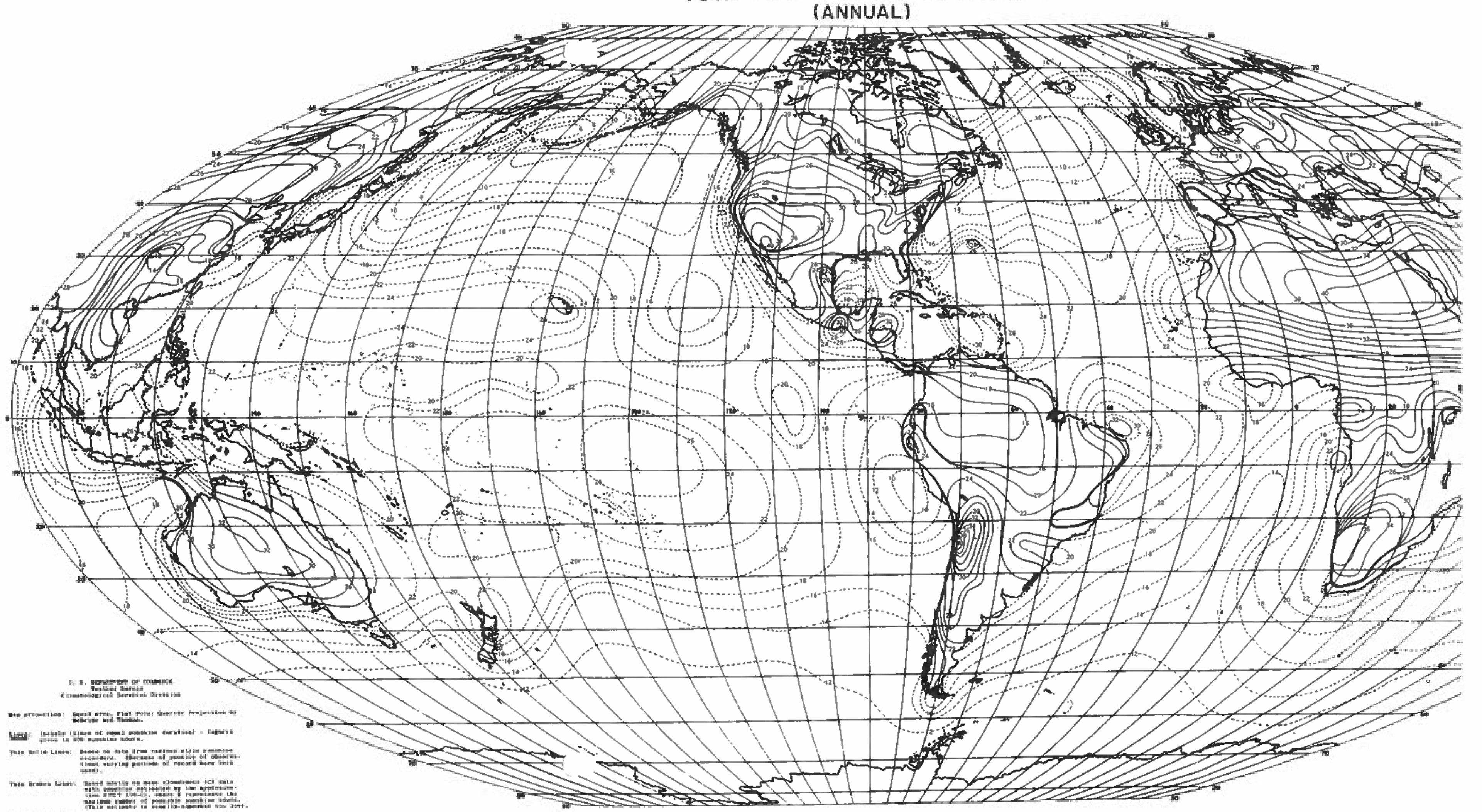


Fig. 12