

UNITED STATES DEPARTMENT OF COMMERCE
U.S. WEATHER BUREAU
WASHINGTON

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MEMO

(Climatological Services Memorandum No. 73)

WASHINGTON, D. C.
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MEMORANDUM

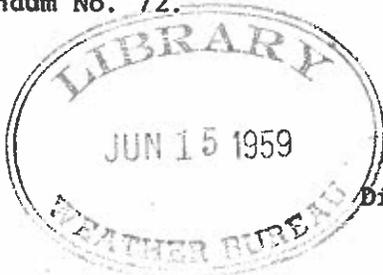
TO : Area and State Climatologists, Field Aides (HC), Field Aides, WRPCs, River Forecast Centers, River District Offices, and Area Engineers (with copies to Regional Offices and First Order Stations for information)

FROM : Office of Climatology

SUBJECT : Climatological Services Memorandum No. 73

The purpose of this Climatological Services Memorandum is to outline the responsibilities, accomplishments and plans of the Office of Climatology, the Area Climatologists, the National Weather Records Center, and the Weather Records Processing Centers.

A similar outline for State Climatologists was presented in Climatological Services Memorandum No. 72.



H. E. Landsberg

H. E. Landsberg
Director, Office of Climatology

TABLE OF CONTENTS

Item	Page
1. Office of Director	2
2. Office of Chief Climatologist.	3
3. Climatic Advisory Service Branch	4
4. Climatic Field Service Branch	7
5. Climatological Investigations Branch	9
6. Area Climatologists.	12
7. The National Weather Records Center.	15
8. Weather Records Processing Centers	18
Organization Chart	21

1. OFFICE OF DIRECTOR: The Director, Office of Climatology, and his immediate staff are responsible for the management of the climatological program of the Weather Bureau. This includes the current operations of the Bureau in this field as well as the orientation of future work.

Climatological needs of agriculture, industry, transportation, and the general public are anticipated and help in shaping the long-range plans of the Office of Climatology. Continuous liaison with major users of climatological information is maintained. Broad technical comprehension of the science of climatology and its advances provide the background for initiation of new projects.

The work of various divisions of the Weather Bureau is interrelated. This requires knowledge of plans of other units, and an appreciation of budgetary problems for smooth progress of all phases of the Bureau's efforts. The Director is responsible to the Chief of Bureau for a comprehensive program in climatology. In discharging this responsibility he has to keep it progressive. New advances should stem from our own personnel. These will be stimulated. Optimum advantage is taken of the work of others. Needs of all data users have to be accommodated. Services have to be provided to other government agencies, broad groups of industry, commerce and agriculture through a comprehensive publication program and by maintaining capabilities for specialized analyses.

Collaborating with the World Meteorological Organization, the Weather Bureau has also assumed responsibilities for data collection and dissemination which go beyond national boundaries. Climatology is of world-wide scope, and the Office of Climatology arranges through the pertinent commissions and working groups of WMO for standards of data collection, analysis, and international interchange.

The Office of the Director coordinates through suitable staff assignments, described below, all climatological work in progress.

The program of the Office of Climatology is under constant scrutiny by an Advisory Committee on Climatology appointed by the National Research Council. The Committee was established in 1955 at the request of the Chief of the Weather Bureau to furnish advice on progress in climatology, and to evaluate independently the technical program of the Bureau in climatology. The present membership of the Committee is as follows:

1. J. H. Longwell, Chairman
Director, Division of Agricultural Science
University of Missouri
2. Phil E. Church
Department of Meteorology and Climatology
University of Washington
3. E. Wendell Hewson
Department of Civil Engineering
University of Michigan

4. William E. Reifsnyder
School of Forestry
Yale University
5. George S. Benton
Department of Civil Engineering
Johns Hopkins University

The Committee meets twice a year. Its most recent meeting was held in October, 1958, and a report of this meeting was included in Climatological Services Memorandum No. 69. A meeting is scheduled in the Office of Climatology for June, 1959.

2. OFFICE OF CHIEF CLIMATOLOGIST: The Office of Chief Climatologist acts as adviser and consultant to all Bureau units on statistical and climatological problems. Basic statistical and climatological research necessary to the development of the programs of the Office of Climatology are carried out. Results of statistical research are adapted to climatological problems of the Bureau and leadership is provided in the solution of problems in the field of climatology, and in practical applications of meteorological statistics.

The Chief Climatologist reviews scientific papers pertaining to climatology before they are published and consults with interested individuals on numerous problems in theoretical and applied climatology.

Some recent activities include publication or preparation for publication in various scientific journals of the following:

- "A Method for the Evaluation of Hail Suppression"
- "Climatological Analysis of Freeze Data for Iowa" (with R. H. Shaw)
- "Time Interval Distribution for Excessive Rainfall"
- "The Distribution of Freeze-date and Freeze-free Period for Climatological Series with Freezeless Years"
- "Design Outside Weather Data for Determining Heating Load"
- "A Note on the Gamma Distribution"

In addition the Chief Climatologist developed methods and prepared confidence intervals for temperature and precipitation means for publication in "Climates of the States"; and prepared wind speed design data for highway sign installation on the Federal Highway Program of the Bureau of Public Roads. He also participated in the following scientific meetings:

American Society of Heating, Refrigerating and Air-Conditioning Engineers meeting in Pittsburgh, Pennsylvania, to present a report on air-conditioning design data.

American Meteorological Society meeting in Ann Arbor, Michigan, to present a paper on "Climatological Analysis in Engineering Design and Operation Problems".

National Academy of Sciences, Committee on Atmospheric Sciences, ad hoc group on statistical requirements for the National Institute of Meteorology.

Plans for the coming year include the completion of wind speed structural design data in cooperation with the Structures Committee, American Society of Civil Engineers; preparation of a report on air-conditioning design data and computation; continued investigation of degree-day statistics and preparation of Climatic Maps for the National Atlas.

3. CLIMATIC ADVISORY SERVICE BRANCH: The Climatic Advisory Service Branch is principally concerned with dissemination of climatic information to the general public and to other government agencies. A natural geographic division of much of the available data permits an equally logical division of the Branch into three Sections: Domestic, Foreign, and Marine. The responsibilities and programs of the three Sections are described more completely in the following paragraphs. In addition, all Sections maintain constant review of professional activities in their fields in other agencies, act as staff consultants, and participate, as required, in maintaining Weather Bureau liaison with domestic and foreign agencies and institutions.

The Domestic Area Section is charged with the duty of furnishing climatic data for all of the United States and its territories. This includes the issue of periodic bulletins and summaries. Liaison is maintained with agricultural and commercial users of data to keep abreast of new developments and needs.

A heavy load of miscellaneous inquiries is handled in the Section. During 1958 this totalled over 5,000 telephone calls, 200 visitors, about 1,500 letters, and 1,000 other requests for publications. The Weekly Weather and Crop Bulletin (52 eight-page issues annually plus an occasional special issue) is prepared in the Section with the cooperative assistance of the U.S.D.A. Agricultural Marketing Service who assign an expert to work in the Section two days per week.

The 14 surface and 18 upper air charts which appear each month in the Climatological Data National Summary (and formerly in the Monthly Weather Review) are analysed in the Section. The "Weather of the Month" and the "Weather of the Year" section of the monthly and annual national summaries (CDNS) are prepared. The annual tornado article for the same publications is compiled in this Section.

Letter Supplements are prepared as the demand dictates and time permits. Those appearing in 1958 include: 1) Temperature Extremes, Highest and Lowest; 2) Average Data of Last Freeze (32°) in Spring and of First in Autumn; and 3) Tornado Occurrences in Major Cities. Basic data were furnished to other Central Office Divisions for other Letter Supplements and articles.

A revision of Tornado Technical Paper No. 20 is in the final draft stage. Much work has been completed on a number of charts for the National Atlas. Assistance is given in revising the Climates of the States series, especially in the preparation of the five maps in each. The isolines are analysed and drawn to give agreement at the borders of adjoining states.

Prospects are that these duties will continue essentially unchanged except that transfer of some of the routine chart and tabular work for the Monthly Weather Review and Climatological Data National Summary to Asheville and preparation of the Storm Data publication there will permit increased attention to new charts for the National Atlas, additional Letter Supplements, and other aids in more effective dissemination of climatic information.

The Foreign Area Section is concerned with world-wide climatological information for land areas outside the United States and Territories. This climatic information is used for the preparation of annotated bibliographies, research projects, and translations. Secondary but important activities of the section include answering letters of inquiry concerning foreign climates, correspondence with foreign countries for data acquisition, microcarding, preparation of climatic data cards, and composing of "climat" messages in international exchange.

Annotated bibliographies are compiled from published sources on the meteorology and climatology of foreign areas including the polar regions. This work is done under contract to military and other agencies. During 1958, about 20 annotated bibliographies were completed such as the annotated "Supplement to the Bibliography on the Climate of Greenland" and the "Bibliography of German Climatic Maps." The more important bibliographies have been printed and deposited in the Weather Bureau Library and sent to the National Weather Records Center. Further distribution was made to interested universities, agencies, libraries, and individuals. These bibliographies are kept in the Section to serve as a ready reference in answering inquiries concerning the climates of foreign lands.

Research projects consisting of details of overseas climates or climatological and meteorological relationships are carried forward to fill specific needs of contracting agencies. For instance, the Greenland project seeks to advance knowledge and understanding of the physical processes of Arctic Meteorology and Climatology. Investigation is proceeding on surface and upper air climatology of Greenland and vicinity, attempting to establish climatic types and regions, disturbances crossing the icecap, climatic trends, and the climatology of the icecap.

Articles, papers, and occasionally books on foreign climates are translated from the Russian, German, French, Italian, or Spanish languages. Fifty to sixty translations and extended summaries (mostly for microcards) in these languages were completed during the past year. In addition, a book "The Heat Balance of the Earth's Surface" by M. I. Budyko (258 pages) was translated from the Russian. Translations of extended abstracts and summaries are extensive enough for the reader to easily and fully understand the original article and tables, graphs and figures. Another function is keeping current a list of meteorological publications translated from the Russian by the Section or other agencies and available in the Weather Bureau. Over 500 items are contained in the most recent list. An occasional activity of this part of the Section is the translation of letters sent to the Weather Bureau from foreign meteorological services.

Preparation of material for microcards, under military contract, from articles, periodicals, and books on climatology and meteorology are made to supply

agencies with a library of selected references and data. Although copies of the microcards are not available for public distribution, copies of nearly all of the foreign language translations and English abstracts have been deposited in the Weather Bureau Library making them available for research workers.

Letters of inquiry concerning foreign climates are answered in this Section. These questions range from school children studying World Geography to requests from Government agencies concerning climatological data. Many inquiries come from industrial firms and individuals engaged in foreign commerce. Data requested are used in planning the shipment of goods, air conditioning design, factory or plantation sites, or other enterprises in foreign countries.

Preparation of the monthly "Climat" broadcasts is a cooperative program of the Domestic and Foreign Area Sections. These comprise an exchange of current climatic information among the weather services of the world. Climatic surface and upper air data are assembled from North and Central America, Pacific Islands, Weather Ships and the Caribbean area. The data from these broadcasts are assembled at National Weather Records Center for publication in the World Meteorological Organization publication "Monthly Climatic Data for the World." Maintaining proper procedural standards requires keeping posted on all changes and resolutions. This in turn means an interchange of letters with the WMO and member countries.

Correspondence with foreign meteorological services regarding the exchange or acquisition of climatological data are initiated in this Section. The universal scope of our national interests results in increasing needs for world climatological data. These data are acquired for special summaries requested by contracting agencies or for use in the Daily Series of Synoptic Surface and 500 mb. weather maps of the "Historical Series" and its companion data tabulation series. This Section serves as an intermediary in the distribution of observations forms (about 1500 annually) to 42 cooperating countries as part of the Northern Hemisphere program.

Climatological data from foreign countries are abstracted from books and publications and placed on cards. These "Climatic Data Cards" provide a quick reference for summarized data of temperature, precipitation, sunshine, wind and other climatic elements for cities like Paris, Rome, Moscow, and other cities throughout the world. Last year about 60 Climatic Data Cards were prepared while revising the data contained in some of the United States Navy Hydrographic Office Sailing Directions. Over 5000 climatic data cards are available in this Section.

Plans for the next year include annotated bibliographies of climatic data sources and maps for some countries not previously completed. Further, the Greenland project will be continued and research is contingent upon the contracting agencies needs. An additional contract is concerned with Russian translations mainly of microclimatology and editing of translations. Due to increased support from contracting agencies the number of all translations will be increased.

The major responsibilities of the Marine Area Section consist of furnishing marine climatic data, compiling hurricane statistics, and maintaining liaison with government and private agencies interested in marine climatology.

Marine climatic data are furnished through various publications. They consist of our own organ the "Mariners Weather Log," the U. S. Navy Hydrographic Office "Sailing Directions" and "Pilot Charts," and the U. S. Coast and Geodetic Survey "Coast Pilots." In addition numerous other requests from individuals and law firms are answered.

In 1958, six issues of the "Mariners Weather Log" were prepared. Each issue contained two feature articles of interest to the maritime industry besides descriptions of past weather which included gale tables and tables of local climatological data for U. S. Ocean Station Vessels.

For the Navy Hydrographic Office the following climatological studies were prepared in 1958 for incorporation into "Sailing Directions": 1) H. O. Pub. 124, Coast of China, 2) H. O. Pub. 135, Eastern Shores of the North Sea, and 3) H. O. Pub. 73, Newfoundland.

Pilot Chart Mapback articles for 1957 Hurricane Season in the North Atlantic and Eastern North Pacific were prepared by this Section and published by the Hydrographic Office.

One climatological summary (West Coast of the United States and Hawaii) was prepared for the U. S. Coast and Geodetic Survey "Coast Pilots."

In 1958 the hurricane tracks were reviewed and a Technical Paper was prepared (to be published in 1959) entitled "North Atlantic Hurricanes and Tropical Storms 1886-1957." Monthly hurricane articles were prepared for the Climatological Data National Summary and annual articles on North Atlantic and Eastern North Pacific Tropical Storms for the annual CDNS. Hurricane Letter Supplements were corrected and brought up-to-date. A paper "Climatological Index for North Atlantic Tropical Storm Activity" by George Cry was presented at the Technical Conference on Hurricanes in Miami 1958.

Besides continuing the program described above, plans for 1959 included the publication of "Climatology and Weather Services of the St. Lawrence Seaway and Great Lakes" (Editor's note: This is now issued,) and the first volume of "Climatological and Oceanographic Charts for Mariners, North Atlantic Ocean." Load Line Charts of 1% and 10% gale frequencies for all oceans will be submitted to Coast Guard for use in the London Load Line Convention of 1960.

4. CLIMATIC FIELD SERVICE BRANCH: The Climatic Field Service Branch of the Office of Climatology is charged with the responsibility of maintaining a climatological program throughout the 50 States and U. S. Territories. This includes the problems of sampling the climate in these areas, and of processing climatological data for all applications.

These responsibilities involve a network of approximately 12,000 observing stations. State and Area Climatologists provide necessary climatological

services throughout the entire country. Three processing centers devote their entire effort to the machine processing of data on a current basis, while the National Weather Records Center provides special summaries, tailor-made for unique applications.

The Climatic Field Service Branch also coordinates the 40 cooperative projects with universities or other state organizations. In projects of this type the Weather Bureau makes available to the cooperator its basic records and copies of its existing card decks. In return, the cooperator agrees to punch into IBM cards certain earlier meteorological observations for which cards have not been prepared by the Weather Bureau.

Activities of the Branch are carried on by three Sections: (1) Field Programming, (2) Field Liaison and (3) Climatic Documentation. During the past year accomplishments of the Branch include publication of the following in the Key to Meteorological Records Documentation series:

1. History of the Climatological Record Book.
2. History of Observation Instructions as Applied to Temperature Recordings.
3. History of Excessive Precipitation Techniques.
4. History of Observational Instructions as Applied to Thunderstorms.
5. Decadal Census of Weather Stations, Alabama.
6. History of Climatological Publications.

A few other issues are in various stages of preparation.

The Branch also gave advice and guidance to Area and State Climatologists through correspondence and Climatological Services Memorandums. Seven of these CSMs were issued during the year. Two of these were special issues, one dealing with the Weather Bureau-University cooperative punched card project and one with the over-all field climatological program. Two other special issues are in process (including this number).

The climatological publications program was continuously surveyed. As a result three preliminary precipitation bulletins were discontinued, a new publication "Storm Data" was established, narrative weather stories in the Climatological Data publication were discontinued except when unusual or severe weather occurred, and the format for the monthly Local Climatological Data was revised to allow more usable space on it.

Planning work to get under way with "Climates of the States" was also done. This involved design of formats, layout and clearance of publication and coordination of work done by first order stations, Area and State Climatologists, the Weather Records Processing Centers, the National Weather Records Center and the Office of Climatology. Two issues, Alabama and Florida, have now been printed.

Coordination of the joint publication of State Weather and Crop Bulletins was completed. The Agricultural Marketing Service of the U. S. Department of Agriculture assumed responsibility for preparing the crop portion of these bulletins, and for publishing and mailing the bulletins in the United States.

For suitable recognition of the work done by voluntary observers, five additional awards were designed. These are:

1. Special Service Certificate
2. Ten Years Service Certificate
3. Certificate for Institutions
- 4) Two awards, Thomas Jefferson and John Campanius Holm certificates
- 5) for outstanding substation observers.

Arrangements were completed to handle the necessary climatological work involved in the collection of records during the International Geophysical Year which ended December 31, 1958. This involved correspondence and discussion with representatives of foreign meteorological services and coordination with other divisions.

Under the over-all guidance of the Assistant Chief for Administration and in accord with the practices of Administrative Services Division and the Division of Personnel Management, new accounting and personnel management procedures at the National Weather Records Center were established.

The Three Weather Records Processing Centers were visited to survey and coordinate their activities.

Plans for the next year include, in addition to the regular duties outlined in the first portion of this summary, several coordination trips to the National Weather Records Center; continuation of the "Climates of the States" project; and the preparation of various papers in the Key to Meteorological Records Documentation series.

5. CLIMATOLOGICAL INVESTIGATIONS BRANCH: The Climatological Investigations Branch is concerned principally with the development of improved methods in the processing of climatological data and their application to research problems. The work of the Branch is organized into four Sections. These are described briefly in the following paragraphs, with examples of completed, current, and contemplated projects. In addition to the specific responsibilities described here, all Sections have a common responsibility in keeping abreast of the literature and professional progress in their fields, anticipating and planning new work on the basis of new requirements, and of reviewing technical papers submitted for publication. All Section Chiefs act as staff consultants in their fields, and carry assignments in intra-Bureau, inter-Departmental, inter-Agency, and international committees.

The Dynamic Climatology Section is involved primarily with problems in aerological and synoptic climatology, microclimatology, and climatic trends. Through correspondence and consultation with visitors the Section acts in an advisory capacity regarding the climatology of the upper air. Constant attention is given to the revision of upper air publications to keep abreast of the rapidly expanding probing of the stratosphere.

Examples of work in this Section include studies in radioactive fallout and dosage values and in air pollution. Work is continuing on the selection and

homogeneity of long records for the bench-mark network and in studies of climatic trends. The "Upper Air Climatology of the United States" Weather Bureau Technical Paper No. 32 is published in sections: Part 1 - Averages for Isobaric Surfaces (Height, Temperature, Humidity, and Density), Part 2 - Extremes and Standard Deviations of Average Heights and Temperatures and Part 3 - Vector Winds and Shear.

The Bioclimatology Section is concerned with a field which, considering its import and potential, has received surprisingly little attention in American climatology. Primary interest is in the relations of weather and climate to life processes in general. This is a broad field. It includes not only human life, health and comfort but plant and animal life as well.

The following examples are typical of the nature of the problems to be studied; the relation of temperature and humidity and other climatic conditions to human comfort, efficiency and behavior, gerontology, and broad categories of disease and epidemics; the relation of atmospheric circulation to diseases and insect pests of plants and animals; the relation of climate to crop yields and climatic limitations on crop production.

Most of the work done so far in the Section has been devoted to agricultural problems, but some attention has been given to human bioclimatology and biometeorology. Some time was spent investigating the role of weather and climate in heart deaths. A pamphlet is being prepared on retirement climates. Some attention has been given to such problems as allergies, histoplasmosis, and rust in wheat.

The problem of drought has been investigated in some detail. A paper is being written defining and evaluating various categories of meteorological drought. This paper will provide a means for making both space and time comparisons of drought severity.

Plans are being made to investigate crop climate limitations. This will be an attempt to determine for various crops the climatic requirements during the various phenological periods. The pilot investigation will likely be based on winter wheat.

The Bioclimatology Section also monitors work in related fields being conducted at State Universities under Weather Bureau contract.

The Analytical Climatology Section is concerned primarily with the development of data reduction and processing techniques and equipment for climatological use.

The most important task on which the Section is engaged at the moment is that of guiding the development of techniques and machines for reducing the tremendous bulk of punched card files to microfilm and for processing the data on the microfilm automatically, at high speeds compatible with modern computers. Machines already in use at the National Weather Records Center as a result of this effort are the FOSDIC Filmer (built by the Census Bureau), which microfilms cards at the rate of 420 per minute, placing 13,000 card images on each 100 ft. roll of 16 mm. film; and FOSDIC Model PC-I (built for us by the Bureau

of Standards), which electronically searches the film data at 4,300 card images per minute, and recopies any specified segment of the data onto punched cards for further processing.

Under present development at the Bureau of Standards is FOSDIC Model PC-2, a much improved and more versatile design. This machine will read the film four times as fast as the first model; will be able to edit the data contained; will predigest and recode the recorded values for any parameter to a "class interval number"; and will be able to feed the data and derived codes into either (a) punched cards, (b) magnetic tape or (c) directly into the computer. Now being built at the Census Bureau is a FOSDIC Parity Punch machine which will put "check" punches in the cards before they are filmed, and will enable FOSDIC to unerringly determine whether it has read a card image correctly or not.

Another machine which has been built by the Census Bureau to specifications and under guidance of this Section is MIMIC (Multiple Image Microcopy Camera). This camera is designed to give unitized 70 mm. microfilm strips similar to microcard; each five-inch strip containing up to 45 document images. MIMIC is now being tested operationally at the National Weather Records Center.

A second preoccupation of the Section is the development of data processing techniques and simplifications of processing. Recent examples are the designing of general procedures for a large project of abstracting grid point upper-air data for the Northern Hemisphere; the streamlining of procedures for checking and processing upper-air data; the development of simple empirical equations to compute at low cost (a) relative humidity from dry bulb and dew point temperatures, and (b) discomfort index (effective temperatures) from dry bulb and wet bulb temperatures, or dry bulb and dew point temperatures, or dry bulb temperature and relative humidity.

The Section frequently gives assistance in a staff consultant capacity on data reduction and data processing matters. It thus, for example, represents the Office of Climatology in a World Meteorological Organization working group on Punched Card Layout; and in inter-divisional committees which guide the planning for automatic surface weather stations and for automatic observing and computing of rawinsonde data.

There are many projects in the development of applications of climatology which do not fall clearly into the programs of the Sections just described or which, for administrative reasons, are given separate attention. The Special Projects Section undertakes or supervises such work.

The "Climatic Guide for New York" (#40-30 of the Climatology of the United States series) is an example of a publication prepared under the supervision of the Section in cooperation with other offices concerned.

The Section also carried on developmental work on the "discomfort index" concept and on the possibility of a value from this index proving satisfactory as base for a badly needed cooling degree day system. This included publication in the Reference Section of "Air Conditioning, Heating and Ventilating" an 8-page article on "Cooling Degree Days" showing computed monthly cooling degree values for 55 stations over the period from 1953 through 1957. Papers were prepared and delivered at the professional society meetings at Ann Arbor,

Michigan, and at Washington, D. C., on this developmental work.

Plans for 1959 include the completion of the Climatic Guide for Chicago and for at least the basic work on a similar publication for the Los Angeles area.

Developmental work will continue on the discomfort index, cooling-degree day concept to determine whether or not the concept as currently used is in a form suitable for all areas of the country. Arrangements are planned for extensive testing of these two concepts on a voluntary basis by as many first order Weather Bureau stations as possible.

6. AREA CLIMATOLOGISTS: There are five Area Climatologists located in New York, New York; Fort Worth, Texas; Ames, Iowa; Seattle, Washington; and Honolulu, T. H. Although located in the field, they are part of the staff of the Office of Climatology, each with responsibility for an assigned area.

Area Climatologists coordinate the efforts of the various State Climatologists in each area by correspondence and visits; advise the Office of Climatology on regional or national climatological problems; render technical assistance and give advice to the State Climatologist and others engaged in climatological activities; promote useful applications of climatic analyses and services by acting as climatological consultants to groups such as Regional Technical Committees, universities, other Federal agencies and State agencies. Regional Technical Committees referred to above are associations of Experiment Stations concerned with agriculture. Some of them are NE-22, on soil-plant-water relationships in the northeast; NE-29, on forage crop research in the northeast; NE-33, on the economics of irrigation in the northeast; NE-35, on the application of climatology to northeastern agriculture; S-47, on responses of forage crops to environmental factors in the south; NC-26, a precipitation probability study in the North Central States and W-48, concerned with phenological studies and detailed climatic analyses in the 11 Western States. In addition to general duties mentioned above, specific accomplishments of the Area Climatologists during the past year and plans for next year follow.

The Northeast Area Climatologist was largely responsible for carrying out a cooperative program (NE-35) whereby records of approximately 175 Weather Bureau voluntary observation stations in the Northeast are being placed on punched cards and analyzed by electronic computers. These data will be summarized and published in a regional climatological atlas. He prepared an article for a national business magazine on the climatological aspects of locating industrial sites in the Northeast and wrote climatological articles for Weather Bureau and professional publications.

The Northeast Area Climatologist's plans for next year include working with the NE-35 Subcommittee on Publication to prepare a temperature study to be issued in 1960 as the first part of the climatological atlas and directing more intensive efforts by the State Climatologist to prepare and publish local climatological summaries from the NE-35 punched card decks, in cooperation with interested local groups.

The Southeastern Area Climatologist encouraged State Climatologists to engage in individual, original or semi-original projects of their own choosing; collaborated with the Texas State Climatologist in devising a plan, satisfactory to all concerned, for eliminating a large number of daily telegrams received for weekly crop bulletin purposes; made special arrangements with Texas A&M for regular receipt of substation forms; addressed a meeting in Stoneville, Mississippi, sponsored by the National Cotton Council and one in Blacksburg, Virginia, of department heads, assistants and graduate students at Virginia Polytechnic Institute.

An article was prepared for a national magazine on the influence of climate on industrial plant location in the southeast U. S. A plan was submitted for investigating to what extent, if any, on-station checking of punched cards at first-order stations could be curtailed.

Plans for next year include working with the S-47 Technical Committee and continuing to work on two investigational projects begun in 1958.

During 1958 the Central Area Climatologist put primary emphasis on the NC-26 precipitation probability study. Much effort was devoted to the technical problems and the administrative work during the first four months of 1958. In this time the Area Climatologist arranged for punching at the Iowa State College Statistical Laboratory of the daily 1009 cards for two Minnesota and six Wisconsin stations to round out the network of approximately ten stations per state in the precipitation study. He coordinated and financially arranged the machine summary work (preparation of 1-, 2-, and 3-week precipitation input cards, IBM 650 computation of the gamma distribution parameters and the probabilities therefrom) for all but Wisconsin, Michigan, Ohio and Indiana. Arrangements were also made for card preparation for 1-, 2-, and 3-week totals for Michigan and Wisconsin.

He spoke at the Indiana State Seed Convention; at the Kansas Agricultural Field Station Personnel Conference; presented a paper at the American Society of Civil Engineers' meeting in Chicago and attended a meeting of the Advisory Committee for Climatology in Missouri. Contract work at two universities was reviewed. The annual NC-26 meeting at Wooster, Ohio, was attended and a progress report given.

Plans for next year include a study of methods to streamline or facilitate routine work at State Climatologists' Offices, such as storm reporting and data furnishing, passing suggestions and recommendations on, both to the Office of Climatology and to State Climatologists. Plans include also encouraging the use of punched cards and crop calendar approaches to crop-weather study applications, actively continuing cooperation on NC-26 work and a visit to the National Weather Records Center.

The Northwest Area Climatologist arranged for the continuation of the eleven-State Phenological Survey (a W-48 sponsored project using Weather Bureau cooperative observers). Early in the year a regional report was released which was later reissued in the National Weekly Weather and Crop Bulletin. He has also prepared and distributed a detailed report outlining statistical procedures using the extreme value theory for snow depth analysis.

He prepared and distributed a survey of the literature on the temperature bias as it relates to the time of observation at climatological stations and prepared an article "Climate and Industrial Siting in the Northwest U. S." for a national magazine.

His plans for next year include strengthening of the cooperative punched card project in the several States where progress has been slow. Assistance will be given to State Climatologists in studies and analyses of weather, either on punched cards or otherwise. Already planned are a summary of selected climatic analysis for both the W-48 Committee and the State Climatologists, as well as some direct assistance with the University of Wyoming in preparing 1009 card data for weekly summation.

Liaison will continue with State Climatologists on such problems as climatic summaries for recreation and tourism interests; climatic network for agriculture; instrumentation at experiment stations (solar radiation, soil temperature, soil moisture, etc.) and special climatic studies or surveys.

He will continue to assist in the 1959 Phenology Survey for the eleven Western States and will develop methods to extend it to other plant species.

In the field of applied research the Pacific Area Climatologist completed the field phase of a joint study (with Joint Task Force - 7) of the microclimatology of Eniwetok Atoll; was in charge of a scientific party of seven persons who made an eight-day field study of the effects of typhoon Ophelia upon Jaluit Atoll; completed and had published a preliminary report on the Jaluit study (Nature, November 8, 1958); worked on preparation of final report on the Jaluit and Eniwetok studies and on a general study of the Effects of Typhoons upon Islands and prepared for publication a brief note on Hurricane Frequencies in American Samoa.

He also visited American Samoa, reorganized the climatological network there and consulted with the Governor and members of his staff; visited the Central Office for two weeks, consulting with Central Office officials regarding plans and activities; presented a paper on the Effect of Typhoons on Atolls and also participated in the symposium on the Heat Budget approach in Geography; conducted a seminar for U. S. Fish and Wildlife Service, Honolulu, on Anomalous Atmospheric Circulation in the Pacific, July-December 1957, and gave two lectures for the trainee program of the Hawaiian Sugar Planters Association.

The Office of the Pacific Area Climatologist also managed the substation network in the area, opening, closing and inspecting stations and maintaining records from them.

General information service was provided through correspondence, phone calls and visits to the office. The first-order station at Johnston Island was visited and a staff study prepared on the station operations; the Pacific Supervisory Office technical library files were reorganized and maintained.

Plans for 1959 include the continuation of most activities mentioned above plus the preparation of three guides to climate data for the Pacific. One

will be for the upper air, another for surface data from land stations and the third for marine and beach data.

It is planned also to complete the reports on the Jaluit typhoon study, the Eniwetok microclimatic study and the general typhoon island effects study. Work may be started on a revised index to climatologic instruments in the Hawaiian Islands and to the corresponding data sources, whether published or unpublished.

Plans will also be drawn up for a comprehensive study of the weather and climate of the Hawaiian Islands.

7. THE NATIONAL WEATHER RECORDS CENTER (NWRC): Need for centralization of government activities in the collection and processing of climatological records was forcibly driven home during World War II. The need for climatological information by the military services resulted in the establishment of numerous scattered projects. These projects were sponsored by several agencies in the Weather Bureau, the Army, and the Navy. To a great extent all use the same basic weather data sources; conflict in overlapping effort was inevitable since the same data and the same punch cards were needed at the same time on widely separated projects. In many cases this resulted in duplication of effort. In 1944 it was generally agreed that centralization of work offered the only reasonable solution.

The first attempt to centralize activities occurred in 1945 at the New Orleans Port of Embarkation where a joint Navy, Air Force and Weather Bureau punched-card library was established. Both the Air Weather Service and the Weather Bureau established machine tabulation units in conjunction with this library, and the Weather Bureau agreed to perform the Navy climatological work on transferred funds.

While this operation centralized and coordinated most of the climatological project work performed by punched cards techniques within the three services and also served in a small way as a focal point of collection of basic weather records, the need for a central depository for all weather records remained unsatisfied and became more urgent. With the location of more suitable space in the Grove Arcade Building in Asheville, North Carolina, in 1950 it was decided to establish a National Weather Records Center there.

At this time the Weather Bureau was designated by the National Archivist to be the official custodian of weather records. This resulted in the greatest collection of weather data that the world has ever seen. Every effort has been made to insure that at least a copy of all available meteorological records collected in the United States and its possessions is stored at this depository. This requires approximately 175,000 square feet of floor space. Approximately 350,000,000 punch cards, containing weather data, are housed and serviced. These files are growing at the rate of about 30,000,000 cards per year. The Center is equipped with a full array of electric accounting machines and in addition now makes use of four digital computers. The Weather Bureau portion of the unit consists presently of six separate sections which comprise a staff of 356 people.

Although the basic function of the National Weather Records Center is that of collecting and servicing meteorological records, a no less important task is that of performing both routine and special data processing.

A routine function of the Center is that of processing all current upper air data. This serves the multiple purpose of quality control, editing and summarization. All marine and Navy data are routinely processed for the Navy and the weighing rain gage records are processed and published for the Corps of Engineers.

The preparation of certain approved climatological summaries of national or international scope is also assigned to the Center. These are: the Climatological Data National Summary, Monthly Climatic Data for the World, Daily Series, Synoptic Weather Maps, Parts I and II, the Bulletin W Supplement and Climates of the States.

A large portion of the Weather Records Processing Center facilities is and will continue to be devoted to special projects for other agencies, financed by funds transferred on a reimbursible basis. In addition, an ever growing amount of special work is done for private climatologists, private industry, and semi-private and local agencies. During the IGY period beginning July 1, 1957 the National Weather Records Center was designated as World Data Center A for meteorology and nuclear radiation. The Center is continuing its activities during the International Geophysical Cooperation period which is an extension of the International Geophysical Year.

Some of the special jobs done at the National Weather Records Center during the past several months include:

- a. The preparation of statistical tabulations and copy for a climatic guide for the New York City area. This publication presents detailed climatological summaries and studies and is one of a series planned for the larger cities of the country. The guide for Baltimore has also been published and the one for Chicago is under preparation.
- b. Climatological and Oceanographic Atlas for Mariners, Volume I, North Atlantic Ocean. This Atlas is an adapted version of the Navy Climatic Atlas for operational maritime problems for both the atmosphere and hydrosphere.
- c. The Marine Atlas, Volume 4, for the South Atlantic and Volume 5 for the South Pacific. Volume 4 has been distributed and Volume 5 is under preparation. These Atlases present a complete climatological study of both surface and upper air for the individual basins.
- d. The power spectrum analysis test project. This is a new technique for testing a time series to uncover statistically any inherent tendencies for cyclical behavior. It was used in testing the climatological record of temperature and precipitation at Woodstock, Maryland.

- e. A climatological study for Civil Defense purposes. This involves summarization of upper air wind values (speed and direction) for construction of climatological patterns to be used as guides in extrapolation of winds to designated levels.
- f. Refractive index jobs for the Bureau of Standards and for the Navy. This was a study of the density discontinuities in the lower levels of the atmosphere for the purposes of understanding and predicting the propagation of radio waves.
- g. A wind comparison study for the Weather Bureau's Observations and Station Facilities Division. This was a situation under which four different types of upper wind observing equipment were tested to determine the relative merit of each.
- h. Cooperation in the preparation of the "Climates of the States" series. There will be an issue for each state presenting text, tables and charts of climatological data pertaining to the states.
- i. Evaluation of aircraft in-flight reports. This is an attempt on the part of WMO (World Meteorological Organization) and ICAO (International Civil Aviation Organization) to determine the best way of summarizing data obtained from aircraft in flight in those remote areas where conventional observations are limited.
- j. A comparative wind summary for the new airport at Chantilly, Virginia. The purpose was to determine orientation of the runway. A limited amount of observational data at Chantilly was related to additional observational data at the Washington National Airport in order to interpret the limited Chantilly data.
- k. An eleven-year summary of sea surface temperature data in the Pacific for the Fish and Wildlife Service and a study of sea surface temperatures and wind speeds at selected locations for Woods Hole Oceanographic Institution.
- l. Development of upper air statistical techniques for Redstone Arsenal for satellite and rocket studies.
- m. Study of the height of maximum winds for the Office of Climatology. This study presents a new parameter for determination of jet streams, both horizontally and vertically.
- n. Summaries of low ceiling-visibility wind data for several locations in connection with instrument landing studies for aircraft.
- o. Basic work on the St. Lawrence Seaway Project. This included preparation of data for Technical Paper No. 35 "Climatology and Weather Services of the St. Lawrence Seaway and Great Lakes", a publication intended to familiarize all concerned with weather conditions and available weather services in the area.

- p. A summary of temperature and wet bulb data for selected foreign cities for the International Cooperation Administration.
- q. The Greenland Project. This involved tabulations of climatological data for a study of the physical processes of Arctic meteorology and climatology.
- r. Obtaining gridpoint data for the 433L project for the Geophysics Research Directorate of the Air Force Cambridge Research Center. This is a large program of reading gridpoint data for the Northern Hemisphere for 5 levels of the atmosphere for a 5-year period in order to supply basic data for the 433L weather system. This project has been organized and is well under way.

8. WEATHER RECORDS PROCESSING CENTERS (WRPC): There are three centers, located at Chattanooga, Tennessee; Kansas City, Missouri; and San Francisco, California. These Centers are responsible for checking and processing surface observations from some 12,000 observing stations. An extensive and detailed check is made of hourly observations from some 300 first order stations. This includes a complete check, utilizing IBM machine techniques, of sky condition, visibility, weather and obstruction to vision, atmospheric pressure, and, within specified limits, the psychrometric data entered on the records. Supplementary data, such as "remarks", and non-record observations which are not punched on cards, together with all autographic records of various types, are reviewed manually. Solar radiation data are processed for the stations equipped with pyrheliometers. The procedures followed provide for testing the reasonableness of observed data, the conformity to established practice in taking and recording observations, and correcting the records when required. As a natural by-product, observational quality is maintained by reporting changes made in the records directly to the observing stations. The numerous substations in the climatological and hydrologic networks also are kept at a high level of efficiency through direct correspondence with the observers and through notification to the traveling field aides of observational and instrumental irregularities.

The observed data utilized in the preparation of the several climatological publications and summaries are either received in punched card form or reduced to such form at the WRPCs. These card decks, after review and use in the preparation of copy for publication, are sent to the Climatological Archives at the National Weather Records Center, Asheville, North Carolina, for use in future studies.

Each WRPC is responsible for maintaining the climatological network in its area (Alaska, Pacific Islands and West Indies excepted); coordinating maintenance and network changes of hydrologic stations with hydroclimatic field aides, supervising stations, and other interested offices; preparing payrolls for paid substations under WRPC supervision; preparation of the newsletter "The Cooperative Observer"; and keeping substation observers supplied with reporting forms and charts, envelopes, instruments and other materials.

The following table outlines the basic work program of the WRPCs last year:

NUMBER PER WRPC DURING 1958

	Chattanooga	Kansas City	San Francisco
Employees	29	30	36
States or territories in area	23	15	14
First order stations	106	95	102
FAA stations in basic 24-hour network	4	8	41
FAA stations not in basic 24-hour network	55	65	51
Substations, temp. and precip.	1,570	1,865	1,917
Substations, precip. non-recording	1,687	3,242	936
Substations, precip. recording	1,012	1,124	892
Substations, evaporation	88	136	176
Solar radiation stations	26	32	34
Soil temp. stations	16	16	18
Storage gages	4	7	357
LCD annuals prepared	103	85	101
LCD supplements prepared	816	852	756
Pages CD prepared	3,001	3,036	3,056
Pages other publications prepared	8	28	51
Cards punched	1,392,000	1,430,000	1,813,224
Cards from first order stations	690,000	730,180	562,750

Special tasks are performed at each of the WRPCs. At San Francisco some 360 fire-weather stations are processed for the several Fire-Weather District Offices, all punching of surface observations is done for Alaskan and Pacific Island first order Weather Bureau stations, and data are processed from 357 precipitation storage gage stations. The WRPC cooperates annually with Montana State College in a phenological survey of the eleven western states. During winter and spring months, precipitation data for 745 stations in four states are furnished three Water Supply Forecast Centers on an advanced deadline basis. Similar collectives of both temperature and precipitation data for stations in several states are transmitted to Bureau of Reclamation,

Corps of Engineers, and about fifteen other governmental units or public utilities for immediate operational use on a year-round basis. This includes hourly precipitation data for several stations used by three California County Flood Control Districts. A precipitation bulletin for California for the water-year ending June 30 is published annually. Through a cooperative arrangement with State Department of Water Resources developed during 1958, the WRPC participates actively in an intensive substation evaluation and improvement program in California which includes supervision of travel planning and technical direction of the three field aides now working in the State.

At Kansas City, data for 76 U. S. Bureau of Reclamation stations in North Dakota, South Dakota, Nebraska, and Kansas are processed and copy prepared for publication; data for 9 Canadian Solar Radiation stations are processed; the WRPC is the supervising office for 93 Tornado and Squall Line stations in Texas, Oklahoma and Kansas; punched cards are furnished to the University of Arkansas for 11 stations; recording gage charts are collected and photocopies made for 8 Soil Conservation stations; recording charts and forms for unpublished stations in the Trinity River Basin are collected for the U. S. Geological Survey at Fort Worth, Texas; a study has been carried on to evaluate the practicability of preparing Local Climatological Data annuals by machine, and monthly precipitation totals are provided the U. S. Lake Survey for 234 Great Lakes Region stations.

At Chattanooga, copy is regularly prepared for a table of precipitation in the Tennessee Valley and a study is underway in an attempt to obtain better machine utilization. Chattanooga also cooperates with the Tennessee Valley Authority by evaluating hourly precipitation for 15 stations, and daily precipitation from recording gage charts is computed for the Corps of Engineers for a few Florida stations. Chattanooga also furnishes monthly precipitation totals to the U. S. Lake Survey for Great Lakes Region stations.

All three WRPCs make surveys from time to time of the accuracy of forecasts as interpreted by cooperative observers. During the next year, in addition to their regular responsibilities, all three offices will cooperate in the preparation of state charts by decades. These will present geographically those weather stations which were in existence in each state at the beginning of each decade from 1890 through 1950.

**OFFICE OF CLIMATOLOGY
Organization Chart**

