UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
WASHINGTON

June 21, 1961

IN REPLY, PLEASE ADDRESS
CHIEF, U. S. WEATHER BUREAU
WASHINGTON 25, D. C.
AND REFER TO

C-3.1

FILE: 922 MEMO (Climatological Services Memorandum No. 87) WASHINGTON, D. C. 6-21-61

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. 87

This Climatological Services Memorandum is devoted entirely to the activities of State Climatologists. It is issued to present a picture of the various State Climatologists' programs as of the spring of 1961, thus bringing up to date similar information in CSM #72.

We hope that this CSM will lead to a better appreciation of the State Climatologists' efforts and will also lead to interchange of ideas especially between those State Climatologists concerned with similar problems.

H. E. Landsberg
Director, Climatology

RECURRING ACTIVITIES OF W. B. STATE CLIMATOLOGISTS

State	Estimated number per month								Climatological Substation Summaries		Is monthly Local Climatological Data prepared?	No. of trips last year			Percent of time on -			
	Severe Storm Reports	News Releases	Substation Records Collected		Letters Answered	Visitors	Phone calls - S/C functions	Items added to Bibliography				To first-order stations	To cooperating agencies	Other	Routine Climatology	Non-routine Climatology	Non-climatological activities	Research
			Unpublished	Published					Prepared	Under Preparation								
Alabama	4	5	9	235	b	b	b	2	10	1	yes	9	28	3	5	20	70	5
Alaska	2	3	31	138	b	b	c	0	0	8	no	5	24	8	40	50	6	4
Arkansas	6	*	13	217	a	a	a	0	6	0	yes	0	0	0	10	5	85	0
Arizona	10	2	33	320	a	a	a	3	110	0	no	0	1	0	25	40	5	30
California	5	1	37	953	c	b	c	15	15	4	yes	15	60	16	25	50	10	15
Colorado	12	2	28	238	a	a	a	2	9	12	no	3	8	3	50	25	20	5
Conn. & R. I.	4	3	25	75	a	a	c	0	1	0	no	2	26	2	30	55	0	15
Florida	12	1	15	125	a	a	b	1	7	1	no	5	10	few	30	35	10	25
Georgia	4	1	6	170	a	a	a	0	37	0	yes	8	6	2	40	40	10	10
Hawaii & Pacific	*	*	1000	350	a	a	b	-	0	0	yes	2	3	3	25	25	20	30
Idaho	4	2	3	135	a	a	b	1	0	2	yes	1	3	1	40	25	25	10
Illinois	9	1	10	180	a	a	b	*	4	0	no	7	12	5	65	20	0	15
Indiana	6	*	10	120	b	b	b	1	10	2	no	5	2	2	40	30	0	30
Iowa	12	3	20	226	b	a	c	2	3	6	no	2	4	7	50	15	20	15
Kansas	30	7	47	305	b	a	b	10	0	0	no	3	10	3	50	30	10	10
Kentucky	10	3	17	158	a	a	b	2	0	0	yes	3	25	2	15	5	75	5
La. & Miss.	10	2	20	318	b	b	b	16	3	0	yes	1	2	1	25	25	45	5
Md. & Del.	1	*	40	98	a	a	b	10	0	15	no	0	80	4	15	70	0	15
Mass., Me., N.H., & Vt.	12	3	35	245	c	c	c	5	4	4	yes	15	56	8	50	35	5	10
Michigan	1	2	67	190	a	b	c	4	26	3	yes	3	5	0	30	10	40	20
Minnesota	9	3	41	207	b	b	c	4	11	3	no	6	22	9	25	11	57	7
Missouri	15	2	15	290	b	a	b	5	1	5	yes	6	25	3	15	15	40	30
Montana	15	7	10	295	b	a	b	8	11	1	yes	6	10	2	20	25	50	5
Nebraska	20	10	10	292	b	b	b	3	2	3	yes	3	14	3	25	30	35	10
New Jersey	2	1	15	82	c	a	c	1	0	1	no	4	32	2	15	45	30	10
New Mexico	5	3	20	270	b	b	c	1	5	30	no	4	4	0	50	30	10	10
New York	4	2	30	370	b	b	a	0	5	0	yes	1	4	0	15	5	75	5
North Carolina	1	10	5	210	b	b	c	1	17	2	yes	5	20	2	40	25	20	15
North Dakota	1	5	10	183	b	a	b	-	2	-	yes	3	4	6	20	20	50	10
Ohio	3	*	20	196	b	a	b	20	8	0	yes	2	10	10	25	20	20	35
Oklahoma	20	*	19	220	a	a	a	*	11	0	no	0	4	2	45	35	5	15
Oregon	4	4	61	242	c	c	c	5	17	0	yes	3	12	2	25	30	35	10
Pennsylvania	9	2	15	300	a	a	b	1	2	2	no	11	30	4	30	50	15	5
Puerto Rico	1	6	175	130	b	b	b	10	0	25	yes	1	20	1	25	50	5	20
South Carolina	5	1	10	114	a	a	b	21	18	0	no	4	10	12	45	45	0	10
South Dakota	5	4	18	164	a	a	a	1	2	2	yes	3	12	6	40	20	25	15
Tennessee	6	*	0	59	a	a	a	3	2	0	no	6	13	0	13	67	0	20
Texas	25	1	70	731	b	a	a	2	8	0	no	0	1	0	50	35	0	15
Utah & Nevada	5	*	20	300	b	a	b	2	24	10	no	2	10	2	40	30	0	30
Virginia	6	2	12	192	b	a	c	5	0	2	yes	5	12	15	7	2	90	1
Washington	2	1	15	250	b	b	c	-	29	4	yes	4	10	3	30	40	10	20
West Virginia	1	0	12	173	a	a	a	0	0	0	yes	1	1	0	10	3	85	2
Wisconsin	4	2	4	175	b	a	c	2	27	51	no	3	0	2	50	40	5	5
Wyoming	3	*	13	191	a	a	a	0	3	0	yes	2	4	2	40	30	10	20

* Less than 1 (a) Less than 50 (b) 50-100 (c) Over 100 - Data not available

EXPLANATION AND SUMMARIZATION

Severe storm reports mentioned in the preceding table are those published in Storm Data; each published item is one report.

The bibliographic material referred to in the table is a bibliography of climatological publications and papers pertaining to the climatology of the state.

In addition to the items listed in the table, an important recurring activity of all State Climatologists in cooperation with other agencies (primarily the Statistical Reporting Service of the USDA (formerly the Agricultural Marketing Service) and Extension Service and State Departments of Agriculture) in a joint Weather and Crop Bulletin.

There have been over 250 papers written in whole or part by State Climatologists since January 1954. These include such items as technical papers, research bulletins of Agricultural Experiment Stations, articles for publication in the Monthly Weather Review, Weekly Weather and Crop Bulletin National Summary, Journal of the American Meteorological Society and similar publications. These are listed by name at the end of the narratives following.

A state by state account of State Climatologists' activities follows, arranged alphabetically by states.

ALABAMA

The State Climatologist for Alabama is located in the Weather Bureau Airport Station, Dannelly Field, RFD #2, Montgomery.

Monthly summaries of Alabama Weather and Climate are furnished to:

1. Associated Press
2. United Press International
3. The Montgomery Advertiser, daily morning Montgomery newspaper
4. The Alabama Journal, daily Montgomery afternoon newspaper
5. U. S. Forest Service
6. Alabama State Forest Service
7. U. S. Geological Survey
8. WSFA TV station Montgomery
9. Alabama Educational TV, Auburn, Ala.
10. Dr. J. T. Cope, Jr., Associate Agronomist, Auburn University, Auburn, Alabama
11. USDA Agricultural Statistician, Montgomery, Ala.

Negotiations are under way with the Anniston Chamber of Commerce, Anniston, Alabama, to publish a climatological summary for that city.

Heating degree day data for the State were computed for the 25-year period, 1931 - 1955, and published in cooperation with the Alabama Planning and Industrial Development Board. It is planned to revise these data and compute them for the 30-year period, 1931 - 1960.

All available Alabama evaporation records have been compiled and summarized from the beginning of record through the year 1958.

Considerable work has been done on "Late Spring and Early Fall Low Temperatures in Alabama" for the 30-year period, 1930-1959. Our present plans are to revise these data for the 30-year period 1931-1960.

Papers prepared since January 1, 1954 include:

Long, A. R. Climate and Irrigation in Alabama. Abstract published in the Journal of the Alabama Academy of Science, December 1954.

Long, A. R. Chilling Requirements for Peaches. Published in the Journal of the Alabama Academy of Science, April 1955.

Long, A. R. Dormancy of Peaches, Weekly Weather and Crop Bulletin, Vol. CLII No. 9.

Long, A. R.; Pate, Floyd C. and Crosby, Rufus O. Lightning Damages in Alabama. Weekly Weather and Crop Bulletin, May 1956.

Long, A. R. Weather and the Peanut Crop. Published in Weekly Weather and Crop Bulletin, November 1956.

Long, A. R. Weather and the Corn Crop. Published in Weekly Weather and Crop Bulletin, October 1958.

ALASKA

Discussions have been held during the past several years with both the University of Alaska, College, and the Alaskan Experiment Station, Palmer, in regard to cooperative weather punch card programs. The former would involve the historical weather records at key Alaskan points while the latter involves the selection, the installation, the observing and recording, and the machine analysis of current special weather observations at the Experiment Station. Special instrumentation to date include anemometers at several heights (for measuring the Knik and Matanuska winds), pyrheliometer, net radiometer, several special evaporimeters, etc. Data collected are now being assembled in tabular form for entry on punch cards. The State Climatologist has been an active consultant on these programs.

For the Soil Conservation Service, in their National Inventory of Soil and Water Conservation Needs, special weather summaries were prepared for all the basic unit areas in Alaska. This report, although not published, becomes a part of the overall National report for SCS. Also for SCS, special summary tabulations have been prepared to provide information for surveys of potential farming areas in Alaska. Completed to date, are summaries for areas on Kodiak Island, Kenaii Peninsula and the Kasilof area. For the Tanana valley, the initial draft of material including considerable new tables on the probabilities of freezes--light through severe--and the growing season have been compiled.

For the State Department of Agriculture, a monthly summary of the weather is regularly prepared for the agricultural areas and is published in Alaska Market News. More recently, plans are now under way with Statistical Reporting Service, USDA, for a cooperative "Weekly Weather and Crop Report" bulletin. This will be similar to other State-side releases.

A complete revision of the collection and compilation of data on the freeze-up and break-up of ice in Alaskan lakes and rivers has been accomplished. These data will be published annually in the June issue of Climatological Data-Alaska. Much of the historical records on this phenomena have been summarized for potential users.

For a symposium on Outdoor Recreation in Alaska, an unpublished manuscript was prepared outlining the climatological considerations in this regard. A copy of this was furnished to a national conservation foundation group for their information and use. Some additional work along this line is being planned in cooperation with the State of Alaska for "tourism" for the coming year.

In cooperation with the Geophysical Institute of the University of Alaska, an investigation of average cloud conditions for the solar eclipse that will

cross Alaska and Canada in July 1963 has been undertaken. Data from both Alaskan and Canadian points were analyzed to determine which areas had the greatest climatological expectancies for minimum cloud cover for viewing the eclipse. A joint paper is being planned on this matter.

This office has a continuing program of extracting and compiling specific climatological data which are based on requests and needs of many diverse users. First, there has been 5 substation climatological summaries that have been compiled. A rather lengthy--but not complete--tabulation of rainfall intensity for various time intervals has been compiled. This is the first such tabulation for Alaska. Tabulations of snow cover and mapping of this information is done on a regular basis during the winter season. For the main agricultural areas, some preliminary work has been done in making evapotranspiration computations for later comparison with some actual measurements.

Increasing demands are being made for climatological data for both research and operational undertakings. Examples of some of these requests are: amount of sublimation of snow during winter season, determining the water equivalent of snow cover at the beginning of the spring break-up, climatic survey for the proposed Rampart Dam, the climatic implications of the large lake impounded by same dam, the climatic factors involved in the "dumping" of a high mountain glacier lake, the selection of precipitation stations or suitable analog stations for a stream flow study.

In Alaska, the basic administration of the substation network is handled by the State Climatologist's office. This includes visiting, inspecting, relocating or installing the climatological substations. Also, the first echelon of quality control is performed by his office since the forms are collected and "checked in" prior to processing by the WRPC.

Papers written since January 1954 include:

Watson, C. E. Important Aspects of Alaska Climate. Unpublished manuscript. Presented at Agricultural Seminar, Agricultural Experiment Station, Palmer, Alaska. 1957.

Watson, C. E. Climatological and Meteorological Factors Likely to Affect the Potential Development of the Greater Anchorage Area. Unpublished, but included in the official report prepared by the firm of Willsey, Han and Blair for the Anchorage City Planning Commission.

Watson, C. E. Probable Climatological Conditions to be Encountered in Geophysical Operations in the Wide Bay Area of the Alaskan Peninsula. Unpublished, but included, unchanged, in the report prepared by the geophysicist and field engineer investigating the feasibility of drilling operations by the Phillips Petroleum Company in the Wide Bay Area.

ARIZONA

The Arizona State Climatologist is located in Room 135, 2800 Sky Harbor Blvd., Phoenix, Arizona.

Cooperative Projects

The cooperative punched card program carried on with the University of Arizona, Institute of Atmospheric Physics, has been completed. The Institute, in cooperation with the Weather Bureau used these punched cards to prepare complete climatic summaries for temperature-precipitation stations for 91 locations in the State. The format of these summaries was patterned after the U. S. Weather Bureau publication, "Local Climatological Data with Comparative Data, Annual Summary." In addition, 19 abbreviated summaries were prepared for long-record sites measuring precipitation only. All 110 of these summarizations were published in 1960 by the University of Arizona Press Bureau in a 500-page publication entitled, "Arizona Climate." The State Climatologist's part in the project consisted of (1) computation of estimated monthly and annual degree-day totals for the 91 temperature stations using the method developed by H.C.S. Thom, (2) preparation of the Station History section and delineation of exposure changes in the monthly temperature and precipitation tables, and (3) assisting with the writing of the narrative climatological summaries. Since funds were not provided by the University Press Bureau to print separates, NWRC supplied the State Climatologist with a microfilm of the entire book, from which separates can be provided locally by using a Thermofax Microfilm Reader-Printer.

A weather table is prepared during the winter season for publication in "Snow Surveys and Water Supply Forecasts", published by the Soil Conservation Service.

The State Climatologist is a member of the Arizona Soil and Water Needs Committee. At its last meeting on August 31, 1960, the Committee examined the suggested format of the conservation needs inventory and suggested publication of an Arizona report from this inventory.

The weather section of the "Arizona Weekly Weather and Crop Bulletin" is prepared each Monday by the State Climatologist. This report is published and circulated by the U.S.D.A., Agricultural Marketing Service (A.M.S.). It is sent weekly to 330 subscribers and has proved to be one of the most popular reports circulated by the Phoenix A.M.S. office. Of 25 reports circulated from the local A.M.S. office, only the "Monthly Cattle and Feed Report" has produced more additions to the mailing list, by direct request, during the past year.

A cooperative project was carried on with the Maricopa County Health Department on smoke pollution in the Salt River Valley. Measurements were made by the Health Department during January, February and March 1960 of gas pollutants, total particulate matter, and haze. These measurements were correlated by the State Climatologist with various meteorological parameters by graphical methods.

Dr. L. Maryland Parker of the Division of Agriculture at Arizona State University inquired if freeze-threshold probability graphs were available for any other stations than the 5 previously mimeographed. As a result of this inquiry, the State Climatologist prepared graphs on log-probability paper for 23 Arizona stations that Dr. Parker chose as being agriculturally significant.. Separate graphs were prepared for "First in Fall", and "Last in Spring", using machine computations of the mean and standard deviation of the 32, 28, 24, 20 and 16-degree thresholds previously provided by NWRC. Thresholds were included which do not occur every year by making use of H.C.S. Thom's method.

Professor Milton Lowenstein, head of the Solar Energy Laboratory at Arizona State University, inquired if mean totals of solar radiation (langleys) were available over 7-day periods, throughout the year for Phoenix. Averages were computed from the available record and smoothed graphically.

The State Dental Director made a talk before a State dentists' convention on the relationship between the amount of fluorine consumed in drinking water in various parts of the State and the maximum temperature. He stated that a relationship has been found to exist between the incidence of fluorosis and the mean maximum temperature; simply because in hotter areas, people drink more water, which can mean that too much fluorine is taken in. The State Climatologist prepared a large map of the mean annual maximum temperature over the state for this talk.

Talks by the State Climatologist since 1958

In April 1959 a paper was read at the Symposium on Hydrology of Arid Lands, Geological Society of America in Tucson.

In June 1959 a one-hour illustrated talk was given on the climate of the Southwest at the University Agricultural Seminar Association meeting at the Cotton Research Center in Tempe.

In June 1959 a paper entitled, "Forecasting Minimum Temperatures on Clear Winter Nights in an Arid Region", was read at the San Diego meeting of the American Meteorological Society.

In January 1961 the State Climatologist was host to an agriculture class from Arizona State University in his office. A talk was given on Arizona climate and the State climatological program was described to the students.

Non-routine press releases to local newspapers

Arizona Precipitation During the Period October 1958-June 1959.

Arizona Weather During the First Half of the 1960 Water-Year.

Arizona Precipitation During the 1960 Water-Year.

Arizona Weather During the 1960 Calendar-Year.

Press release to "Arizona Farmer Ranchman", August 1, 1959

Arizona's Water-Year.

Mimeographed summaries prepared since last report

Monthly surface wind roses for the following stations: Ajo, Luke AFB, Williams AFB, Tucson, Yuma (2 sheets each).

Annual surface wind roses for 17 Arizona stations (4 sheets).

Climatological temperature expectancies aloft at Phoenix, Arizona (4 sheets).

Tables of the diurnal variation of the dry bulb temperature, relative humidity, wet bulb temperature, and the temperature-humidity index for WBAS, Phoenix, Arizona (5 sheets).

Estimated mean maximum and minimum temperatures at 5-day intervals throughout the year. (These estimates were prepared for 32 selected Arizona stations by computing the first 4 harmonics of a Fourier series using 12 average monthly values).

Climatological summarizations prepared
(not mimeographed)

Graphs of the diurnal variation of mean sky coverage at Phoenix, Arizona during each month of the year.

Tables of percentage frequency of sky coverage in ranges 0-3/10, 4-7/10 and 8-10/10 for each hour of the day during each month at Phoenix, Arizona.

Diurnal variation of surface wind speed during each month for Phoenix, Arizona.

Tables showing the total number of days with precipitation greater than or equal to (1) a trace, (2) .05 inch, (3) .25 inch, (4) .50 inch. The tables give totals for each day of the year for the period of record 1909-1958. Since this is a 50-year period, multiplication by 2 gives the unsmoothed probability that precipitation greater than or equal to the threshold amount will be observed on any given day of the year.

Maps showing the maximum depth of snow-on-ground reported over the State in each of the months December, January and February.

Graphs showing the average soil temperature during each week of the climatological year for the University of Arizona Citrus Experiment Farm in Tempe (8,20,39 and 89-inch depths).

Monthly (prorated) precipitation averages for all Arizona storage gages, based on entire period of record through 1960. (These averages will be kept up-to-date as more data become available from the Water Supply Forecast Unit in Salt Lake City).

Average monthly evaporation totals for all evaporation stations in Arizona from the beginning of record through 1960. (These averages will be made current at the end of each year).

Papers written since January 1, 1954 include:

Kangieser, Paul C. A Physical Explanation of the Hollow Structure of Waterspout Tubes, Monthly Weather Review, June 1954.

Kangieser, Paul C. A Possible Singularity in the January Minimum Temperature at Phoenix, Arizona, Monthly Weather Review, February 1957.

Kangieser, Paul C. Bacterial Wilt and Stewart's Leaf Blight of Corn, Weekly Weather and Crop Bulletin, Vol. XLIII, No. 17.

Kangieser, Paul C. Forecasting the Minimum Temperature on Clear Winter Nights in an Arid Region, Monthly Weather Review, January 1959.

Kangieser, Paul C. The Climate of the Southwest. Industrial Development Magazine, May 1959.

ARKANSAS

The Arkansas State Climatologist is located on the 2nd Floor, Administration Building, Adams Field, Little Rock, Arkansas.

Cooperation is maintained with the District Engineer, Corps of Engineers, Little Rock District, in climatological studies relevant to the planning for establishment of rainfall reporting networks.

The office cooperates with the Soil Conservation Service in the maintenance and operation of the Six-Mile Creek Watershed Project at Paris, Arkansas.

CALIFORNIA

The California State Climatologist is located in Room 557, Federal Office Building, 50 Fulton Street, San Francisco 2, California.

Back punching of substation cards continues at the University of California, and the State Department of Water Resources is now punching daily cards for a number of early stations as well as for a number of current stations that are not published by the Weather Bureau. At the present time there are approximately 40 stations for which daily cards have been punched back to the beginning of record. The Department of Water Resources has been using their cards and others purchased from Asheville in a number of climatological studies. The Irrigation Department of the University of California has been using the Madera cards in some studies relating to cotton production.

During the year most of the work has been completed on the Conservation Needs Inventory, the Climatologist serving both on the subcommittee and the main committee for California. We have worked with the Soil Conservation Service

and the University of California on evapotranspiration studies throughout the State, and we have met with their technicians on several occasions to discuss the significance of the figures and maps. The climate chapters have been prepared for three County Reports, and work is going forward on others.

We have worked with a number of other agencies, either furnishing data for their use or helping them locate climatological data applicable to their problems. Some of these agencies are the State Department of Public Health, the Bay Area Air Pollution Control District, the Southwestern Forest and Range Experiment Station, the State Development Commission, the San Juan Capistrano Conservation District, and the State Department of Forestry.

Articles prepared by this office in the past year include:

C. R. Elford: Evapotranspiration as an indicator of land-use capability. Presented at Monterey Meeting of American Meteorological Society.

C. R. Elford: Evapotranspiration in California as an Index of Potential Crop Production. Presented to San Diego Branch, American Meteorological Society.

C. R. Elford: Accuracy of observations, as it affects uses of climatological data. Presented to meeting of Field Aides at San Francisco.

C. R. Elford and M. R. McDonough: The Climate of Tehama County. Prepared for inclusion in Soil Survey Report to be published by SCS.

C. R. Elford and M. R. McDonough: The Climate of Siskiyou County. Prepared for inclusion in Natural Resources Survey to be published by Siskiyou County. Prepared for inclusion in Soil Survey Report to be published by SCS.

C. R. Elford and M. R. McDonough: The Climate of Amador County. Prepared for inclusion in Soil Survey Report to be published by SCS.

M. R. McDonough: Survey of Evaporation Records in California. Presented to Monterey Meeting of American Meteorological Society.

COLORADO

The State Climatologist for Colorado is located in Room 468, Post Office Building, 18th and Stout Streets, Denver, Colorado.

Colorado State University has completed two cooperative card punching projects: (1) 15 stations in the eastern plains of Colorado, and (2) 19 stations in western Colorado, 1 in New Mexico, 5 in Utah, and 5 in Wyoming. The first project was financed by the Soil Conservation Service in connection with the Great Plains Project. Plans for punching and analysis of records for Fort Collins and an additional network of northeastern Colorado stations await availability of funds for implementation. The second project is in connection with studies of the upper Colorado River precipitation and streamflow relationships, financed by the State of Colorado with cooperation by neighboring states. Machine processing of the punched card records is used in analysis of records by storm periods and of the relationship of storm total precipitation above certain thresholds to streamflow. Application of results to streamflow forecasting is being studied.

The State Climatologist is a member of the state central working committee for the National Inventory of Soil and Water Needs; works with the state committee of the Soil Conservation Service in providing climatic data useful for county soil surveys; also works with the Soil Conservation group in developing procedures for the evaluation of the Kiowa Creek Watershed Project.

The State Climatologist serves as Weather Bureau representative to the Great Plains Agricultural Council, an organization of the Experiment Stations and Extension Services of the 10 Great Plains states, and of Department of Agriculture agencies. He participates in annual meetings of the Council; serves as Weather Bureau representative to the Joint USDA - Weather Bureau Committee on Weather and Agriculture in the Great Plains, associated with the Research Committee of the Council; and is a member of the Council's Technical Committee for the GP-1 project on patterning of weather factors important to agriculture on the Great Plains. He also serves as consulting member of the Technical Committee for GP-4, a project on Grasshopper Research.

Liaison activity and cooperation in specific projects to varying degrees are carried on with Bureau of Reclamation regional, state and local offices; Corps of Engineers; High Altitude Observatory at Climax and Boulder; Colorado Department of Highways, Colorado Game and Fish Department; State Engineer; Denver Board of Water Commissioners; the Rio Grande Compact Commission, as well as other agencies. Such projects carried on by Colorado State University include the establishment of an evaporation station and a network of precipitation stations in northeast Colorado for investigation of ground water recharge from surface run-off; microclimatic work on mountain snowfall and seeding tests; hail studies in northeast Colorado; and pollution studies for the Denver area. Precipitation reports are compiled for water supply forecasts and monthly precipitation summaries by river basin areas are prepared during the forecast season. Arrangements have been made for precipitation measurements in remote areas during the snow season in cooperation with the Snow Survey Unit, Soil Conservation Service, at Fort Collins. Projects underway include: statewide compilation of degree day data with development of practical procedures for adjustment to topography; computation of relative humidity averages for mountain areas; probabilities of spring and fall freeze thresholds; collection of historical information for the state as related to weather and weather records. A revision was written of "Colorado Climate" in the Resources of Colorado Section, Colorado Yearbook, 1956 - 1958, published by the Colorado State Planning Division.

CONNECTICUT - RHODE ISLAND

The State Climatologist for Connecticut and Rhode Island is located at the Weather Bureau Airport Station, Windsor Locks, Connecticut.

The State Climatologist cooperates with the University of Connecticut, Yale University, Wesleyan University and the University of Rhode Island. Some examples follow. Estimates of missing data for the cooperative punch card program were furnished the University of Connecticut. Also in cooperation with this University, a study of the occurrence in Spring of periods with 42 degree mean temperatures for various Connecticut locations was completed for the important commercial gardening problem of transplanting shrubbery.

Recommendations were given the University's Storrs Experimental Station for probability and extreme value studies of rainfall being undertaken by the Station in cooperation with the Northeast 35 Committee. Data estimates for snowfall were made for a forestry research project at Yale University. Cooperation at Wesleyan included furnishing data and suggestions useful to complete a fuel marketing survey. In cooperation with the University of Rhode Island, studies were made of climatic factors in the timing of blueberry ripening and of maximum temperatures during maturation and occurrence of apple scald. A microclimatic study of freeze data probabilities for Rhode Island is being completed for publication during the Fall. Cooperative projects with the universities and experiment stations have each involved the following efforts on the part of the State Climatologist: compilation of essential climatological data, investigations to determine new or more effective applications or manipulations of the data to the biological or agronomical problem and personal discussions with the researcher.

An evaluation of the severe summer drought of 1957 in Connecticut and Rhode Island was made; also considerable work was done on the freeze probability statistics for both states. Determination of snowfall threshold probabilities and studies of occurrences of summer maxima of 80°, 85°, and 90° were made for Hartford, New Haven and Providence.

A climatic summary for Hartford Co., Connecticut, was written for the Soil Conservations Service's county soil survey. A revision of Kirk's "Weather and Climate of Connecticut" (1939) is in progress and will be published by the State Geological and Natural History Survey early next year.

A climatological evaluation for New Haven County, Connecticut, of the Weather Bureau's "30-Day Outlook" is regularly prepared during the growing season for publication by the County Extension Service.

A number of specialized summaries for industrial concerns and the State of Connecticut Development Commission have been completed during the past year.

Future plans include increased emphasis on climatologically promoting the industrial development and recreational aspects of both Connecticut and Rhode Island and all seasonal sports. Finally, there is a strong possibility that a vigorous research program to determine the micro precipitation climate of the State of Connecticut will begin soon in cooperation with State Weather Control Board.

Papers written since January 1, 1954 include:

Pack, A. Boyd. Weather and Curing of Cigar Tobacco. National Weekly Weather and Crop Bulletin, September 17, 1956.

Pack, A. Boyd. Influence of Drying Rate During Curing on the Physical Properties and Quality of Shade-Grown Tobacco. Connecticut Agricultural Experiment Station Bulletin No. 599. June 1956.

Pack, A. Boyd. Influence of Wet-bulb Temperature During Curing on Properties of Shade-Grown Tobacco. Connecticut Agricultural Experiment Station Bulletin No. 612. February 1958.

Brumbach, J. J. and Gosslee, D. G. Connecticut Precipitation and Temperature Probabilities. Storrs Agricultural Experiment Station, University of Connecticut. In press to be released this year.

FLORIDA

The office of the Florida State Climatologist is located on the campus of the University of Florida in room 308 Newell Hall. Mailing address is: U. S. Weather Bureau State Climatologist, P. O. Box 3658, University Station, Gainesville, Florida.

The State Climatologist holds a courtesy appointment on the staff of the Agronomy Department, University of Florida Agricultural Experiment Station and is an active participant in a station research project concerned with the effects of climate on forage production in Florida. A mobile micrometeorological laboratory has been assembled and observations are being made in the field in connection with this project. The State Climatologist also acts in an advisory capacity to a number of other research projects in the Experiment Station which are affected by weather and climatic conditions. He is currently cooperating in the conduct of a graduate student seminar course in the Soils Department devoted to studying the water relations of plants. Limited funds have become available for the analysis of weather data previously placed on punched cards under the Weather Bureau-Florida Agricultural Experiment Station cooperative punched card project. From time to time the State Climatologist is called upon to appear on programs of Symposia or Departmental Field Days when weather and/or climate are related to the topics discussed. Examples are: Symposium "Comfort of Dairy Cattle during Hot Weather" and the annual Solar Energy Symposium held by the Department of Mechanical Engineering. The State Climatologist also conducts one or two laboratory classes each semester in agricultural courses which contain a section devoted to the better understanding and usefulness of climatic data. Occasionally the State Climatologist is called upon to transcribe short talks for subsequent broadcast over the Florida Farm Hour.

Cooperation with the U.S.D.A. Soil Conservation Service has included active participation in the preparation of the National Inventory of Soil and Water Needs and service on the state committee during the preparation of the Florida report. Other activities in association with the Soil Conservation Service include participation in field reviews of the "Small Watershed Planning Outlines", preparing the climatic portion of those outlines and preparing the climatic portions of county Soil Survey Guides.

Close liaison is maintained with the Florida Department of Water Resources by attending meetings sponsored by that organization and by contributing regularly to the publication "Florida Water News". Because of the high variability of summer rainfall in Florida, we are jointly exploring the possibility of expanding the precipitation network in Florida.

From time to time other state or local agencies call upon the State Climatologist to assist them in problems where weather plays an important role. Some examples of these are: Meeting with local Civil Defense officials and the University of Florida Radiological Control Officer to consider radio-active

fallout distributions in northern sections of the state. The State Climatologist has also served in an advisory capacity to the Florida State Board of Health in the preparation of the meteorology section of the report "Florida's Air Resources".

Recurring responsibilities of the Florida State Climatologist include the collection of severe storm reports, preparation of the weather portion of the Weekly Weather and Crop Bulletin and supplying data and/or advice in answer to professional and/or general public inquiries. About 20 inquiries per week are received from the general public and a brochure of climatic material has been assembled to answer these numerous inquiries.

Investigative programs in progress and planned for continuance include: assembling phenological data concerning tomatoes grown on the Experiment Station Farm; study of climatic effects upon the internal quality of citrus fruits; analysis of historical weather data now on punched cards.

Papers written since January 1, 1954 include:

Butson, Keith. Florida's Winter Weather: 1957-58; Weatherwise, Vol. 11, No. 2, April 1958.

Butson, Keith. Peninsular Florida Rainfall; Winter Minimum Temperatures in Peninsular Florida, Federal-State Frost Warning Service, Lakeland, Florida, April 1958.

Butson, Keith. Precipitation; Florida's Water Resources - A report by the Florida Water Resources Study Commission, Gainesville, Florida, December 1956.

Butson, Keith. Some Aspects of Citrus and Weather in Florida; Weekly Weather and Crop Bulletin, National Summary, Vol. XLIII, No. 49, December 3, 1956.

Prine, G. M. and Butson, Keith. Soil Temperature Data - Gainesville, Florida (Mimeograph, November 1958).

Prine, G. M. and Butson, Keith. Daily Total Solar Radiation and Net Radiation for Gainesville, Florida, 1957. Mimeograph, June 1958.

Butson, Keith. Some Weather Extremes. The Florida Handbook, 1959-60.

Butson, Keith. Some Aspects of Seasonal Distribution of Rainfall in Florida. Proc. Fla. State Hort. Soc. Vol. 72, 1959, pp 171-176.

Butson, Keith. Six-Month Rainfall Summary. Florida Water News. Vol. 1, No. 2, August, 1959.

Butson, Keith. 1959 Rainfall Summary. Florida Water News, Vol. 2, No. 1, January 1960.

Gammon, Nathan Jr., Keith D. Butson and Ralph H. Sharpe. Magnesium Content of Pecan Leaves as Influenced by Seasonal Rainfall and Soil Type. To be published in 1960 Proc. Soil and Crop Sci. Soc. of Florida.

Butson, Keith. Six-Month Rainfall Summary, January through June 1960. Florida Water News, Vol. 2, No. 7, July 1960.

Butson, Keith. Summer Weather Conditions in Florida. Mimeograph presented at Symposium "Comfort of Dairy Cattle during Hot Weather", September 1960.

Butson, Keith. Hurricane Donna in Florida. Weatherwise, Vol. 13, No. 5 October, 1960.

Butson, Keith. Seasonal Distribution of Rainfall in Florida. Florida Water News, Vol. 2, No. 11, Nov. 1960.

Butson, Keith. 1960 Rainfall Summary. Florida Water News, Vol. 3, No. 1, January 1961.

Prine, G. M. and K. D. Butson. Soil Temperatures Under Short Bahiagrass Sod at Gainesville, Florida for the Four Year Period September 1956 through August 1960. Mimeograph, January, 1961.

Butson, Keith. Seasonal Variations of Solar Radiation in Florida. Paper presented at Solar Energy Symposium, University of Florida, April 10-11, 1961.

GEORGIA

The office of the Georgia State Climatologist is located in Room 202, Agricultural Engineering Building (Barrow Hall) University of Georgia, Athens, Ga.

The Cooperative Punch Card Project with the University of Georgia, College of Agriculture, has been in operation since 1959. The University has completed the punching of back records for eight climatological stations in southwest Georgia, and is now actively engaged in the analysis of these records. Approximately 110,000 cards have been punched by the University and duplicates furnished the Weather Bureau. Approximately 370,000 surplus 1009 cards have been furnished the University by the Weather Bureau. The State Climatologist was instrumental in the establishment of the punch card project, and has been active in its operation. He will collaborate in any publications resulting from the analyses which are currently underway. First priority is being given to a study of rainfall probabilities for periods of one, two and three weeks.

The State Climatologist is a member of the Georgia State Committee for the National Inventory of Soil and Water Conservation Needs and of Water Use and Conservation Association of Georgia. He is also an Associate Staff Member of the Athens Training Center of the Soil Conservation Service; and, in this capacity, lectures to all classes of professional and sub-professional Soil Conservation Service employees that pass through the Center. The Athens Center serves nine southeastern states and the Caribbean area of Puerto Rico and the Virgin Islands.

Close liaison is maintained with the State Office of the Soil Conservation Service, which is located in Athens. Specific examples of cooperation include the preparation of county climatic summaries for their County Soil Survey Reports, and the preparation and interpretation of data for use in their small watershed studies.

Close and amicable working relations continue with the U. S. Department of Agriculture's Soil and Water Conservation Experiment Station at Watkinsville,

Georgia, the Agricultural Marketing Service, with whom the State Climatologist collaborates in the issuance of the Georgia Weekly Weather and Crop Bulletin, and with the Agricultural Research Service. Of especial interest has been the latter's research on the use of solar radiation for supplemental heating of farm homes and developmental work on an automatic agricultural weather station.

The State Climatologist is on the University of Georgia staff as Research Associate in the College of Agriculture's Department of Agricultural Engineering. In this capacity, he serves as Climatological Consultant to staff members and departments in the College of Agriculture, including the Agricultural Extension Service, and to schools and departments throughout the University. One of the regular recurring assignments is to lecture to all classes in Soil and Water Conservation. Relations with officials of the University continue on an excellent basis.

Through the very fine cooperation of the Georgia State Department of Agriculture, the U. S. Agricultural Marketing Service and local Chambers of Commerce, local climatological summaries have been published for 37 communities throughout the State. 29 of these summaries were printed by the Department of Agriculture and 8 through the efforts of local Chambers of Commerce. Considerable clerical assistance was given the State Climatologist by both the Agricultural Marketing Service and the State Department of Agriculture. This program will continue as needs develop, and as additional stations accumulate 30 years of continuous records.

The State Climatologist is actively participating in a microclimatic research project at the University of Georgia, which is designed to study the effect of elevation and slope exposure on soil and air temperatures on a typical Georgia Piedmont farm. Cooperating in this project are the University's Departments of Agricultural Engineering and Horticulture. So far, the work has consisted of selection of sites, installation of equipment and collection of data. However, soil temperature data from the project are currently being released to the public on a weekly basis by press and radio for operational use.

Tabular data were prepared for the Atlanta Forecast Office and other Weather Bureau Offices for use in their forecast and service programs.

Cooperation with the Georgia Department of Public Health and the U. S. Public Health Service is anticipated during the next several months in the development of an Air Pollution Survey for Georgia. Preliminary conferences were recently held with State and Federal health officials concerning plans for the survey. The State Climatologist will prepare the meteorological and climatological material for the final report.

Continuing programs will include (1) assistance with the punch card project, especially in the analysis of data and preparation of material for publication, (2) the Cooperative Microclimatic study, (3) work on the planned Air Pollution Survey, (4) preparing monthly rainfall probability tables, by climatological divisions, based on the 30-year period 1931-1960, (5) preparing a mimeographed release on average monthly relative humidities over Georgia,

and (6) answering the increasing number of personal and mail requests for climatological data, interpretations and advices.

Papers written since January 1954 include:

Carter, Horace S. Weather and Peaches in Georgia. Weekly Weather and Crop Bulletin, National Summary, Vol. XLIV, No. 4, January 28, 1957.

Carter, Horace S. Late Spring and Early Fall Freezes in Georgia, Bulletin N.S. 41, Georgia Agricultural Experiment Stations, University of Georgia, College of Agriculture.

Carter, Horace S. Degree Days in Georgia. Mimeographed. Furnished their offices throughout State by Georgia Power Company.

Carter, Horace S. The Climate of Georgia. Published in Georgia Agricultural Facts 1900-1956, Agricultural Marketing Service, USDA in cooperation with Agricultural Extension Service, University of Georgia, College of Agriculture and the Georgia Department of Agriculture.

Carter, Horace S. Tornadoes in Georgia. Mimeographed.

Carter, Horace S. Weekly Rainfall Probabilities, Athens, Georgia. Mimeographed.

Carter, Horace S. Weather and Poultry in Georgia, Weekly Weather and Crop Bulletin, National Summary, Vol. XLVI, No. 34, August 24, 1959.

Carter, Horace S. Josiah Meigs, Pioneer Weatherman, Weatherwise, Vol. 13, No. 4, August 1960.

HAWAII AND PACIFIC AREA

A comprehensive study of typhoon effects upon islets neared completion during 1959 and 1960 and included completion of a monograph (jointly with other scientists) of typhoon effects on Jaluit Atoll and near-completion of a joint paper on effects at Ulithi Atoll, which was visited after the typhoon of November, 1960.

Major effort was directed toward the study of Kona Rainfall, this subject being investigated by William J. Taliaferro. Taliaferro also completed a comprehensive survey of climatological stations in Hawaii, which led to completion of a major publication showing the history, status, location, etc. of these stations and their programs. This in turn led to a survey of the substation network in Hawaii, which is being revised.

A study was started of variations in rainfall profiles across Oahu and Hawaii under different types of major synoptic situations. This empirical investigation may add to existing knowledge of how topography influences rainfall under different circumstances.

A Symposium was arranged on Pleistocene and Post-Pleistocene Climatic Variations in the Pacific Area, to be convened at the TENTH PACIFIC SCIENCE CONGRESS in August, 1961. Work was also started in organizing the entire program for that Congress.

Cooperative work of an advisory nature continued with a number of agencies, including especially the U. S. Geological Survey, Federal Aviation Agency, Corps of Engineers, Soil Conservation Service, Navy, Air Force, Trust Territory of the Pacific, Government of American Samoa, Hawaii Water Authority, Honolulu Board of Water Supply, Pineapple Research Institute, Hawaiian Sugar Planters Association, and various individuals at the University of Hawaii carrying out work in agriculture, botany, and other fields. In carrying out this and related duties the Climatologist was a member of The Committee on Evaporation of the Institute of Geophysics, U. of Hawaii; the Sub-committee on Water of the Conservation Council of Hawaii; the Committee on Land Utilization and Conservation of the SCS; and the WB-Navy-USAF Committee on Sources of Meteorological Data in the Pacific.

The Climatologist is also Lecturer in Climatology on the Affiliate Faculty, U. of Hawaii.

Papers written since October 1955 include:

Blumenstock, D. I. The Synoptic Climatology of the Moscow Basin (with Olga Ph. Prozorowski -- for Air Force Cambridge Research Center).

Blumenstock, D. I. Chapters for U. S. Geological Survey Reports on Yap, Guam, Truk, Tinian.

Blumenstock, D. I. Paper for UNESCO Symposium, paper titled, The Characteristics and Distribution of Tropical Climates, presented at IX Pacific Science Congress, Bangkok.

Blumenstock, D. I. Paper for Nature titled Typhoon Effects at Jaluit in the Marshall Islands.

Blumenstock, D. I. A note for the Bulletin of the American Meteorological Society on hurricane frequencies in the area of American Samoa.

Blumenstock, D. I. The Climate of Guam, USGS monograph series in Military Geology.

Blumenstock, D. I. The Climate of Tinian, USGS monograph series in Military Geology.

Blumenstock, D. I. The Climate of Yap, USGS monograph series in Military Geology.

Blumenstock, D. I. The Ocean of Air, Rutgers University Press, 1959.

Blumenstock, D. I. A Note on Hurricane Frequencies in American Samoa, Bull. American Meteorological Society.

David I. Blumenstock and Daniel F. Rex, Microclimatic Observations at Eniwetok, JTFMC TP-16 (1959) and Atoll Research Bull., No. 71, 1960.

The following item is in press:

David I. Blumenstock, R. F. Fosberg, and Charles E. Johnson, Resurvey of Typhoon Effects at Jaluit, accepted for publication in NATURE.

Taliaferro, William J. Kona Rainfall. Published by Hawaii Water Authority. 1959.

Taliaferro, William J. A Supplement to Kona Rainfall. Published by Hawaii Water Authority. 1959.

Taliaferro, William J. A Key to Climatologic Observations in Hawaii. IN PRESS.

IDAHO

A cooperative punched card agreement has been in effect with the University of Idaho, Moscow, since February 1957.

Some progress has been made in the cooperative punch card project with the University of Idaho since 1958. To date the complete records for nine stations have been punched and cards for August 1948 to December 1957 (declared surplus by NWRC) for 49 additional stations have been added to the card library at the University of Idaho Statistical Service Center. Interpolations to provice data for missing observations have been completed for the nine stations for which complete records have been punched. One study involving the use of punch card data for temperature frequencies was completed in 1958. A report issued by the Department of Agricultural Engineering is entitled "Research Investigations Relating to Barn Curing of Hay with Forced Ventilation". Machine summaries of Moscow, Idaho, data have been prepared for a proposed revision of Dr. Klage's Bulletin No. 245, December 1942, University of Idaho Agricultural Experiment Station, entitled "Climate of the Palouse Area of Idaho as Indicated by Fifty Years of Climatological Data on the University Farm". Data for three stations, for which complete data were punched with financial assistance from the Inland Research Center of the U. S. Forest Service, are being used in a study of the development and spread of blister rust on white pine. Plans are underway to include complete data for another seven Idaho stations in the study.

Probability of freeze data (both spring and fall) have been tabulated and computed for 25 stations in the State and released as a supplement to the Idaho Weekly Weather and Crop Bulletin. In addition, weekly normals of temperature and precipitation have been derived for representative points for this weekly bulletin as well as for use by Agricultural Marketing Service officials.

The State Highway Department has been furnished considerable data as well as the interpretation thereof. On one occasion, this resulted in a project with the National Weather Records Center in the detailed analysis of over 50 sta-

tions; information therefrom is to be used in planning and scheduling highway construction and maintenance.

For a University Extension Service Publication entitled "Fruit Varieties in Idaho" (Bulletin 300, May 1959), assistance was given to Tony Horn, State Horticulturist, in delineating climatic zones favorable for the culture of various fruits.

Compilation of data has been completed for two substation summaries, with the first, for Caldwell, to be published early this summer.

Climatic summaries, including computed evapotranspiration data, are nearing completion for Gem and Teton counties for the Soil Conservation Survey county soil surveys. The first of these surveys is to be completed this summer.

Evapotranspiration data for 19 northern Idaho stations are being prepared for Dr. Daubenmire, Dept. of Biology, Washington State University, who is continuing his studies of climate in relation to vegetation. Dr. Daubenmire's article "Climate as a Determinant of Vegetative Distribution in Eastern Washington and Northern Idaho" appeared in Ecological Monographs, April 1956.

Work has been started with the Agricultural Marketing Service and the University Extension Service for the preparation of a crop-weather calendar for Idaho.

Assistance was given to the Idaho Department of Highways, Design Section, in the use of W. B. Technical Papers 24, 25 and 28, in preparing a manual on "Urban Storm Sewer Design for Idaho Highways". The state was divided into nine zones and for each zone a set of Intensity-Duration curves was presented for return periods of 2, 5, 10, 25, 50 and 100 years.

Data were furnished to the Idaho Power Co. for preparation of Temperature-Humidity Index tables for Boise and Twin Falls, Idaho, and Ontario, Oregon. Using IBM equipment, all hourly values exceeding 69 were tabulated for the months of June, July and August for 1958 and 1959.

Beginning in June 1960 and continuing through the record-breaking temperatures of July, the State Climatologist maintained a daily graph of the hourly THI values at Boise. He also prepared a brief article on the record maximum of 111° on July 19th, emphasizing the reasons for non-acceptance of a widely publicized reading of 121° on August 17, 1871. The article was printed in the Idaho Daily Statesman and was also made a permanent part of the local climatological record.

A study of precipitation records in eastern Idaho has been initiated because of the marked change in average annual precipitation between the early years of record and more recent decades. At Idaho Falls the 25-year average for a period ending with 1919 was 13.76 inches, whereas for the 1931-55 period the average was 8.97 inches.

Graphs have been prepared depicting the monthly distribution of precipitation at 23 locations in Idaho. Marked differences are apparent from north

to south and from east to west, ranging from pronounced winter maximum and summer minimum in the extreme north to summer maximum and winter minimum in the east-central part of the state. These graphs remain unpublished.

Temperature and snowfall data were tabulated for the ten coldest and ten warmest winters at Boise during a 58-year period. These served as the basis for a newspaper article, but otherwise remain unpublished.

ILLINOIS

The office of the State Climatologist is located at 601 1/2 E. Springfield Street, Champaign, Illinois, adjacent to the campus of the University of Illinois in quarters furnished by the State Water Survey.

The State Climatologist is on the staff of the University as a cooperator with several departments of the University and with the Illinois Water Survey. Mr. R. W. Harms was appointed State Climatologist in June of 1960 upon the transfer of Mr. L. A. Joos to the Office of Climatology.

The meteorological section of the Water Survey consists of a staff of approximately 20 full-time research scientists concerned with hydrometeorological investigations of precipitation; climatological studies of precipitation and related weather phenomena; radar utilization to study rainfall, severe thunderstorms and hailstorms; precipitation physics and weather (cloud) modification. The State Climatologist participates in seminars at the meteorological section, occasionally reviews technical papers prepared by the section and furnishes climatological data and advice as requested. A cooperative punched card program was completed in 1957 with 63 stations' records punched back to 1900. Under terms of the agreement, cards from 1949 through 1957 have been furnished the section by the Weather Bureau.

The State Climatologist is a member of the Illinois Soil Conservation Service State soils committee which prepares guides and outlines for soil survey reports and SCS handbooks. A climatic summary for Lake county is currently being prepared for the SCS with 3 additional summaries scheduled over an eighteen month period.

Two county climatological summaries have been prepared for the USDA Crop Reporting Service at Springfield with 3 additional summaries scheduled within the next few months.

Four local climatological summaries have been prepared in cooperation with the Illinois State Water Survey meteorological section. It is anticipated that additional summaries will be prepared, particularly for the eastern portion of the state.

The State Climatologist has been cooperating with the NC-26 committee in follow-up on temperature probability work at the computer laboratory of the University.

The State Climatologist is occasionally requested to lecture on various facets of climatology. Currently talks are scheduled before the Illinois Acad-

emy of Science and the Hydraulics Engineers group.

Numerous "press release" type articles are written and distributed by the State Climatologist, particularly on tornadoes and general Illinois climate. An approximate 2,000 word article is furnished annually to the "Decatur Outlook".

Papers written since January 1, 1954 include:

Joos, L. A. Hay Drying Weather. Published in National Weekly Weather and Crop Bulletin, 42 (25):7-8, June 20, 1955.

Joos, L. A. Climate of Illinois. Illinois State Department of Agriculture, 40th Annual Report, Fiscal Year ending 6/30/57: pages 15-20.

Joos, L. A. Climate of Sangamon County (Springfield). In Bulletin C-1 of Illinois Cooperative Crop Reporting Service, 1958.

Joos, L. A. North Central Area Weather Factors. Industrial Development, Vol. 128, No. a:56-63, February 1959. (Conway Publications, Atlanta, Ga.).

Joos, L. A. Illinois Hail Storm of January 21-22, 1959 Volume 12, Number 2, Weatherwise, April, 1959.

Joos, L. A. Freeze Probabilities in Illinois. Bulletin 650 Agricultural Experiment Station, University of Illinois. January, 1960.

Joos, L. A. Time trends in Mid-west Tornado Statistics (mimeographed 5/4/60).

Joos, L. A. Mean vs Median in Weekly Precipitation (mimeographed 5/13/60).

Harms, R. W. Climate of Will County. In Bulletin C-2 of Illinois Cooperative Crop Reporting Service (submitted December, 1960).

INDIANA

The State Climatologist for Indiana is located in Room 3422, Life Science Building on the campus of Purdue University. The State Climatologist, as assistant professor of climatology in the Department of Agronomy, encourages the application of climatology in the Agronomy Department, in Purdue University, and in Indiana. He works closely with the Agricultural Statisticians, Agricultural Engineers, Soil Scientists and others in the University and state.

The State Climatologist joins with other professors in advising graduate students who are applying climatology in their research. The largest project near the publishing stage is a spring and fall freeze bulletin developed jointly with Dr. F. H. Emerson of the Horticulture Department who wrote the section about spring and fall freezes as they affect fruit and vegetable crops and Professor J. E. Newman who wrote the section pertaining to field crops. The State Climatologist summarized the weather data.

The State Climatologist occasionally lectures in university classes, gives seminars, and appears on TV with county agricultural agents. He described climatological measurements and their application at a Field Day held at the Southern Indiana Forage Farm where county agricultural agents, farmers, and researchers gathered to be briefed on the research activities on the farm.

The State Climatologist acted on a committee of three in the Agronomy Department in developing a plan for an Indiana agricultural forecast and advisory center for Indiana at Purdue University. This program was developed with some detail and submitted to the Weather Bureau with the idea of utilizing in the most complete way the meteorological skill of the Weather Bureau, the agricultural skill of Purdue scientists, and the tested extension methods of the University in the counties of the state.

The State Climatologist cooperates with Professor James Newman in his work with the north central agricultural experiment stations in calculating rainfall and temperature probabilities. Soil moisture, soil temperature, and phenological networks are taking some form. Two soil temperature and four soil moisture stations are now functioning under the guidance of Professors Dan Wiersma and James Newman.

First-order Weather Bureau Stations in central and southern Indiana were visited with a Purdue Committee of three to encourage local agricultural forecasts.

Climatological summaries were made for Owen and Fayette Counties for the county soil survey reports which are published by the Soil Conservation Service. Summaries for some other counties are in the formative stages.

Some unpublished papers by the State Climatologist are: (1) "Geology and Climate" given at the Hoosier Chapter of the Soil Conservation Society of America. (2) "Collecting Indiana Weather Data in the Nineteenth Century", given at the Indiana Academy of Science. (3) "Useful Weekly Weather and Crop Reporting in Indiana", given at the Third Conference on Agricultural Meteorology. (4) "Weekly Weather and Crop Report" given at an Agricultural Conference, Purdue University.

Many activities of the State Climatologist are closely connected to the University. These may be shown by listing university publications in which climatological data are presented in some way: (1) Report of Progress in Research, Southern Indiana Forage Farm, "Weather on the Forage Farm". (2) Agronomy Farm Research, "Agronomy Farm Weather". (3) Local Climatological Data, O'Neill and Agronomy Farm (4) Indiana Weekly Weather and Crop Report (5) Agronomy Handbook, "Agricultural Climatology" (6) A Map of Indiana Soils, "Spring and Fall Freeze Maps".

IOWA

The Iowa State Climatologist is located in Room 400, U. S. Court House Building, Des Moines 9, Iowa.

Snowfall threshold studies were enlarged to include several climatological stations in Iowa.

Climatic Summaries were prepared for Van Buren and Adams Counties for publication in the County Soil Surveys by the Soil Conservation Service.

The cooperation with the Agricultural Research Service at Iowa State University has resulted in a wet bulb climatology of the United States in the form of 24 maps. These data are expected to be useful for grain dryer design information.

In various stages of progress are (1) six substation Climatic Summaries, (2) a "Climatology of Iowa Tornadoes" by Spohn and Waite, (3) "A Wet Bulb Climatology of the U. S. by Schmidt (ARS) and Waite, (4) "Some Five Day Solar Radiation Relationships" by Waite, and (5) "Spring Freeze Hazards in Iowa" by Iowa Crop and Livestock Reporting Service and the State Climatologist.

The State Climatologist is on the Staff at Iowa State University and spends approximately 20% of his time at the University participating in seminars, climatological consultation and liaison. University liaison has included cooperation and consultation with Agronomy, Agricultural Engineering, Forestry, Soils, Agronomy Extension, ARS and Soil Conservation Service. Cooperation with the Extension Division included cooperative preparation of climatological information for extension workers partly in response to 4-H climatological training program inaugurated in the last two or three years.

Papers written since 1959 and 1960:

Waite, P. J. and Shaw, R. H., "Solar Radiation and Sunshine in Iowa", Iowa State Journal of Science, Vol. 35, No. 13, P. 355-365, February 1961.

Iowa Crop and Livestock Reporting Service and U. S. Weather Bureau, "Growing Season and Fall Freeze Hazards", August 1960.

Shaw, R. H., Dale, R. F., Waite, P. J. and Duncan, E. R., "Atmospheric Influences on Crops (Iowa's Agricultural Weather)", Iowa State University, Cooperative Extension Service, January 1961.

KANSAS

The Kansas State Climatologist is located in Room 401, Federal Building, Topeka, Kansas.

Punched cards have been punched by and are now available at Kansas State University, Manhattan, Kansas for about 30 stations over Kansas beginning with 1900. In addition there are quite a large number of cards for stations selected by Kansas State University from the surplus from the NWRC. The balance of cards from this surplus was provided the University of Kansas at Lawrence.

The cards from 10 of these stations were used in the NC-26 Rainfall Probability Study, and those available at the time were used in preparation of a

Bulletin No. 415, December 1959, "When to Expect Late Spring or Early Fall Freezes in Kansas", by the Agricultural Experiment Station. Also the State Climatologist furnished considerable information on station location for preparation of Bulletin No. 415.

A Preliminary Monthly Weather Summary is prepared for issue to the Associated and United Press Associations for distribution to newspapers and radio and T.V. stations in the state. There are also approximately 130 Commercial, Agricultural, Federal and State interests who subscribe to this bulletin. Weather significant to agriculture, for the month, is stressed in this bulletin. Special releases on particular phases of the weather as drought, storms, etc. are prepared as needed.

In cooperation with the Agricultural Marketing Service, a map or paragraph has been carried at an appropriate time in the Kansas Weekly Weather and Crop Bulletin relative to the chances for frost damage on specified dates, since 1958.

Climatic Summaries have been prepared for the Soil Conservation Service County Soil Surveys for Hamilton, Greeley, Stevens, Stanton, Kearny, and Ford Counties, and some of the basic data for two additional counties have been compiled. None of these have as yet appeared in print.

Charts and graphs have been made from the approximately 1800 tornadoes of record in Kansas since 1859 showing the frequency of occurrence through the hours of the day and months of the year. These have been found helpful in speaking before Civic Organizations or Service clubs, especially in the spring time when the approach of the tornado season prompts such programs.

All substation records for the entire period of record, except 1951-53, thru 1954, were bound in one-station volumes for greater convenience and accessibility and prevention of loss. Records for 1951-53 are available on microfilm.

In process of preparation are monthly climatological maps of Kansas covering the period from beginning of record through 1960 for (1) Greatest Monthly Precipitation, (2) Greatest 24-hour Precipitation, (3) Greatest monthly Snowfall, (4) Highest Temperature, (5) Lowest Temperature. Date, month, and year are given as needed.

The State Climatologist is a member of the following committees: National Inventory of Soil and Water Conservation Needs. Meetings are held as needed.

Agricultural Agencies Committee, composed of heads of Federal & State Agricultural Agencies in Kansas. Meetings are held bimonthly. There is always an interest in the weather in these meetings, and in the program of the Weather Bureau.

Weather Committee of Kansas State University, Manhattan, Kansas. Occasional meetings are held especially at the time of the Extension Service Conferences, when the Experiment Station supervisors are at Manhattan. Recommendations are made to the University authorities regarding the location and

type of weather stations needed at the Experimental Farms and Fields, the data needed and possible uses for the data.

A John Companius Holm award was made in a personal presentation to Mr. L. E. Gorsuch, Leoti, Kansas for his many years of excellent record. This was accomplished at the annual 4-H Businessmen's Picnic for Wichita County on July 25, 1960.

In addition to news releases the following papers have been written:

Robb, A. D. What Kansas Weather did in 1958, published in Kansas Farmer December 20, 1958.

Robb, A. D. Important Items in Kansas Weather. Prepared for a bulletin on Kansas Crops and Weather by C. J. Chandler, Chairman of the Board, First National Bank, Wichita, Kansas and used also by the Fidelity State Bank, Topeka, Kansas. In 1959 the review for 1958 was featured in the Weekly Kansas City Star, Kansas City, Mo. Slight revisions as necessary are made yearly shortly after the close of the year.

Robb, A. D. Outstanding Tornadoes in Kansas 1887-1958. A mimeographed listing of all the known important or severely damaging tornadoes that had one or more of the following features: A path of 50 miles, 10 or more persons killed, or at least $50,000.00 damage. Issued January 29, 1959. A number of additional severe tornadoes have occurred and others have been reported in earlier years which necessitate the revision of this listing.

Robb, A. D. Tornadoes in Kansas, Published in the Kansas Government Journal, April, 1959. This is the journal of the League of Kansas Municipalities, Topeka, Kansas.

Robb, A. D. Severe Hail Storm, Selden, Kansas, June 3, 1959, published in Monthly Weather Review, August, 1959.

Robb, A. D. Rose Culture and the Weather, published in the National Weekly Weather and Crop Bulletin, January 11, 1960.

Robb, A. D. Lessons From 100 Years of Kansas Weather, published in Kansas Farmer, Topeka, Kansas, in the issues of March 4 and 18, 1961.

In addition to these published articles considerable material as to station location, hill or valley, value of records etc. was furnished as a guide to Dr. L. D. Bark, Kansas State University, Manhattan, Kansas when preparing the Bulletin No. 415 previously mentioned.

The State Climatologist also furnished data and suggestions for an article by a special writer for the Oklahoma Stockman on the prospects for a return of drier years in this region and furnished the same writer material for an article on the mildness of the past winter, using the number of degree days at the Weather Bureau Offices as a basis for comparison.

KENTUCKY

The State Climatologist Office for Kentucky is located in the Weather Bureau Airport Station on the Second Floor of the Lee Terminal Building, Standiford Field, Louisville, Kentucky.

The State Climatologist Office continues liaison on air pollution studies at the local level as well as with the U. S. Public Health Service and Weather Bureau Research station at Cincinnati, Ohio. Liaison at frequent intervals on allergy-climate problems with the local representative of the American College of Allergy. The State Climatologist participated in a several months long study of the Kentucky Water Resources Study Commission, and drafted the chapter on Climate, Evaporation, and Potential Evapo-transpiration which appeared in the published study of this Commission in August 1959. He is a member of that commission. Liaison has continued at the state and local level with representatives of the Soil Conservation Service and U. S. Geological Survey with assistance and advice in studies of stream flow and water tables in Kentucky and additional water-shed precipitation networks.

A drought study of Kentucky has been underway for the past eighteen months. A study of late spring and early fall freezes in Kentucky was undertaken by this office in 1959. This is now under review by cooperators at the University of Kentucky, Lexington, Kentucky, who expect to publish this study within the next few months.

LOUISIANA-MISSISSIPPI

The State Climatologist for Louisiana and Mississippi is located in Room 317 of the Post Office Building on Camp Street, opposite Lafayette Square. After November 1, 1961 the office will be on the 14th floor, Federal Office Building, Loyola Avenue and Girod Streets.

Health-climate studies have been undertaken in cooperation with Public Health Service and local Chamber of Commerce, assisting Tulane University in their Asthma study.

"In cooperation with the State Conservationists, Soil Conservation Service, preparing climatic summaries (narrative and tabular), for parishes in Louisiana and counties in Mississippi at the rate of several per year for each state. Tabular data are now being prepared in accordance with revised instructions and a revised format. Analysis of substation records has been completed to provide best possible data for parishes and counties where there is no station, or no long-period record."

Climatic atlases for Louisiana and for Mississippi are being compiled and at present consist of the following maps and charts:

1. Maps of freeze risk (32°) of 75%, 50%, 35%, 20%, and 10% for last spring and first fall occurrence;

2. Maps showing all tornadoes, damaging windstorms and damaging hailstorms of record 1916-1960 with additions annually. Contour lines of 42-year tornado occurrences with 10 mile square grids have been computed; also graphs of diurnal distribution of occurrence;

3. Maps showing distribution of average number of days temperature 90° or higher, 32° or lower, and chance of temperature 20° or lower occurring at least once during the winter;

4. Maps have been prepared showing the path of hurricanes and tropical storms which have entered or affected these two States. They show the path of the storm center and the approximate area of hurricane and/or gale force winds, lowest pressure, highest wind speed (corrected to true values), and other significant data.

It is planned to withhold preparation of charts of normal temperature and precipitation until 30-year normals through 1960 have been computed. Efforts are being made to have this material published.

Preparation and publication of Weekly Weather and Crop Bulletins in Louisiana and Mississippi in cooperation with the Agricultural Marketing Service was started in January 1958. Responsibility for the weather portion of the Mississippi bulletin was transferred to the Jackson, Mississippi office April 1, 1959.

The narrative "Climate of Louisiana" and "Climate of Mississippi" prepared for the revision of "Climates of the States" has been reproduced (ditto) for local distribution, and supplied to State Superintendents of Education for reprinting and dissemination to science teachers in the high schools of the state. The published "Climates of the States" for Louisiana and Mississippi are now available and have been very helpful in answering inquiries.

Beginning with 1947, detailed reports of hurricanes affecting the two states have been prepared and reproduced for use within the states. These have been especially helpful in satisfying requests for certification for court use.

Graphs of relative humidity occurrence have been prepared for all hourly-reporting stations in or adjoining the two states and copies have been supplied to the local stations. These include frequency distribution by seasons and year for all temperatures, temperatures 90° or higher, 80° or higher, 70° or higher, and 50° or lower. Time distribution of significant relative humidity ranges seasonally and for the year were also prepared.

Certification of weather data for use in Local State and Federal Courts in the two states is increasing as awareness of the availability of such data grows.

MARYLAND - DELAWARE

The Maryland-Delaware State Climatologist is located at the Weather Bureau Airport Station, Friendship Airport, Baltimore, Maryland.

Direct supervision is given to cooperative punched-card programs with the University of Maryland, University of Delaware, and the Baltimore Gas and Electric Company. Equipment and personnel are in the State Climatologist's office. As of February 28, 1961 a total of 1,147,392 cards were punched since the beginning of the program in 1956. Punching of 119,766 cards was sponsored by the University of Delaware, 707,242 the University of Maryland, and 320,384 for Baltimore, sponsored by the Baltimore Gas & Electric Company.

An auxiliary office is maintained at the University of Maryland where the State Climatologist is present several days per month for consultation with faculty members in connection with research work involving climatology. Periodic visits are made to the University of Delaware where there is also active interest in research in soil temperature, soil moisture, and irrigation problems. Occasional trips to the Baltimore Gas & Electric Company are made in connection with the processing of the large volume of weather data on punched cards for Baltimore, Maryland.

The State Climatologist was appointed as Official Collaborator to the Delaware Station on Regional Project NE-35, The Application of Climatology to Northeast Agriculture (by letter dated December 20, 1960 from Dr. G. M. Worrilow, Dean and Director, School of Agriculture, University of Delaware).

In cooperation with the Hydrologic Services Division of the U. S. Weather Bureau, the University of Maryland, the University of Delaware, and C. W. Thornthwaite Associates (The Laboratory of Climatology), the State Climatologist developed several high-speed computer programs for the IBM 650 Data Processing System for daily computation from climatological data of potential evapotranspiration and various quantities involved in the soil moisture accounting problem.

Liaison is maintained with the Soil Conservation Service, Office of the State Conservationist; also, with developments having climatological implications at Beltsville, Maryland, headquarters of the Agricultural Research Service, USDA. Discussions have been held with representatives of the Water Resources Survey on county climatic summaries. Cooperation is carried on with the Horticultural Crops Research Branch, ARS, USDA, Newark, Delaware in connection with plant disease forecasting.

Work has been done on freeze probabilities, drought occurrences, phenological data, survey of past tornado occurrences in Maryland and Delaware, compilations and analysis of THI (temperature-humidity-index) data and cooling degree-day data (based on THI) for 10 years of record for Friendship International Airport in cooperation with the Baltimore Gas & Electric Company, survey of past ice conditions on Chesapeake Bay and its tributaries dating as far back as 1871 with reference to earlier years, report on hurricane DONNA (September 12, 1960) as it affected Maryland and Delaware, etc. The punched card program has made the Baltimore climatological records available in various forms convenient for press, radio and TV dissemination of comparative information at times of newsworthy weather events.

Papers written since January 1, 1954 include:

Engelbrecht, Howard H. The Climatology of California. 1955 (mimeographed and distributed by the San Francisco Public School Board for use by the San Francisco Public Schools).

Engelbrecht, Howard H. The Climatology and Ecology of the Pacific Coast, 31st National Shade Tree Conference Proceedings, 1955, pp. 7-24.

Engelbrecht, Howard H. A Note on the 1957 Drought in Maryland. 1957. (mimeographed for local distribution).

Engelbrecht, Howard H. Average Precipitation by Divisions - Maryland and Delaware - and related Comparative Precipitation Data for 1957 Drought in Maryland and Delaware. 1957. (mimeographed for local distribution).

Engelbrecht, Howard H. A Brief Summary of Delaware Climates. (Revised November 5, 1957). (mimeographed for local distribution).

Engelbrecht, Howard H. Speed Up Irrigation Research with High Speed Computers. 1958. (mimeographed for local distribution).

Engelbrecht, Howard H. A Demonstration of an IBM 650 Program for the Computation of Potential Evapotranspiration and Theoretical Soil Moisture Data. 1958. (mimeographed for local distribution).

Engelbrecht, Howard H. and Brancato, G. N. World Record One-Minute Rainfall at Unionville, Maryland. 1958. Monthly Weather Review, August 1959, pp. 303-306.

Engelbrecht, Howard H. The Application of High-Speed Computers in Irrigation Research. Bull. of the Amer. Meteor. Soc., Vol. 40, No. 11, November 1959, pp. 566-570.

Engelbrecht, Howard H. Manual for Use of IBM 650 Program HHE001 - Potential Evapotranspiration (Thornthwaite or Penman) and Soil Moisture Accounting (Various Methods). Friendship International Airport, Baltimore, Maryland. Revised December 24, 1959.

Engelbrecht, Howard H. Manual for Use of IBM 650 Program HHE002 - Potential Evapotranspiration and Soil Moisture Accounting (Kohler Method). Friendship International Airport, Baltimore, Maryland. Revised January 4, 1960.

Engelbrecht, Howard H. Manual for Use of IBM 650 Program HHE003 - Kohler Multiple Deficiency Method for Basin Soil Moisture Accounting. Friendship International Airport, Baltimore, Maryland. March 24, 1961.

Engelbrecht, Howard H. Manual for Use of IBM 650 Program HHE003A - Kohler Multiple Deficiency Method for Basin Soil Moisture Accounting (exponent n = 2). Friendship International Airport, Baltimore, Maryland. March 28, 1961.

Engelbrecht, Howard H. Manual for Use of IBM 650 Program HHE004 - Thornthwaite Method for Computing Potential Evapotranspiration and the Water Bal-

ance. 1961 (to be published by the Laboratory of Climatology, Centerton, New Jersey.)

Engelbrecht, Howard H. Computing Soil Moisture Deficiencies According to the Kohler Method. Printed manuscript. U. S. Weather Bureau, Washington, D. C. November 9, 1960.

Engelbrecht, Howard H. Early Winter Ice Conditions on the Upper Chesapeake Bay in 1958-1959. Volume 3, No. 3, pp. 65-68, Mariners Weather Log, May 1959.

Engelbrecht, Howard H. Severe Ice Conditions on Chesapeake Bay During the Winter of 1960-1961. (To be published in the Mariners Weather Log for May 1961.)

MICHIGAN

The Michigan State Climatologist is located in Room 201, 1405 South Harrison Road, East Lansing, Michigan.

13 stations have been completed in the cooperative punched card program; no more are planned at present.

Cooperation in a micro-precipitation project conducted to gain basic information on rainfall variability over small basins, run-off and sedimentation, is being carried on with U. S. Geological Survey, Agricultural Engineering Division at Michigan State and the State Water Resources Commission. Department of Agricultural Engineering, Michigan State University, changes charts on the 22 recording gages involved, and hourly, daily, monthly and excessive precipitation are tabulated in the Weather Bureau Office by State personnel under the supervision of the State Climatologist. This information, together with run-off data furnished by U. S. Geological Survey and sedimentation data furnished by Agricultural Engineering, is used for further studies in writing papers such as "Hydrologic Studies of Small Watersheds in Agricultural Areas of Southern Michigan, "Preliminary Report of Excessive Precipitation over Sloan Creek, a small Watershed," and "Variation in Summertime Rainfall in South-Central Michigan." The field aide (HC) calibrates the gages annually. Half of these gages were furnished by the Weather Bureau; the other half by the State of Michigan.

Climatographies - A total of twenty-six Climatographies have now been published for Michigan. Consumers Power Company has been very cooperative in this project for points in the Lower Peninsula, the area in which they furnish power and gas, and Michigan Weather Service funds are now being used to complete Climatographies at other points in northern Lower Michigan and the Upper Peninsula. Additional Climatographies will be completed during this next year as it has been found that this one sheet publication is the single most useful publication which we have to furnish in answering requests for climate information by both industry and individuals. Consumers Power Company in preparing brochures for use by industries considering plant locations at various locations in Michigan, makes use of these Climatographies as part of the brochure.

In the winter of 1960, after a number of meetings between representatives of the Weather Bureau, United States Geological Survey and the Detroit Metropolitan Area Regional Planning Commission; the Michigan Weather Service, took over the processing of recording rain gage records from approximately forty gages owned and operated by various city and county units of government in the Detroit Metropolitan Area. They have set up an annual budget of $6,000 to pay for tabulation of the data and inspections of the stations along with other expenses. Supervision is furnished by the State Climatologist and data are put on punch cards with monthly publications prepared directly from these punch cards at the University I.B.M. center. Special storms are analyzed. Participation in this program was authorized by the C.O. and it is believed the Weather Bureau will benefit by having the records, from a network covering such an area, and also that the Detroit Metropolitan Area will benefit by having the records analyzed on a uniform basis and by special storms studies from which they can gain information for storm sewer, expressway drainage, bridge and culvert design etc.

Liaison is maintained with the Soil Conservation Service, Office of the State Conservationist and one county climatic summary has been prepared in cooperation with the Soil Conservation Service. Two more are planned for this year.

The State Climatologist is Director of the Michigan Weather Service, a state government department.

The State Climatologist is chairman of the Precipitation Committee appointed by the Detroit Metropolitan Area Planning Commission to study precipitation and run-off in that area.

The State Climatologist is also liaison official for Lake Survey and Army Engineers in a project to gain additional information on precipitation over Lake Michigan. In this project, six storage gages, with windshields, were placed on small, uninhabited islands in northern Lake Michigan to determine if precipitation is the same as over land areas. Since records showed variations in precipitation, 5-digit dial anemometers were installed at three of the gages to determine difference in wind velocities over the gages. Also on Ile Aux Galets, a barren island, the regular storage gage and anemometer has been supplemented with an 8" gage in a pit surrounded with a picket fence for windbreak. A second anemometer is installed beside the 8" gage. The catch of the two gages will be compared.

Current programs:

93 years of East Lansing weather records are being studied to determine probability of having one, two, three or more consecutive days without rain given the condition of rain or no rain today. Also tests are being made for weather singularities. A paper on this subject will be written soon.

A paper has been written by W. D. Baten, Agricultural Experiment Station, Michigan State University, and the state climatologist on "Comparing Weather Data at Two Locations by Use of a Discriminate Function." This is currently being revised for submission to the Office of Climatology for publication approval.

Frost probabilities and standard deviations are being studied with the idea of using a common standard deviation for the state for the spring and one for the fall.

Papers written since January 1, 1954 include:

Eichmeier, A. H. Is our Climate Changing? Michigan Farmer Bi-Weekly, June 1954.

Eichmeier, A. H. and Baten, W.D. Is Michigan Getting Warmer? Quarterly Bulletin, Michigan State University, Article 39-12, August 1956.

Eichmeier, A. H. and Baten, W. D. Corn Weather - Michigan & Iowa. Quarterly Bulletin, Michigan State University, Article 40-40, November 1957.

Eichmeier, A. H. and Baten, W. D. A summary of Weather Conditions at South Haven, Michigan. Special Bulletin, Michigan State University, Agricultural Experiment Station, January 1955.

Eichmeier, A. H. and Baten, W. D. A Comparison of Weather Conditions at Monroe, East Lansing and South Haven, Michigan. Special Bulletin, Michigan State University, Agricultural Experiment Station, March 1958.

Eichmeier, A. H. Michigan As a Corn State. Michigan Farmer Bi-Weekly, October 1957.

Eichmeier, A. H.; Ash, A. D.; Kidder, E. H.; Granger, D. W.; and others. Hydrologic Studies of Small Watersheds in Agricultural Areas of Southern Michigan, report No. 1. Water Resources Commission-Michigan, June 1958.

Eichmeier, A. H. and Baten, W. D. A Summary of Weather Conditions at the Upper Peninsula Experiment Station, Chatham, Michigan. Special Bulletin, Michigan State University, Agricultural Experiment Station, December 1955.

Eichmeier, A. H. Weather and Maple Syrup. National Weekly Weather and Crop Bulletin, January 17, 1955.

Eichmeier, A. H.; Wheaton, R. Z. and Kidder, E. H. Variation in Summertime Rainfall in south Central Michigan. Quarterly Bulletin, Michigan State University. Article 41-93, May 1959.

Eichmeier, A. H.; Wheaton, R. Z. and Kidder, E. H. Preliminary Report of Excessive Precipitation Over Sloan Creek Basin, a Small Watershed. Quarterly Bulletin, Michigan State University, article 41-94, May 1959.

Eichmeier, A. H. and Wheaton, R. Z. Hydrologic Studies of Small Watersheds in Agricultural Areas of Southern Michigan. Report No. 2, August 1960.

Eichmeier, A. H. and Baten, W. D. Rainfall Probabilities During the Crop Season in Southern Lower Michigan. Quarterly Bulletin, Michigan State University. Article 43-41, November 1960.

MINNESOTA

The State Climatologist for Minnesota is located on the 6th floor of the Federal Building and U. S. Court House, 110 South Fourth Street, Minneapolis 1, Minnesota.

The Weather Bureau-University of Minnesota punch card program that originated on the Main Campus was reactivated at the Institute of Agriculture, University of Minnesota, St. Paul Campus late in 1958 under the supervision of the Director, Agricultural Experiment Station.

An agricultural climatology committee was appointed by the Director with the Assistant Director of the Agricultural Station as the chairman. Other members of this committee are the University's designee to NC-26, Soils Department, Agricultural Engineering, the Station's Statistician, other interested departments on the St. Paul Campus and the Weather Bureau State Climatologist.

The Agri-Clim Committee is proposing establishment of weather stations at their eight experiment stations with instrumentation similar to that outlined in the North Central Regional Publication No. 97 dated June 1959. The two most complete stations are the St. Paul Campus, Department of Soils Field Site and the new Lamberton SW Experiment Station in southwest Minnesota. Official observations began at both locations on October 1, 1960. Lamberton evaporation data and St. Paul soil temperatures will be published in the Minnesota CD effective January 1, 1961.

The Institute of Agriculture accepted NWRC's offer of Minnesota surplus 1009 cards for the period 1948 through 1957, approximately 960,000 Daily 1009 cards. They were catalogued into the Statistician's punch card library in May 1960.

The station's statistician is currently punching Minnesota data for the NC-26 temperature study.

Before, during, and after the 1959 and 1960 growing season the Soils Department computed soil moisture reserve and evapotranspiration at selected locations throughout the state. Weather Bureau substation observations were used as basic data for the computations. The results of the combined effort were disseminated to the county agents and farmers through the Institutes' Information Service. Soil moisture samples and evapotranspiration computations will be continued during the 1961 season.

A freeze data study is in process with Dr. Donald Baker, Soils Department. Computations have been completed for 75 climatological stations throughout the state. As soon as the narrative is written and approved the University will print it as a bulletin.

Dr. Donald Baker, Soils Department, has prepared material for 3 credit hour course to be offered during spring quarter 1961 titled Micro-Climatology (Soils). Assistance was given as to reference books and data to be included.

Cooperation is continuing with numerous state and federal agencies as it has in past reports. Additional cooperation is, or was, in progress with the following. Weather Bureau first order and/or substation data will be used in writing up the research with technical guidance from this office as requested.

Metropolitan Mosquito Control District, Minneapolis - began May 7, 1959.
U. S. Department of Agriculture - Soil Conservation Service.
Calculation of Temperature Humidity Index, average THI and monthly distribution of THI for 20 year period for 5 months May-September, 1940-1959 for Minneapolis with Northern States Power Company, Systems Operations, Minneapolis. Completed December 28, 1959.
Asthma Study - University of Minnesota, School of Public Health. Five year study, January 1, 1960.
Minnesota Highway Department-U. S. Geological Survey Runoff Culvert Design Project, 1960.
Minnesota State Department of Education, Adult Education Civil Defense Program. A 32-frame colored filmstrip "Disaster Preparedness" describing natural disasters in Minnesota, November 1960.
Minnesota Highway Department - Salt-sand Combination, Road Sanding Project under different temperature conditions., December 1960.
U. S. Department of Agriculture, Soil Conservation Service - Soil Survey Reports. Initial contact December 1960 for Waseca County.

Papers, weather sections and/or formats written since January 1954:

Strub, J. H. Jr. - Disastrous Tornadoes Can Occur in Minnesota. Minnesota Municipalities, Volume XVIV, No. 4, April 1959.

Strub, J. H. Jr. - Hydrologic Atlas of Minnesota. Bulletin No. 11 Division of Waters, Minnesota Conservation Department, St. Paul, Minnesota, April 1959.

Bouslough, Vinton R. and Strub, J. H. Jr. - Coldest Area in Minnesota. Mimeographed Paper, WBO, Minneapolis, December 1959.

Strub, J. H. Jr. - Minnesota Snow Facts. Mimeographed paper, WBO, Minneapolis, Minnesota, October 1960.

Strub, J. H. Jr. - An Appraisal of Air Pollution in Minnesota. Minnesota Department of Health, University Campus, Minneapolis 14, Minnesota, January 1961.

MISSOURI

The office of Missouri State Climatologist is located in Room 201, Post Office Building, 6th & Cherry Street, Columbia, Mo.

Cooperative punching of cards at the University of Missouri has been completed for several years. Major efforts are now directed toward encouraging the use of data in this form. An electronic computer has been installed at the University and several major projects are underway, using this facility and the various punched card decks containing weather data. These have included com-

putation of 55 years of evapotranspiration data using Columbia, Missouri records for a Master's thesis by a graduate student in Agriculture, and further computations of grain drying data, using 25 years of hourly data for Columbia, Missouri and development of a method of computation of wet-bulb data given dry-bulb and dew point data. Also underway is a computation of probabilities of runs of dry days using a mathematical model developed by S/C, Missouri, which takes into account the characteristics of several soil types and various lengths of work time. A research bulletin describing this project and giving the probabilities of completion of outdoor work in Missouri will be published later this year.

The State Climatologist has had an appointment as Research Associate in the Soils Department of the University of Missouri for five years. The Agricultural Economics Department of the University of Missouri has established a weather project, "The Effect of Climate on Resource Use and Enterprise Combinations on Missouri Farms." The State Climatologist has taken an active part in this project. A paper entitled, "Economic Analyses Involving Random Weather Inputs," by J. P. Doll and J. D. McQuigg has been submitted for publication in the Journal of Farm Economics. A paper entitled, "Climate and Equity Farm Financing," by J. D. McQuigg is almost ready for submission for presentation at the summer meeting of the Farm Economics Association.

Stories have been issued through the facilities of the Extension Service during periods of critical weather. These have been concerned with drought, excessive rain or snow, tornadoes, freezes, etc., and have included the climatological expectancies for future periods.

Papers written since January 1, 1954 include:

McQuigg, J. D. Solar Energy. Research Bulletin 671, University of Missouri.

McQuigg, J. D. Precipitation in Missouri. Weekly Weather and Crop Bulletin, National Summary, Vol. XLIV, No. 39, September 30, 1957.

McQuigg, J. D. A Simple Index of Drought Conditions. Weatherwise, 7: No. 3, pages 64-67, June 1954.

McQuigg, J. D. Tornadoes in Missouri-1957. (Mimeographed).

McQuigg, J. D. Will This Be a Dry Winter in Missouri? October 1956. (Mimeographed).

McQuigg, J. D. Freeze Data. February 1957. (Mimeographed).

McQuigg, J. D. The Weather Bureau State Climatologist and his Service to Agriculture. Paper presented at Agricultural Meteorology Conference, Kansas City, Mo., 1960.

McQuigg, J. D. and Doll, J. P. Management Decisions When Weather is an Economic Factor. Paper presented at Third Conference on Applied Meteorology, April 1960, Santa Barbara, California.

McQuigg, J. D. Economic Analysis of Weather Inputs. M.S. Thesis, University of Missouri, 1960. To be expanded and published as a Research Bulletin by the University of Missouri in 1961.

Brooker, D. B. and McQuigg, J. D. Analysis of Weather Data Pertinent to Grain Drying. Transactions of the American Society of Agricultural Engineers, Vol. 3, No. 2, 1960.

McQuigg, J. D. Climatology section of a Report on an Industrial Survey for the Mid-Missouri Development Council, published by the University of Missouri Industrial Engineering Department, February 1961.

MONTANA

The State Climatologist for Montana is located at the Weather Bureau Airport Station in Helena, Montana.

The cooperative card punching project with Montana State College has been in operation since February 27, 1952 -- a total of nearly nine years. Records for 50 stations have been punched, and duplicate cards have been furnished in every case to the National Weather Records Center representing 2,100 station-years of observations or nearly 800,000 cards. Duplicate cards through 1957 have been microfilmed at the NWRC, and the extra decks have been returned to Montana State College for future analysis work, and are now stored there. As a part of the project, the Montana State Climatologist has started a program for estimating missing data for stations with occasional missing records for periods of from a day or two to a month. This will prevent many difficulties during subsequent machine analyses.

Also the College at Bozeman has conducted an 11-state phenological survey for three years -- a survey that started with Montana alone in 1956, and expanded to 11 states in 1957. The 1961 survey will be the fifth for the 11-state area. Initial counsel, coordination and advice originated with the Montana State Climatologist; those functions are now handled by the Western Area Climatologist in view of the area involved.

Considerable help has been given Montana Experiment Station staff members in planning and operating special livestock and crop studies, involving such things as range precipitation and forage response, livestock behavior under varying weather conditions, soil moisture and temperature measurements, portable weather stations, and choice of additional instrumentation for such things as solar radiation, evaporation, transpiration, etc.

Climate sections for Water Resources Surveys, by counties, have been prepared on a more or less continuing basis. In addition to the 22 counties covered through 1958, such summaries have been written for the State Engineer's office for nine more counties during the last two years. Further, far more extensive summaries, for SCS soil survey reports by counties, were written during 1959 and 1960 for Judith Basin and Yellowstone Counties, for eventual SCS publication.

A total of nine communities are now covered by local climatological summaries prepared in cooperation with local Chambers of Commerce or service groups, and an extensive summary for Glacier National Park, involving records from several stations, is in course of preparation.

The active cooperation between the U.S. Weather Bureau, U.S. Geological Survey and the National Park Service in detailed studies of climate and related phases in Glacier National Park continues. A professional paper covering all work to date is in process of organization, and the State Climatologist's part of this paper (preliminary draft) has already been sent to the USGS coordinator for review. Annually, yearly data are furnished both NPS and USGS for annual glacier study reports.

Beyond the soil temperature and moisture measurements obtained for several years from the SCS at Bozeman for the Agriculture College station site, the college has been encouraged to install equipment of this type at experiment station sites across Montana, data to be processed and published by the Weather Bureau. The first of these new installations are expected to provide data in 1961 from Moccasin, Huntley and Bozeman 6W Experiment Farm, with others to follow.

Routinely, about 80 preliminary precipitation amounts are furnished each month November-June, incl., as early as possible each month, to Water Supply Forecast Units in Kansas City, Missouri and Portland, Oregon. Other routines involve the preparation of running precipitatinn accumulations, both actual and normal, on both weekly and monthly bases for publication in the "Montana Weekly Crop, Livestock, and Weather Bulletin" of the AMS. Each week a written text as well is provided for the bulletin, containing two or more paragraphs on the week's weather phases of particular interest to agriculture. Special issues of this bulletin from time to time contain seasonal weather summaries, freeze studies, water supply forecasts, etc.

Papers written between January 1, 1954 and January 1958 include:

Dightman, R. A. Grinnell Glacier Studies, A Progress Report as Related to Climate. Monthly Weather Review, September 1956.

Dightman, R. A. Precipitation and Production of Wheat in Montana. National Weekly Weather and Crop Bulletin, May 14, 1956.

Dightman, R. A. New Concepts in Climatology. Presented at Northwest Scientific Association, Missoula, Montana, December 1954.

Dightman, R. A. Unusual Freeze, June 25, 1958, Northwestern Plains. Unpublished.

Dightman, R. A. Our Rainfall is Limited but Well-Timed. Montana Farmer-Stockman, April 1, 1956, page 9.

Dightman, R. A. What is Happening to Montana's Climate? Montana Farmer-Stockman, February 15, 1956.

In addition to writing the nine county summaries (Powder River, Cascade, Missoula, Carter, Fallon, Wibaux, Granite, Powell, and Ravalli Counties) for the State Engineer, and the two (Judith Basin and Yellowstone) for the Soil Conservation Survey's soil survey reports, the following have been written since January 1, 1958:

Dightman, R. A. An Application of Climatology to Alfalfa Harvesting. National Weekly Weather & Crop Bulletin, July 13, 1959.

Dightman, R. A. Altitude Effect on Heating or Cooling Capacity of Air. National Weekly Weather & Crop Bulletin, Sept. 28, 1959.

Dightman, R. A. Comparison of Evaporation from Weather Bureau Class A and Bureau of Plant Industry (BPI) Sunken Pans, Fort Assinniboine, Montana. Monthly Weather Review, March 1960.

Dightman, R. A. Is November's Weather an Indicator? Montana Farmer-Stockman, January 1, 1960.

Dightman, R. A. Whence the Weather Bureau? Historical article for Montana Stockgrower, March 1960.

NEBRASKA

The office of the State Climatologist is located on the 5th floor of Nebraska Hall, University of Nebraska, 901 North 17th Street, Lincoln 8, Nebraska.

Complete records from 23 stations in Nebraska have been placed on cards through the cooperative card punching program. These are on file at the University of Nebraska. Cards containing daily weather records for 39 additional stations for the period 1948-1957 have been added to the local files.

Liaison is maintained with the State Soil Scientist, Soil Conservation Service, U. S. Department of Agriculture. County Climatic Summaries for SCS Soil Survey Reports have been written for the following counties: Gage, Washington, Saunders, Scottsbluff, Dundy, Hooker, and Red Willow.

The probabilities of occurrence of freezing temperatures at selected stations have been computed. The study is being expanded to cover additional sections of the state. It is expected that this information, when completed, will be published in bulletin form in cooperation with the Agricultural Experiment Station, University of Nebraska. A similar publication on the probabilities of receiving amounts of precipitation in excess of selected values is anticipated.

Assistance has been supplied in the editing of temperature records for the eleven Nebraska stations selected to be used in the NC-26 study on temperature distribution.

Climatic information and its interpretation has been supplied to consulting firms and to local Chambers of Commerce in connection with industrial surveys

being conducted across the state.

The State Climatologist serves as the Weather Bureau State Civil Defense liaison official. There is extensive cooperation with the OCDM and active participation is taken in Civil Defense exercises.

Consultation service and data as required are provided to the various departments of the University of Nebraska. Assistance is given to graduate students whose research problems involve climatic conditions. The State Climatologist is an instructor of meteorology in the Geography Department of the University of Nebraska.

Substation summaries for a number of cities in Nebraska have been and are being prepared. These are published in cooperation with the local Chambers of Commerce. More are anticipated.

Information is supplied for the climatic section of the "Nebraska Blue Book", a biennial publication by the Nebraska Legislative Council.

Climatic conditions are furnished to the Nebraska State Highway Department for investigation into their effect upon the strength of cement products being manufactured in Lincoln.

The State Climatologist is a member of the Soil and Water Research Sub-Committee of the Nebraska Advisory Flood Control Committee.

NEW JERSEY

The office of the New Jersey Climatologist is located in Room 506, Federal Office Building (Main Post Office), 402 East State Street, Trenton, New Jersey.

A cooperative punched card program with Rutgers, the State University, is well under way. Punching of ten stations was completed by the National Weather Records Center and the checking and interpolating of missing data have been completed. Work has been carried on with members of the meteorology and chemical engineering departments at Rutgers on air pollution studies. Further work has been undertaken in the field of air pollution with personnel of the Air Sanitation Program of the New Jersey Department of Health, and with the Board of Health of the City of Trenton.

A snowfall probability threshold study has been prepared for newspapers; a freeze probability study for the State College of Agriculture; soil-moisture and evapotranspiration studies made for four locations in cooperation with the agricultural college; also, a drought study of coastal and southern New Jersey. Cooperation exists in a drainage study of the "Jersey Meadows" with the Passaic Valley Citizens Planning Association and a Holland firm, the Netherlands Engineering Consultants. A study of prolonged rainy periods without rain, was made for central New Jersey.

The New Jersey Climatologist is a staff member of the State Civil Defense

organization. He has met with the committee on "National Inventory of Soil and Water Conservation Needs." He has assisted in a water resources survey of the Somerset County Planning Board; in a county soil survey made by the Mercer County unit of the Soil Conservation Service; and in the water studies of the Stony Brook-Millstone Watershed group. He serves as a consultant to the conservation division of the national headquarters of the Boy Scouts of America. He has lectured on climatology to student groups from Trenton State College, and to a seminar at Union Junior College in Cranford.

Papers written since January 1, 1954 include:

Dunlap, D. V. Rainfall in New Jersey, January-July 1958. National Weekly Weather and Crop Bulletin, August 11, 1958.

Dunlap, D. V. Chances of Spring Frost. Mercer County Soil Conservation District Newsletter, May 1960.

Dunlap, D. V. Likelihood of Autumn Frost. Mercer County Soil Conservation District Newsletter, September 1960.

Dunlap, D. V. Snowfall in Mercer County. Mercer County Soil Conservation District Newsletter, December 1960.

NEW MEXICO

The State Climatologist for New Mexico is located in the Airlines Terminal Building, Municipal Airport, Albuquerque, New Mexico.

The full period of record made at five climatological substations in eastern New Mexico has been placed on punch cards at the State University in connection with the Great Plains program. Punch cards containing climatological data recently made surplus at National Weather Records Center have been transferred to the University of New Mexico in Albuquerque where they will be used in research projects.

In cooperation with the University of New Mexico Bureau of Business Research, data have been compiled and copy prepared for climatological summaries for 35 cities in New Mexico including at least one city in each county. Five of these are places where earlier summaries are to be updated. Formats for the printer are being typed and summaries should be in print by May 1, 1961.

A climatological summary for Roosevelt county has been prepared for inclusion in the County Soil Survey reports being prepared by the Soil Conservation Service and data are being compiled for the Torrance county summary. Other cooperation with the SCS includes consultation in connection with the National Inventory of Soil and Water Conservation, in a study on effective precipitation in relation to crop production, and in furnishing precipitation data for their snow survey program.

Twelve Wind Summary bulletins have been published for New Mexico stations showing wind roses and detailed wind data for these locations.

A thorough review and classification of weather for a 30-day period covering the past 20 years was prepared for the New Mexico State Fair Board to enable them to select the most desirable week between mid-September and mid-October for scheduling the State Fair.

A detailed tabulation of all blowing dust in the local area covering the period 1945 to date is maintained. Classification of storms as to severity and data on mean and extreme duration of these storms is used in answering inquiries where dust is a health or industrial problem.

Climatological information and suggestions on instrumentation have been furnished the U. S. Forest Service for use in their research program on soil moisture, evapotranspiration and range rehabilitation. A climatological summary has been prepared for a Soil Survey Bulletin to be issued jointly by the Forest Service and the Soil Conservation Service.

Considerable assistance and advice was furnished the State Engineer's Office in an extensive tabulation of climatological data for the State. These data were published in State Technical Bulletins Nos. 5 and 6.

Average temperature and precipitation data together with various extreme values for all substations in the State are entered on cards in a visible card file. Various national and world weather records are also entered on these cards from many sources. The file is used as a ready reference in answering inquiries.

Papers written since January 1, 1954, include:

Von Eschen, G. F. Drought in New Mexico. New Mexico Stockman, February 1957.

Von Eschen, G. F. Climatic Trends in New Mexico. Weatherwise, December 1958.

Von Eschen, G. F. Nighttime Temperature Rises in Mountain Canyons. Monthly Weather Review, February 1960.

Von Eschen, G. F. Dust Storms in Albuquerque, New Mexico, Mimeographed.

NEW YORK

The New York State Climatologist is located at 516 Federal Building, State and Broadway Streets, Albany, New York.

There has been extensive cooperation in an advisory capacity and in the furnishing of data for the following projects:

1. With New York State Department of Welfare in a study of statewide heating degree days as a guide for allocation of welfare fuel allotments.

2. With New York State Public Service Commission for degree day data

and soil moisture.

3. New York State Building Code revisions.

4. New York State Department of Health - studies on water pollution of the Great Lakes.

5. New York State Commerce Department - skiing and winter sports weather.

6. With Robert Muller and Dr. Carter, Syracuse University, on "Great Lakes Snows."

7. With New York State agencies and private industry on weather conditions in areas contemplated for installation of atomic reactors.

8. Bureau of Public Roads in connection with extensive highway drainage problems.

9. With the U. S. Geological Survey monthly on an early report of weather conditions, statewide, for release in their Monthly National Report.

10. With the State Legislative Committee on Water Conservation Needs - on Committee for Pilot Study of Mohawk Drainage Basin.

11. With the State Health Department in the matter of air pollution studies locally and throughout the State.

12. Cooperation with the State Department of Public Works in a research project into freezing and thawing conditions on highway surfaces.

13. Cooperation with the Geneva Agricultural Experiment Station in developing the Geneva Bench Mark station.

14. Close cooperation with the Agricultural and Meteorological Departments of Cornell University in working out NE-35 projects and other proposed studies for New York State. Currently under consideration are a study of hay-drying weather and a snowfall study.

15. Cooperation with various communities in the State in tabulating and publishing some five substation summaries.

Albany punched cards were checked for use in the NE-35 program by Cornell University.

The State Climatologist's office has cooperated with the group interested in Soil and Water Conservation Needs and with the Soil Conservation Service in operating small watershed projects. Stewart's disease charts have been prepared for Cornell. A file of information on tornadoes in the State has been completed and one on hurricanes is under way.

Papers written since January 1, 1954 include:

Johnson, E. C. and Frederick, R. H. The 1957 Drought in New York State. Mimeo.

Frederick, R. H. Statistical Wind Analysis for Albany, N. Y. Mimeo.

Frederick, R. H., Johnson, E. C., MacDonald, H. A. Spring and Fall Freezing Temperatures in New York State, Cornell Misc. Bulletin 33.

Albany Weather Bureau Staff. New York State Weather Conservationist 101. 101 11 No. 5 April-May 1957.

NORTH CAROLINA

The North Carolina State Climatologist is located in the Weather Bureau Building, Raleigh-Durham Airport.

The State Climatologist serves as member of the joint Weather Bureau-North Carolina State College Committee for Climatology. Member State Radiological and Fallout Committee. Consultant to the following:

a. North Carolina Division of Commerce and Industry, Department of Conservation and Development.

b. North Carolina offices of U. S. Department of Agriculture, Soil Conservation Service, Agricultural Research Service, and Agricultural Marketing Service.

c. The Research Triangle.

d. North Carolina Committee on Hurricane Rehabilitation.

e. North Carolina Department of Water Resources.

f. North Carolina State Board of Health.

g. North Carolina Forestry Foundation.

h. U. S. Army Corps of Engineers, Norfolk Office.

i. U. S. Geological Survey, Raleigh Office.

j. Various departments of University of North Carolina, North Carolina State College, and Duke University.

Monthly and annual stories on state and local weather are regularly prepared for publication in local newspapers.

Annual reviews of the preceding year's weather are prepared for Associated Press.

Assistance was given Soil Conservation Service in the preparation of the Yadkin County Soil Survey. A similar survey is proposed for Iredell County; the State Climatologist will prepare the section on Climate.

Listings of North Carolina hurricanes and tornadoes are in progress, with brief accounts of individual storms when available.

Lectures on Climatology and Meteorology are occasionally given to classes of North Carolina State College and University of North Carolina, and to personnel of the local offices of Soil Conservation Service, Agricultural Research Service, and Agricultural Marketing Service.

Plans are being made for a program of research in climatological support for the forecast program of the Raleigh Office. The help of interested staff members is being enlisted.

Papers written since January 1, 1954 include:

Carney, C. B.; assisted by van Bavel, C.H.M. and Hardy, A. V. Weather and Climate in North Carolina. Bulletin 396, Agricultural Experiment Station, North Carolina State College. Published October 1955, Reprinted October 1958.

Carney, C. B. Rainfall and Evapotranspiration at Selected Localities in North Carolina. Mimeographed by North Carolina Extension Service for distribution to farmers and industry.

Carney, C. B. and Hardy, A. V. A Comparative Drought Index. Unpublished.

Carney, C. B. North Carolina Rainfall. Included in Report of N. C. Board of Water Commissioners, October 1956.

Carney, C. B. Tornadoes. Feature article, News and Observer, March 6, 1955.

Carney, C. B. Thunderstorms. Feature article, News and Observer, September 4, 1955.

Carney, C. B. Spring Weather. Feature article, News and Observer, March 18, 1956.

Hardy, A. V. Drought in North Carolina. N. C. Agricultural Statistics, 1954.

Hardy, A. V. Hail Damage in North Carolina. N. C. Agricultural Statistics, 1956.

Hardy, A. V. Thunderstorms in North Carolina. N. C. Agricultural Statistics, 1958.

Hardy, A. V. Index of Snowstorms in North Carolina. Unpublished.

Carney, C. B. The Climate of Piedmont North Carolina. Feature Article, Charlotte Observer, February 4, 1959.

Carney, C. B., and Hardy, A. V. Cleaner Air for North Carolina, Pages 11-15 (section on Meteorology), North Carolina State Board of Health, September 1959.

Hardy, A. V. Hurricane Donna in North Carolina. Weatherwise, October 1960.

NORTH DAKOTA

The State Climatologist for North Dakota is located at the Weather Bureau Airport Station, Bismarck, N. Dakota.

At Bismarck, the Meteorologist in Charge devotes only a portion of time to the position of State Climatologist. Because of overlapping functions, it is difficult at times to delineate whether one is acting as a Meteorologist in Charge or in the capacity of a Climatologist. The following activities are those which would normally be considered those of a Climatologist's position.

Serves on a committee with members of state and federal agencies to study the shelterbelt problems of the state of North Dakota.

Serves as both meteorological and climatological advisor to the staff of Agricultural Research Service located at the Northern Great Plains Field Station at Mandan.

Serves as consultant to various members of the staff of the School of Agriculture at the State University of North Dakota.

On several occasions has advised members concerning the climatological aspects of proposed research development in Agronomy.

Climatological substation summary for Grand Forks and Dickinson have been completed and published.

A freeze probability study is being undertaken in cooperation with the North Dakota State University and will be published as a research bulletin.

Paper written:

Miller, S. R. Precipitation Probability Study for Des Moines, Iowa. Unpublished.

NORTHERN NEW ENGLAND
(Maine, New Hampshire, Vermont, Massachusetts)

The State Climatologist's office is located in Room 1900, U. S. Post Office and Court House Building, Boston, Mass.

A cooperative project in agricultural climatology (NE-35) is active in all four states. Daily data were checked for errors and missing data interpo-

lated for 30 stations in preparation for processing by electronic computers. Results from these computations are being prepared for publication in regional bulletins. The first scheduled publication will include spring and fall freeze probabilities for various temperature thresholds and the lengths of the various seasons free of the specified temperature. Additional stations were analyzed to aid in location of isograms supplementing NE-35 data.

Colleges and Universities are visited in all four States, especially the State Agricultural Colleges and Experiment stations, including stations and experimental farms located distantly from campuses. Cooperation, advice, help, and stimulation of interest in weather connected problems is provided by personal and other contact. Problems range from the investigation of weather factors in the production of such specialized crops as maple sugar, cranberries, and blueberries to the relation of weather to production and to disease and insect injury of other crops. Help is also given to the several States regarding interpretation and use of NE-35 results, including the publication of various maps, graphs, and bulletins.

Cooperation is active with other Federal, State, and private agencies dealing with forests, soil conservation, wildlife conservation, Civil Defense, etc. The State Climatologist also helps the economic development commissions of each State.

Considerable advice and weather data are furnished many Boston area medical research teams. Recently begun studies include relationship of weather factors to fatal automobile accidents in and near Boston and the relationship of weather to epistaxis. (nosebleed)

Cooperation is continued with the U. S. Air Force research group at Blue Hill concerning the application of radar to severe storm detection and warnings, with special emphasis on tornado and hail occurrences.

The State Climatologist is a member of the State Committees for Massachusetts and New Hampshire for the National Inventory of Soil and Water Conservation needs. He also serves on a committee of the American Meteorological Society.

A study of average and extreme frequencies of various daily snowfall amounts by months and seasons is in progress. This is based upon selected stations with good snowfall records.

Papers written since January 1, 1954 include:

Lautzenheiser, R. E. The Storm and Tornadoes of March 3, 1955. Monthly Weather Review, Vol. 83, No. 4, pages 94 and 98, April 1955.

Lautzenheiser, R. E. Weatherman Looks at Boston's Weather (A Comparison of Climate, Boston and Chicago). Boston Globe, page 8-A, Sunday, March 24, 1957.

Lautzenheiser, R. E. Late Season Freeze Hits New England. Weekly Weather and Crop Bulletin, National Summary, pages 1-2, May 28, 1956.

Lautzenheiser, R. E. The January Thaw. Weekly Weather and Crop Bulletin, National Summary, February 11, 1957.

Sable, Edward. Insured Rainfall. The Standard, September 12, 1958.

Lautzenheiser, R. E. Tinted Rain at Dunstable, Mass., June 6, 1959 (Weather Note) Monthly Weather Review, Vol. 87, page 238.

Lautzenheiser, R. E., and Fay, Richard. Heavy Rainfall at Island Falls, Maine. Not yet published.

Lautzenheiser, R. E. Are Dust-Devils a Forecast Problem? June 19, 1956. Mimeographed.

Lautzenheiser, R. E. Heating Degree Days. September 22, 1960, Mimeographed.

Sable, Edward. Dates of Damaging Storms in or near Boston from January 1950 through May 1958. June 4, 1958. Mimeographed.

Sable, Edward. Tornado Occurrences in Maine, New Hampshire, Vermont, and Massachusetts during period January 1950 through May 1958. June, 1958. Mimeographed.

OHIO

The Ohio State Climatologist is located in room 253, New Post Office Building, 85 Marconi Boulevard, Columbus 16, Ohio.

What is considered to be the first stage of the cooperative punch card program was completed by 1958 with the punching of records for 8 cooperative substations. The prime cooperator was the Ohio Agricultural Experiment Station, though part of the work was done by the Dept. of Agricultural Economics of Ohio State University. With its completion the project has become temporarily inactive, although attempts are being made by the Ohio Department of Natural Resources, Water Division to secure funds for a continuation of the work. The eventual goal is for better than 50 additional stations.

Prior to the inauguration of a program of computing the Temperature-Humidity-Index at first order stations, a preliminary study of Cooling Degree Days and "Discomfort Index" was made, and collection of energy consumption data for large air conditioning installations was attempted. Due mainly to the large volume of hand calculation required, and the development of a program for machine processing of the data, this study has become inactive. If and when a sufficient volume of processed data for Ohio stations becomes available, however, it is planned to resume the work. The duration of THI above specific threshold values on Cooling Degree-Day accumulations could well offer an understandable way of classifying and comparing climates over the state.

A comprehensive freeze probability study has been completed and published as Special Circular #94 by the Ohio Agr. Experiment Station. This circular has been well received by users.

A rather ambitious program of observations has been maintained since early 1957 with the cooperation of Ohio State Agronomy and Physics Departments.

This is an agricultural weather station located on University Farm where daily observations of temperature, precipitation, humidity, wind movement at 1 Meter level, evaporation, and soil temperature at 4 depths are made. Soil moisture is being measured to 36" at weekly intervals throughout the year plus special determinations as required by going projects. This plot has been maintained in permanent meadow. In 1960, however, a portion was planted to field corn where soil moisture and temperature were routinely measured as well as 14" air temperature and growth rates of corn plants.

During the 1961 growing season a 40' x 40' plot will be set aside for soil temperature and moisture determinations under bare-surface conditions. The object is to determine the moisture extraction pattern by evaporation alone. Similar measurements will be made on an adjacent plot planted to corn.

A program of routine weekly measurement of soil moisture under altafescue plots has been in operation since 1957 at the headquarters and 4 outlying farms of the Ohio Agricultural Experiment Station. Resistance meter readings are sent by mail to the State Climatologist for reduction to usable form and addition to the fund of soil moisture statistics for Ohio. Similar moisture records are obtained at University Farm in Columbus and the Agricultural Research Service Station at Coshocton.

In 1960, a special network of 15 soil temperature stations was installed in Ross County. Observers were interested farmers who used inexpensive thermometers to measure 4" soil, and 14" air temperature plus rainfall in fields of corn, oats, and meadow. A smaller number of similar farm observation stations were operated in Seneca County. Parallel observations using similar equipment and recording techniques were also made by Horticulture Dept. people elsewhere in the state. At the end of the season an analysis was made and report presented to cooperating farmers. The object of this program is to acquaint farmers with the behavior and practical importance of soil temperature. The same program will continue in 1961 season.

Length-of-service awards have been made by the State Climatologist to 6 observers with service periods of 25 to 50 years.

The State Climatologist is a cooperating member of the staff at Ohio Agricultural Experiment Station and consults with regular staff members on various subjects involving meteorological factors.

The project which has received more concentrated and long-continued attention has been the study of evapotranspiration and the development of methods for keeping a running account of changes in soil moisture under crops common to Ohio. Several progress reports have been made and 4 of the published articles listed below deal with this subject. While evapotranspiration has been studied extensively in recent years, it has been our aim to develop practical methods of estimating both evapotranspiration and current soil moisture through the use of temperature and rainfall data alone, both of which are universally available. A complete procedure has been developed for the meadow crop, and efforts are now being made to adapt it for use in estimating moisture losses from the corn crop. While this is vastly more complex, progress is being made; and future plans call for adaptations to wheat, oats and

other Ohio crops.

With the assistance of a Student Trainee, a special slide rule has been developed for use in computing evapotranspiration from the meadow crop, and a report has been written describing developmental methods used. This rule utilizes 2 movable slides, and permits ready application of 4 correction factors to an initially-estimated potential evapotranspiration figure. Computation time is greatly reduced.

Future plans call for continued study of agricultural applications of meteorological data, although it is hoped that proportional time expenditures will be gradually reduced in favor of more conventional climatological studies.

Papers published since January 1954 include:

Pierce, L. T. 1959 The Occurrence of Freezing Temperatures in Late Spring and Early Fall - Ohio Agr. Expt. Sta. Special Circular #94.

Pierce, L. T. 1950-1960 Occasional brief articles in "Ohio Farmer Magazine" on timely subjects such as freeze risk, floods, soil temperature work, etc.

Pierce, L. T. 1958 Estimating Seasonal and Short-term Fluctuations in Evapotranspiration from Meadow Crops. Bull. Amer. Met. Soc. vol. 39, no. 2, pp. 73-78.

Pierce, L. T. 1960 A Practical Method of Determining Evapotranspiration From Temperature and Rainfall. Trans. ASAE, vol. 3, no. 1, pp. 77-81, 1960.

Pierce, L. T. 1960 Directions for Estimation of Daily Evapotranspiration and Current Soil Moisture for Meadows in Ohio. Ohio Expt. Sta., Agronomy Dept. series no. 157. (Mimeo.).

Pierce, L. T. 1960 Some Results from Soil Temperature Measurements in Ross County Cornfields During 1960 Growing Season - Mimeograph report.

Pierce, L. T. 1960 Estimating Mean Hourly Temperatures From Long-term Average Maximum and Minimum Temperatures. Unpublished but distributed to Ohio first-order stations.

Pierce, L. T. and Snyder, George H. 1961 Development and Use of Special Slide-rule for Computing Meadow Evapotranspiration. Submitted for W. B. Printed Manuscript.

OKLAHOMA

The State Climatologist for Oklahoma City is located at the Weather Bureau Airport Station, Will Rogers Field, Oklahoma City.

The Oklahoma State University cooperative card punch project has not punched any additional stations since the first 24 were completed in 1957. Data for 4 of these stations were used in a drought probability study in a paper on

the economics of irrigation. In 1960 a summary program was started on the 24 stations. Weekly summary cards will be completed in 1961. A pilot study was completed for Stillwater in 1960. This included a frequency distribution of wet and dry spells. The wet periods are broken down by number of days of .1 inch to an inch and by .25 inch above an inch. The 10 years of excess cards for all stations in Oklahoma released by the National Weather Records Center were added to the University's card library. Continued development of the project seems very likely.

The State Climatologist is a member of the State Committee for the National Inventory of Soil and Water Conservation Needs.

Data were furnished to the Soil Conservation Service for 5 counties for the preparation of the Climatic Section of the County Soil Survey Report. The State Climatologist prepared the Climatic Section for one county in 1961 and 5 more are planned for this year.

Tables of Long Term Means of mean maximum and mean minimum temperatures, and maps of average temperature, precipitation, and spring and fall mean freeze dates were furnished the University of Oklahoma Bureau of Business Research for publication in the Statistical Abstract of Oklahoma.

Revised maps of average annual precipitation and temperature and average dates of spring and fall freeze maps have been mimeographed. A freeze probability study was prepared for Oklahoma City.

Sentient temperature cooling degree hours were computed for Oklahoma City for 1958 and 1959 and furnished to a local power company. It was hoped that a practical application of this approach to the cooling degree day needs would result from this cooperative effort. The Temperature-Humidity-Index method for computing cooling degree days was established by the Weather Bureau about this time and the power company adopted this method as it was quite similar and easily adapted to their backlog of data. Some data on electric power for air conditioning was obtained from the power company and graphical comparisons were made to several cooling degree day data approaches. The power company data seemed rather erratic and correlations were so poor that any planned summarization appeared ill advised and the project was abandoned.

The State Climatologist has cooperated with Oklahoma State University representatives on climatological applications and procedures. One application was the use of summarized upper wind data in relation to the migration of the pink boll worm moth. Another was the use of summarized temperature, wind and humidity data relative to cooling and ventilating an experimental chicken house.

The following paper was written since January 1, 1954:

Lehrer, H. V. Chemical Means for Controlling Evaporation from Open Water Surfaces. National Weekly Weather and Crop Bulletin, Vol. XLV No. 47, November 24, 1958.

OREGON

The Oregon State Climatologist is located in Room 325, Custom House, Portland.

A cooperative project with the Portland office of the Agricultural Marketing Service has been completed through which that office, utilizing facilities of Commodities Stabilization Service, punched approximately 232,600 historical weather records (1928-1948) for 33 Oregon stations on IBM punch cards. It is planned that these will be utilized to develop improved techniques for crop yield forecasts through consideration of early season weather data. The Weather Bureau's file of these cards has been shipped to NWRC.

The State Climatologist has assumed responsibility for preparation of the data to be used in the climatological section of the Soil Conservation Service's "County Soil Survey Reports". Two counties, Marion and Yamhill, are now in progress.

The Fire Weather Unit of the Oregon State Forester's office was assisted in an advisory capacity in the utilization of certain weather data that office has obtained from the lookout stations. These have been prepared by having the observations entered on punch cards with electro-sensitive pencils to permit direct punching of data by machines without further manual operations. Present concern is to use this to determine appropriate boundaries for differentiating between fire districts for forecast purposes; also to prepare certain fire-weather climatic studies to more accurately evaluate the components of the burning index.

The State Climatologist acts in an advisory capacity to various departments at Oregon State College engaged in research in which climatological data are of major significance. This has included:

(1) Assistance in obtaining desired data and making use of it for projects already in progress.
(2) Outlining, at the request of department heads, possible research of general public usefulness. The latter has resulted in the preparation of a Master thesis in the natural resources department in which the dates for various probabilities of last occurrence in spring and first in fall of temperatures of 24°, 28° and 32° for approximately 100 Oregon stations are shown. Similar dates were also computed for a select number of stations for occurrences of 36° and 40°. In addition to appearance as a thesis the Oregon State College Experiment Station is issuing a bulletin of this data. It should be available within the next few weeks.
(3) Suggesting types of instrumentation and exposures for special instrumentation (e.g. - soil temperature set up in accord with WMO standards at Hyslop Agronomy Farm.)

Also the State Climatologist continues to serve as a member of the State Committee on Soil and Water Conservation Needs.

Four additional Substation Climatological Summaries were prepared and printed in cooperation with the Oregon State Department of Planning and Develop-

ment. Three summaries previously issued in cooperation with Chambers of Commerce were revised and brought up to date.

"Oregon Degree Day Data" was prepared and issued by the Weather Bureau as Letter Supplement No. 5920.

Contributions on climatology were provided for use in various information bulletins put out by the State or educational institutions. This has included such items as "Our Climate" pages 48-51 of Agriculture in Oregon, 1960, and "Climate" pages 20-29 of The Oregon Almanac 1961-1962 compiled by the Social Science Department of Portland State College.

The Snow Climate of Oregon: the 10 percentiles of probability are being determined for each item listed below. The latest 30 years of fairly reliable records are being used or, if less than thirty are available, the total number of years. Accepted standard statistical methods are being used in all computations:

(1) Dates of first and last 24-hour snowfall of 1, 4, 8 and 12 inches.
(2) Dates when depths of 2, 6, 10, 12, 18, 24, 36 and 48 inches are first reached in fall and last recorded in spring. (At least 10 occurrences of any depth are required before computation of data for that depth.)
(3) Maximum monthly depths
(4) Maximum seasonal depths
(5) Date of occurrence of maximum depth
(6) Maximum monthly 24, 48 and 72 hour snowfalls.

Computation of Monthly Evaporation Probabilities: This is being done for all Oregon evaporation stations. A normal distribution is being assumed. In most cases the sample of data is not large enough to determine this with too great a certainty but coefficient of skewness computed have not been large and have appeared to be fairly randomly and fairly evenly distributed as to sign.

Study of Oregon's "silver thaws" and Ice Storms generally: ("silver thaws" being considered only as formation of clear ice as against both clear ice and white (frost) ice for all ice storms. Areas and frequencies of occurrence are being delineated. Records being used are all official storm reports of any type available here containing these data for entire period of record (though generally not much available before 1920) and the logs of service interruptions maintained by the Pacific Power and Light and the Portland General Electric Companies for the past 7 years. Official storm reports and Pacific Power and Light records tabulated.

Heat Use-Weather Correlation: oil consumption data from Ione Plaza (a 300 unit modern Portland apartment house) are collected and processed together with daily weather records for eventual correlation between various weather elements and heat usage. Completion of the study is awaiting the collection of some more data of particular types of weather as well as time to carry out the actual correlations.

Papers written since January 1, 1954 include:

Sternes, G. L. Oregon Sunshine. National Weekly Weather and Crop Bulletin. June 22, 1959.

Sternes, G. L. Sunshine and Agriculture. National Weekly Weather and Crop Bulletin, November 10, 1958.

Sternes, G. L. Weather Records in Private Litigation. Issued as Letter Supplement 5711 by the Weather Bureau (also published all or in part by three Bar Journals).

Sternes, G. L. Temperature-Relative Humidity-Mixing Ratio Study, Portland, Oregon. Heating, Piping and Air Conditioning, September 1957.

Sternes, G. L. Climatological Records and Oregon Agriculture. National Weekly Weather and Crop Bulletin, August 20, 1956.

PENNSYLVANIA

The Pennsylvania State Climatologist is located at the Weather Bureau Airport Station, Harrisburg State Airport, New Cumberland, Pa.

A cooperative punch card program has been completed with the Pennsylvania State University and summarizations produced from the daily cards according to the NE-35 outline. Records for 38 stations have been punched for the period 1926-1948. One project in which the cards are useful is the machine preparation of data for Substation Climatological Summaries, 2 of which have been published to date.

In cooperation with the College of Agriculture of the Pennsylvania State University a program has been set up for publishing a series of 8 regional weather summaries for Pennsylvania, the first of which is presently being prepared.

"Late Spring and Early Fall Freezes in Pennsylvania", has been prepared for publication in cooperation with the Agricultural Marketing Service. This study for some 38 stations includes maps of probability of occurrence at the 50% level as well as a probability of occurrence table showing the degree of risk from 10 to 90 percent.

A program has been established for collecting frost depth data annually from all sections of the state through the cooperation of members of the Pennsylvania Cemetery Association. Among the items reported are the average and maximum depth of frost as well as information concerning the snow cover during the winter season. A statewide map of mean depth penetration will be produced from the collected information.

The State Climatologist collaborated in the preparation of a forthcoming report on air pollution problems and conditions in Pennsylvania. This included the preparation of a chapter on "Topography and Climatology as Related to Air Pollution".

Early efforts and more recent discussions with the Pennsylvania Department of Internal Affairs have resulted in the inclusion and expansion of the climatic data section in their annual publication, "Pennsylvania Statistical Abstracts".

Periodic assistance is given to the Agricultural Extension Service of the Pennsylvania State University by supplying temperature data that makes possible a seasonal forecast for the following summer, of the likelihood of outbreaks of Stewart's Disease or bacterial wilt in sweet corn throughout the state.

The State Climatologist is a member of the state committee for the National Inventory of Soil and Water Conservation Needs and has attended several meetings. Discussions have been held with Soil Conservation Service personnel responsible for the supervision of county surveys and data furnished to several county work groups. A weather summary for York County has been prepared and more such summaries are anticipated.

Cooperation is carried on with the state Civil Defense organization, U. S. Geological Survey, Pennsylvania Department of Forests and Waters, Pennsylvania Bureau of Community and Industrial Development, State Chamber of Commerce and the Pennsylvania Vacation and Travel Development Bureau.

The State Climatologist has had contact with a number of industrial and business firms dealing with problems varying from the location of ski resorts to the placement of a nuclear reactor.

Papers written since January 1, 1954 include:

Kauffman, N. M. The 16th National Plowing Contest and Conservation Exposition. National Weekly Weather and Crop Bulletin, August 18, 1958.

PUERTO RICO AND VIRGIN ISLANDS

The office of the Territorial Climatologist is located in downtown San Juan. The address is: U. S. Weather Bureau, Box 5417, Puerto de Tierra Station, San Juan 27, Puerto Rico.

The area of concern to the Territorial Climatologist in San Juan, Puerto Rico covers all the islands of the Caribbean plus portions of the South American countries of French Guiana, British Guiana, Suriname, Venezuela, and Colombia together with all of the Central American nations, Panama and the Canal Zone, Nicaragua, El Salvador, Costa Rica, Honduras, British Honduras, and the Yucatan Peninsula of Mexico. The area of direct responsibility includes Puerto Rico and the Virgin Islands. Sixteen individual meteorological services operate in this area and they produce publications in English, Spanish, French and Dutch.

Publication of the "Climatological Data Bulletin" for this area has been resumed recently. The data for this bulletin are contained on approximately 700 monthly forms, which are routed first through the Office of the Territor-

ial Climatologist for a preliminary quality control check before delivery to the Chattanooga Weather Records Processing Center. This procedure is in contrast to that in the continental United States where all forms go directly to the WRPC.

The Substation Inspector for Puerto Rico and the Virgin Islands operates directly under the supervision of the Territorial Climatologist. Therefore, in this office plans are made for the installation, inspection, relocation, and closure of sub-stations. Also, the forms and envelopes are supplied from this office to the sub-stations.

The "Cooperative Observer" newsletter is issued independently at this office for distribution to the Puerto Rico and Virgin Island observers, and it is printed in Spanish and English.

In Puerto Rico, liaison is maintained with the local representatives of United States agencies; with the Departments of the Commonwealth of Puerto Rico; and with the various agencies of the Virgin Islands Government, some of which are basically Federal and within the scope of the Department of Interior, while others are directly under the local Government.

When the WBO, San Juan was consolidated with the WBAS in 1957, a partial observational program was continued at the same office downtown, which is now used for the climatological work.

Since there is only one First-Order Station in the Puerto Rico-Virgin Island area, arrangements have been made to receive regular hourly observations from two FAA Stations in the Virgin Islands and from the Air Weather Service and Navy Air Stations on Puerto Rico. At the present time monthly summaries of these data are available from the beginning of 1953 for the two Virgin Island Stations, from the beginning of 1956 for Ramey Air Force Base, and from the beginning of 1959 for the Roosevelt Roads Naval Station.

Although Puerto Rico is primarily an agricultural island, its total population of 2,346,000 inhabitants occupy an area of only 3,435 square miles. Therefore, it is important that improved farming methods be developed. In the past, the application of climatological analyses to this problem have been few and there is still much work which must be done.

Although a weekly Weather and Crop bulletin for Puerto Rico has been issued for many years, recent arrangements have made it possible for the Department of Agriculture and Commerce of the Commonwealth of Puerto Rico to assume responsibility for the issuance of this bulletin. The Territorial Climatologist Office continues to furnish the weather summary, a table of temperature data, and a page of temperature and rainfall maps. In addition, beginning recently, it has been possible to furnish data for the Virgin Islands to be included in the National Weekly Weather and Crop Bulletin issued in Washington, D. C.

Active cooperation with the Agricultural Experiment Station of the University of Puerto Rico has been maintained. Recently, a cooperative punch card agreement was negotiated between the Weather Bureau and the Agricultural Ex-

periment Station and it is expected that this will go into active operation in April, 1961.

The Territorial Climatologist has assisted actively in various projects of other agencies of the U.S. Department of Agriculture, such as the Forest Service, the Soil Conservation Service, and the Agricultural Stabilization and Conservation Office. Most of this work is confined to Puerto Rico, since there is not much agricultural enterprise on the Virgin Islands. Working contacts are maintained with many other agricultural agencies, such as the Sugar Producers Association of Puerto Rico, but they are too numerous to mention here.

In recent years, a vigorous campaign to attract industry to Puerto Rico, termed "Operation Bootstrap", has been conducted in order to diversify the economy of the Island. Naturally, in conducting this campaign it has been necessary to assemble a great deal of climatological data, which will answer questions raised by manufacturers of plastic, leather goods, electronic equipment, gasoline and oil products, chemicals, shoes, cigars, needlework, and the like. In addition, engineering firms and architects are interested in climatological data for planning air conditioning installations and housing.

Puerto Rico's attention to tourism has increased greatly in the recent years. Both Puerto Rico and the Virgin Islands offer a climate particularly suitable to vacationing tourists. The Territorial Climatologist has provided a great deal of climatological information to the Departments of Tourism of Puerto Rico and the Virgin Islands and has assisted actively in preparing the brochures and press releases, which they issue in order to attract a greater number of tourists.

A great many potential visitors to this area are interested in the climate as it may affect or improve their health. Also, the Territorial Climatologist is called on by such agencies as the Veterans Administration Hospital, the U. S. Public Health Service, The School of Medicine of the University of Puerto Rico, and the U. S. Army's Tropical Research Medical Laboratory to assist in their studies concerning diseases common to this area.

In 1956 and in 1960, the Territorial Climatologist, acting as the Climatological Representative of the Weather Bureau, attended the two meetings of the Eastern Caribbean Hurricane Committee. The first of these meetings was held in the Dominican Republic and the second in Curacao. Although most of the attention of the representatives attending these meetings was directed toward hurricane forecasting problems, it was possible for the Territorial Climatologist to discuss climatological matters as well.

In addition to the items listed below, a great many mimeographed summaries for many stations in the Virgin Islands and in Puerto Rico are available for distribution.

Papers written since January 1, 1954 include:

Smedley, D. Suggested Methods for Estimating the Monthly Mean Surface Temperatures Anomaly 15 Days in Advance. 1954 unpublished.

Smedley, D. Summary of Rainfall Conditions in Puerto Rico from November 1, 1954 through January 31, 1955. February 1955. Mimeographed for local distribution.

Smedley, D. Drought in Puerto Rico, Climatological Data-Puerto Rico and Virgin Islands. April 1957.

Smedley, D. The Weather of April 1957 in Downtown San Juan. May 1957.

Smedley, D. Drought-Puerto Rico-January through April 1957. Climatological Data-Puerto Rico and Virgin Islands. May 1957. Mimeographed for local distribution.

Smedley, D. Drought in Puerto Rico-January through July 1957. August 1957. Mimeographed for local distribution.

Smedley, D. Floods in Puerto Rico during May 1958. Climatological Data-Puerto Rico and Virgin Islands. May 1958.

Smedley, D. Floods of May 3, 1959 in Northeastern Puerto Rico. Climatological Data-Puerto Rico and Virgin Islands. May 1959.

Smedley, D. Floods in the Virgin Islands and Puerto Rico during May 1960. Climatological Data-Puerto Rico and Virgin Islands. May 1960.

Smedley, D. Effects of Hurricane Donna in Puerto Rico and Virgin Islands. Climatological Data-Puerto Rico and Virgin Islands. September 1960.

Smedley, D. Floods in late November and early December 1960-Puerto Rico and Virgin Islands. Climatological Data-Puerto Rico and Virgin Islands. December 1960.

SOUTH CAROLINA

The State Climatologist for South Carolina is located in the Weather Bureau Airport Station, Columbia Airport, West Columbia, South Carolina.

Nineteen substation summaries were prepared in cooperation with state and local Chambers of Commerce, state and local Planning and Development Boards and other government and private agencies which helped by defraying the cost of printing and sometimes helped in the labor of preparation. These summaries were distributed to all Weather Bureau stations in and around South Carolina, to the National Weather Records Center, to the Office of Climatology, as well as to educational institutions, libraries and state and local agencies. The summaries were prominently featured in brochures designed to attract industry and in other literatures dealing with finance and commerce. The agencies which helped in the issuance of the substation summaries annually receive copies of the processed form WB 1066 (Annual Climatological Summary) to enable them to keep the file of climate data up to date.

Clemson College School of Agriculture and the South Carolina Experiment Station have pooled their efforts with those of the State Climatologist and the

Meteorologist in Charge of the Columbia Weather Bureau Airport Station, in presenting to the varied interests in the state climatic studies which might be of help in the solution of problems containing climate as an element. Many institutions, agencies and individuals were consulted to determine how the studies should be designed for best use. Among those interviewed were heating and air conditioning concerns, farmers, highway and construction engineers, newspapers, radio and television stations and a rather complete assortment of government officials. The studies and publications which have finally emerged represent the result of this survey of the public needs. The information was, therefore, tailored for general use and, insofar as possible, technical complexities were shunned. While the labor involved in developing these studies was considerable, it is considered very worth while, from the State Climatologist's point of view, because the total work-load of the station has been lightened through the decrease of special requests which are laborious to compile, as well as through the ability to furnish copies containing data not normally summarized in regular Weather Bureau publications. A complete list of articles and papers which were approved for editorial release by the Weather Bureau is given at the end of this account; and these studies were given the widest available distribution.

Continuing contacts are being maintained with such organizations as the Soil Conservation Service, the Agricultural Marketing Service (Crop Estimates Division), the State Offices of Agriculture, Education and Planning and Development Board, and The U.S. Geological Survey. These particular agencies often need special analytical material and statistics which require meticulous extraction, research, and calculations. Examples of these are the Soil Survey Climatic Summaries, potential evapotranspiration calculations, crop-weather analyses, river-basin rainfall summaries, climatic material for classrooms, climatic articles for local or state publications and occasionally, special narratives for Climatological Data for South Carolina.

The State Climatologist is a member of the Agricultural Council of South Carolina which meets about six times a year in various parts of the state for discussions and presentations of studies. The membership of the Council comprises important representatives of the agricultural complex of the state.

Papers published since January 1954 include:

Purvis, J.C. Notes on Hurricanes in South Carolina, USWB Manuscript, October, 1955.

Purvis, J.C. Notes on Tornadoes in South Carolina, USWB Manuscript, July 1956.

Kronberg, N. Climatic Chapter, 1957 Yearbook, South Carolina Department of Agriculture, April 1958 and repeated without revision in succeeding year.

Kronberg, N. and Purvis, J.C. Climatic Data for Air Conditioning in South Carolina, mimeographed in October 1957. Was distributed to Weather Bureau and to interested engineering establishments.

Kronberg, N. and Purvis, J.C. Climate of South Carolina, Series 1. General Climate and Tables, 32 pages, published by South Carolina Experiment Sta-

tion, July 1958.

Kronberg, N. and Purvis, J.C. Freeze Analysis for South Carolina. Climate Series No. 2, 56 pages. Published by South Carolina Experiment Station, December 1958.

Purvis, J.C. Weather and Peaches in South Carolina, National Weekly Weather and Crop Bulletin, January 12, 1959.

Kronberg, N. and Purvis, J.C. Climatic Data for Air Conditioning in South Carolina, revised, expanded and brought up to date, Climate Series No. 3, 21 pages, published by South Carolina Experiment Station April 1959.

Kronberg, N. Climate Chapter, pages 18-31, Cotton Fiber and Spinning Test Study published by South Carolina Experiment Station, July 1959.

Purvis, J.C. Winds in the Vicinity of Columbia, S. C., 7 pages, published by The Cleaner Air Committee, Columbia, S. C., August 1959.

Kronberg, N. and Purvis, J.C. Climate and Peach Production in South Carolina. Climatic Series No. 4, 29 pages. Published by the South Carolina Experiment Station, October 1959.

Kronberg, N. Climatic Tables of Soil Survey Reports for Cherokee and Oconee Counties, published by Soil Conservation Service late in 1959.

Kronberg, N. and Purvis, J.C. Text, Climates of the States, South Carolina, Published by Weather Bureau, December 1959.

Purvis, J.C. Winter Temperatures Foretell Cotton Yield in Central South Carolina, 6 pages, paper presented at Richland County Agricultural Meeting. Mimeographed distribution by the Weather Bureau Airport Station, Columbia, S. C., January 1960.

Purvis, J.C. An Experiment in Forecasting Blossoming Dates of Sullivan Elberta Peaches - 9 pages, address to South Carolina Peach Council, mimeographed distribution at WBAS, Columbia, S. C., February 9, 1960.

Kronberg, N. Climate Chapter, pages 22-28, 1959 Yearbook (A practically unchanged repetition of material in 1957 and 1958). Published by South Carolina Department of Agriculture, April 1960.

Kronberg, N. and Purvis, J.C. Weather and Corn Production in South Carolina. Climatic Series No. 5, 25 pages. Published by South Carolina Experiment Station June 1960.

Purvis, J.C. Snowfall in Central South Carolina, 13 pages, mimeographed distribution at WBAS, Columbia, S. C., July 1960.

Kronberg, N. and Purvis, J.C. Distribution of Precipitation in South Carolina, Climatic Series No. 6, 54 pages approved for editorial release by Weather Bureau, has been submitted to the South Carolina Experiment Station

for publication which will be completed about March 1961.

Kronberg, N. Climatic Chapter of Lee County Soil Survey Report, 10 pages. Submitted to Soil Conservation Service after article received approval from Office of Climatology, Jan. 15, 1961; not yet published.

Kronberg, N. and Purvis, J.C. Mean Monthly Temperature Probabilities in South Carolina at Surface and Aloft. About 35 pages, calculations now almost complete, awaits text developments. Will be submitted for editorial release by April 1961.

SOUTH DAKOTA

The South Dakota State Climatologist is located in Room 209, Post Office Building, 4th and Dakota Street, S. Huron, South Dakota.

The cooperative punch card program utilizing the full record of 60 long-term stations and partial records for some 10 additional stations have been continued with State College. Professor Pengra, of the Economics Department, was assisted in the preparation of his publication, "Seasonal Variations of Soil Moisture in South Dakota".

A climate summary has been written for the Soil Conservation Survey County Soil Survey Report for Minnehaha County, South Dakota. Climate summaries in the substation summary program have been compiled and published for the cities of Madison and Redfield, and work is in progress on summaries for Brookings and Pierre.

Cooperative research studies have been undertaken with other agencies as follows:

1. Weather relationships to waterfowl migration in the Northern Great Plains in cooperation with the U.S. Fish and Wildlife Service.

2. Weather factors, such as precipitation, heat unit accumulation, etc. in the performance tests of new varieties of small grains at various field stations in the state in cooperation with the Agronomy Department, South Dakota State College.

Sunshine data have been tabulated for the Agricultural Engineering Department at State College in connection with a project on the collecting and storage of solar heat for indoor heating.

Research studies are underway as follows:

1. Relationship of barometric pressure at key stations in the Pacific high pressure, the Great Basin anticyclone, and in the desert southwest to monthly, seasonal, and annual precipitation in South Dakota.

2. Weather relationships to the occurrence and severity of grasshopper infestation in the state.

Cooperation with the South Dakota Crop and Livestock Reporting Service, Agricultural Marketing Service, USDA, has continued in the issuance of the Weekly Weather, Crop, and Livestock Bulletin. As the occasion warrants, supplemental weather information such as seasonal precipitation patterns and departures, freeze probabilities, etc. are issued with the weekly bulletin.

The State Climatologist also serves as the Weather Bureau's State Civil Defense and Aviation Liaison Official.

The following publication was co-authored while the State Climatologist served in the same position for the states of Connecticut and Rhode Island:

> Waggonner, P.E., A. Boyd Pack, and W.F. Reifsnyder. 1959. The Climate of Shade. Connecticut Agricultural Experiment Station, New Haven. Bulletin 626.

TENNESSEE

The Tennessee State Climatologist is located at the Weather Bureau Airport Station in Nashville.

The State Climatologist has taken part in both local and statewide air pollution studies. He has served as consultant to the Vanderbilt University Dept. of Preventive Medicine and Public Health in connection with a Public Health Service-sponsored study of the effects of air pollution on the health of people in the Nashville area. This has entailed furnishing advice on climatological matters, providing a preliminary estimate of pollution distribution based on a climatological analysis, attending planning conferences at Nashville and at the Taft Sanitary Engineering Center, Cincinnati, Ohio, as well as visiting the Public Health Service in Washington, D. C., to become acquainted with their air pollution studies. A summary of Nashville climate, emphasizing air pollution-related features and highlighting abnormalities of the survey period was prepared for inclusion in the Public Health Service report dealing with the results of this study. The State Climatologist has also served as consultant to the Public Health Service Sanitary Engineer surveying the air pollution potential of the state. In this connection, data have been furnished, interpretations made and the resultant report reviewed. These activities led to the presentation of a talk on "Climatological Aids to Air Pollution Evaluation" as part of an Air Pollution Meteorology Training Course at the Taft Sanitary Engineering Center, Cincinnati, Ohio. The material developed will be included in a chapter on Meteorology being prepared elsewhere for an industrial hygiene group. Finally, a paper has been prepared relating particulate air pollution at Nashville to meteorological variables.

Cooperation with the University of Tennessee Agricultural Experiment Station has been frequent and varied. Collaboration is underway with the Head of the Horticulture Department in the preparation of a paper on freezing temperatures in Tennessee. Soil moisture computations have been made for comparison with measurements made by the University in connection with irrigation experiments

across the state. The State Climatologist has assisted in the selection of a computed soil moisture parameter for use in a crop-yield study, has discussed in detail with several research workers the methodology of soil moisture computations by the Thornthwaite method (using the Palmer-Havens graphs), and has provided average computed potential evapotranspiration amounts for a statewide network of stations. In connection with numerous research projects the State Climatologist has discussed the relationship of climatological variables to the problem at hand, assisted in obtaining required climatological data and provided, where needed, references to literature. A recent request has been for the presentation, at a Horticulture Dept. Seminar, of a talk on evapotranspiration computations from climatological data and their use in irrigation scheduling. Elsewhere at the University of Tennessee, activity has included presentation of a lecture on the "Climate of the Southern Appalachians" at a Botany Dept. Seminar and review of an extensive climatologically-oriented manuscript prior to publication. The University Agricultural Experiment Station, Engineering Experiment Station and Botany Department, together with the TVA and the State Division of Water Resources have expressed an interest in surplus Weather Bureau punched cards.

The State Climatologist has served a number of conservation interests. At the request of the Water Resources Division of the Tennessee Department of Conservation and Commerce, a proposed State Water Resources Act which included regulation of weather modification activity was reviewed and a conference of water users to discuss the proposed act was attended. The State Climatologist served as chairman of a Climate Fact-finding Committee established by the Water Resources Division, and participated in the preparation of a comprehensive report by that Committee. Climatological analyses dealing with the feasibility of artificial lakes in certain parts of the state have been furnished the Water Resources Division and the Tennessee Fish and Game Commission. Discussions have also been held with personnel of the State Fish and Game Commission on the relationship of climatological variables to several management problems. In cooperation with the Soil Conservation Service, climate sections of county survey reports are being written by the State Climatologist.

The State Climatologist has had contact with several industrial and business firms dealing with problems varying from data for airport design to disposal of waste products. Through contacts with two industrial concerns who are also cooperative observers, supplementary climatological data are made available each month on WB Form 612-14A or substitute. Eight years of wind summaries from this source have proved very useful for industrial planning and airport design in a portion of the state somewhat removed from full-time Weather Bureau offices. Considerable climatological information has been furnished to the Tennessee State Planning Commission and the State Industrial and Agricultural Development Commission. A major instance was the determination of climatological information available across the state pertinent to the location of a nuclear reactor. A recent program in cooperation with the Tennessee Valley Authority has been the investigation of the temperature-humidity-index in relation to air conditioning power requirements.

Some progress has been made in better specifying the climate of Tennessee. Maps have been constructed showing frequency of tornado occurrence by counties and tornado occurrence per square mile by counties. The latter chart pro-

vides much needed comparable data. Revised maps of average annual precipitation, average January and July temperatures, and average dates of last spring and first fall freezing temperatures have been prepared and were included in a State Department of Agriculture publication. Monthly and annual heating degree days have been computed for a network of 35 stations across the State. A paper, "Some Climate - Altitude Relationships in the Southern Appalachian Mountain Region", which considers temperature, daily temperature range, growing season, potential evapotranspiration and snowfall was published. In connection with freezing temperatures in Tennessee, revised average date maps, maps of 90% and 10% probability, and probability graphs have been prepared.

To promote more efficient dissemination of climatological data the preparation of a series of "Information Sheets" has been inaugurated. Those published thus far have been: "Tennessee Climatological Data on Punched Cards", "Mean Degree Days, Tennessee" (published as W.B. Letter Supplement 5801), "Tennessee Tornado Fact Sheet" (published as W.B. Letter Supplement 5907) and "Freezing Temperatures in Tennessee" (published as W.B. Letter Supplement 5910).

Various climatology-related publications and information have been provided Weather Bureau offices in Tennessee. These have included climatological information sheets described above and pertinent publications of the University of Tennessee Agricultural Experiment Station and Agricultural Extension Service and the USDA Agricultural Marketing Service. A paper "The Prediction of Rain vs. Snow in Tennessee", an evaluation and extension, for this area, of certain approaches presented in Weather Bureau Forecasting Guide No. 2, was prepared and distributed to Tennessee Weather Bureau offices.

Papers written since January 1, 1954 include:

Dickson, R.R. Interim Manual of Aids to Jet Stream Forecasting. U.S. Navy NAVAER 50-1P-533, pages 1-53. January 1955.

Dickson, R.R. A Case Study of the Jet Stream. Bulletin of the American Meteorological Society, Volume 36, No. 5, pages 195-203, May 1955.

Dickson, R.R. 1956 Agricultural Drought in Tennessee. National Weekly Weather and Crop Bulletin, Vol. XLIV, No. 3, January 21, 1957.

Dickson, R.R. A Note on the Computation of Agricultural Drought Days. National Weekly Weather and Crop Bulletin, Vol. XLV, No. 35, September 1, 1958.

Dickson, R.R. Tornadoes of January 21, 1959 - A Feature of a Weather Singularity? Monthly Weather Review, Vol. 87, No. 1, pages 40-42, January 1959.

Dickson, R.R. Some Climate - Altitude Relationships in the Southern Appalachian Mountain Region. Bulletin of the American Meteorological Society, Vol. 40, No. 7, pages 352-359, July 1959.

Dickson, R.R. Meteorological Factors Affecting Particulate Air Pollution of a City. Accepted for publication in the Bulletin of the American Meteorolo-

gical Society.

Dickson, R. R. The prediction of Snow vs. Rain in Tennessee, December 1960. Unpublished.

TEXAS

The Texas State Climatologist is located at the Weather Bureau Airport Station, 1710 Wilshire Boulevard in Austin.

A cooperative card punching program is maintained with the Texas State Board of Water Engineers. Regular climatological station data, as well as precipitation data from the Hydrologic Bulletin, are being placed on punched cards under this cooperative agreement.

The State Climatologist serves as a member of the Soil Conservation Service National Soil and Water Needs Committee for Texas.

Climatological summaries for 4 Texas counties have been prepared for the SCS Soil Survey Reports.

The State Climatologist served as a consultant to the authors of "An Appraisal of Air Pollution in Texas," published by the State Department of Health, and as a consultant to this agency in the preparation of a report on air pollution problems in El Paso, Texas.

The weather and climate section (about 12 pages) of the TEXAS ALMANAC is prepared by the State Climatologist in cooperation with the Dallas Morning News. This is an annual publication.

The State Climatologist works closely with the State offices of the Bureau of Reclamation, U. S. Geological Survey, Agricultural Marketing Service, and the Texas State Board of Water Engineers as a consultant for their various studies utilizing climatological data for the State. He also cooperates with the University of Texas, Texas A & M College, and the Texas Agricultural Experiment Station System, in the advancement of various climatological programs initiated at these institutions.

This office has furnished guidance to many Weather Bureau offices in the State on the preparation of crop calendars for their areas.

For 3 summers, the State Climatologist conducted a training program for university meteorology students in climatology.

This office provided data, critical evaluation, and made suggestions for maps of meteorological parameters prepared by the University of Texas Bureau of Business Research for inclusion in an atlas of the State.

The concepts of discomfort indices, climograms, and possible influences of different meteorological variables on the variability of growth rates of children at five Texas locations were introduced and explained to Dr. Jessie

Whitacre, Texas A & M College Department of Home Economics. The State Climatologist assisted in collecting required data, reviewed and commented on the completed manuscript.

Tabulations of tornadoes in Texas since 1896 have been completed. A tabulation of tropical storms entering the Texas coast has been compiled. A card index of unusual weather events in Texas has been established, and is continually maintained.

A climatological summary was prepared for Robertson County based on records from the surrounding area.

A study on the effective use of evaporative coolers for air conditioners in Texas is currently in progress.

Papers written since January 1, 1954 include:

Blood, R.D. and Hildreth, R.J. Late Spring and Early Fall Low Temperatures in Texas. Miscellaneous Publication No. 298, published by the Texas Agricultural Experiment Station, August 1958.

Orton, R.B. Climate of Texas. Published by the Texas Education Agency, December 1960.

UTAH - NEVADA

The State Climatologist for Utah and Nevada is located in Room 103, Government Building, Weather Bureau Airport Station, Salt Lake City, Utah.

Two cooperative punch card projects, one with Utah State University at Logan and one with the University of Utah at Salt Lake City, have been completed. The number of weather punched cards for these two projects totals approximately 325,000. Utah State University has obtained the services of a meteorologist, and several studies in cooperation with the Weather Bureau are contemplated, using these cards.

The State Climatologist served on the advisory committee of the "National Inventory of Soil and Water Conservation Needs", and is providing technical advice (along with two other Weather Bureau representatives) to the Humboldt River Study being conducted by the Nevada Department of Conservation and Natural Resources.

In cooperation with the U.S. Geological Survey, a metropolitan Salt Lake City rain gage network was established. Data from the various stations are used in making studies and reports of damaging rain storms in the area.

The "climate" section of several county Soil Survey reports for Utah and Nevada have been completed for the Soil Conservation Service.

The State Climatologist served on the Western Regional Technical Work Planning Conference for Soil Survey. Partly as a result of the recommendations of the conference "climate" committee, a detailed isohyetal map for Utah has

been prepared.

Cooperation of the American Smelting and Refining Company was obtained in securing and preparing for publication solar radiation data for a location in the Salt Lake Valley. Arrangements have also been made for that company to prepare soil temperature data for publication by the Weather Bureau.

The State Climatologist cooperated with the Bureau of Land Management in preparing wind, temperature and precipitation charts for Utah and Nevada for use in the BLM fire weather program.

A special pollen survey was recently conducted in the Salt Lake Valley by the medical profession (allergists). The State Climatologist participated in the establishment of the pollen stations and assisted in the analysis of the climatological data which was collected during the survey.

Arrangements were made for the shipping of a number of surplus weather punched cards from the National Weather Records Center at Asheville, North Carolina, to the University of Nevada at Reno.

Assistance has been provided the Soil Conservation Service in estimating climatological data at several locations for use in computing the water budget.

The assistance of the State of Nevada Highway Department has been obtained in connection with the Weather Bureau cooperative substation climatological program.

Papers written since January 1, 1954 include:

Brown, M.J. The Relation of Weather Factors to the Yield of Winter Wheat in Boxelder County, Utah. Monthly Weather Review, Volume 87, No. 3, March 1959. Pages 97-99.

Brown, M.J. The Utah Storm of April 22-23, 1957. Monthly Weather Review. Volume 85, No. 9, pages 302 and 326, September 1957.

Brown, M.J. and Tillotson, K.C. Forecasting Ceilings at Denver, Colorado. Bulletin of American Meteorological Society, Volume 38, No. 4, pages 193-205. April 1957.

Maximum Snow Loads Along the Western Slopes of the Wasatch Mountains of Utah, by Merle J. Brown and Philip Williams, Jr. Submitted to the Proceedings, American Society of Civil Engineers for publication.

An Approach to the Development of Isohyetal Maps for Mountainous Areas, by Eugene L. Peck and Merle J. Brown. Submitted to the Weather Bureau for review and planned for publication at a later date.

Easterly Winds Along the Wasatch Range of Utah, by Merle J. Brown. This paper was presented at a meeting of the Weber County Builders Association in December, 1959.

Review of Hydro-climatological Network for Utah, by Merle J. Brown and Eugene L. Peck. This paper was prepared for presentation at the Pacific Southwest Inter-Agency Committee Meeting at Boulder, Colorado, in August 1960.

Report of the Weather Bureau for Nevada, 1960 . Prepared for the Annual Nevada Water Conference at Carson City, Nevada, in September 1960.

VIRGINIA

The Virginia State Climatologist is located in Room 213, Terminal Building, Richmond's Byrd Field, Sandston, Va.

There continue to be occasional exchange visits between this office and divisions of Virginia Polytechnic Institute at Blacksburg, Virginia. Arrangements have been made with VPI for transferring their collections of soil moisture observations to NWRC Asheville for microfilming.

Arrangements have been completed with Alderman Library, University of Virginia, for the transfer of surplus punch cards for Virginia Climatological Substations from NWRC to the University Library. A project is underway for preparation of Virginia County Climatological Summaries for the Soil Conservation Service where these narrative and tabular summaries will be incorporated in their soil survey reports in published form for the individual counties. Two counties have been completed.

Monthly Climatological Summaries for Richmond are prepared for release to press and other information agencies at the end of each month for the forthcoming month.

Work continues toward expanding the narrative, tabular, and chart sections of the Climate of the States for Virginia, primarily for use within the state.

A TV Education film and narrative has been made in cooperation with Richmond's Public Schools and Station WTVR. The film is entitled "Richmond Weather Bureau Operations".

Aviation Studies Completed, 1938 through 1957

1. Frequency distributions of ceilings and visibilities at Richmond's Byrd Field
2. Frequency Distributions, "Times of beginning of thunderstorms, Richmond's Byrd Field".

The Weather-Crop Reporting Network has been expanded to include 54 stations. The format for the Weekly Weather Crop Report has been revised and expanded to include a more complete narrative description of the weather for the period of the report.

The State Health Department has been assisted on several occasions with their air pollution projects.

Several field trips have been made in the company of the Hydro-Climatic Field Aide for the purpose of familiarization. Liaison contacts have been maintained with our more prominent cooperators in the state, agricultural statistician, county agents, soil conservation service, U. S. Geological Survey, Virginia Water Resources Board, etc.

Papers prepared since January 1, 1958:

Rice, K. A. "Temperature and Egg Production" (published in Weekly Weather and Crop Bulletin May 30, 1960).

WASHINGTON

The State Climatologist for Washington is located at 703 Federal Building in Seattle.

Two cooperative punch card projects have been initiated in the State, one at the University of Washington, Seattle, and the other at Washington State University, Pullman. The complete period of record has been placed on IBM cards for 6 stations by the University of Washington. These cards were used by a graduate student in the preparation of a masters thesis "Spectrum Analysis of the Mean Daily Temperature for Five Stations in Washington". As a result of some of the work, the State Climatologist received weekly mean maximum/minimum temperatures, precipitation, heating and growing degree days, with the standard deviation of each for the 5 stations.

At Washington State University, past climatological records for one location (Prosser Irrigation Experiment Station) have been placed on cards and used in determining the maximum evaporation rates for "N" days from 1 to 30. With good correlation between evaporation and consumptive use of water by plants, the data were used to assist agricultural engineers in the proper design of sprinkler irrigation equipment. The punch card project has been rather inactive for the past year, however, plans are being made at the present time to place past records for a number of stations on cards under a research project sponsored by the National Science Foundation.

Soil temperature records kept over a period of years at the U.S. Department of AgricultureEntomology Research Station at Walla Walla, Agricultural Experiment Stations at Pullman, Prosser, Mt. Vernon, and at the University of Washington, were assembled and forwarded to the National Weather Records Center for microfilming.

The State Climatologist has assisted staff members of the Century 21 organization in the preparation of news releases regarding the weather in the Seattle area and in the use of climatological data in the design of structures and in the development of operational plans for the exhibition.

In addition to routine work with the Agricultural Marketing Service on the Weekly Weather and Crop Bulletin, special tabulations of precipitation and freeze data are prepared at appropriate seasons and released as supplements to this publication.

The State Climatologist is cooperating with the Soil Conservation Service in the preparation of the County Soil Survey Bulletins for the State.

Close liaison is maintained with the Bureau of Reclamation, the Corps of Engineers, the U.S. Forest Service and the meteorological staff at Boeing Airplane Company.

The State Climatologist served in an advisory capacity to the State of Washington, Division of Water Resources, in the selection of climatological data utilized in the preparation of Water Supply Bulletin No. 12, "Water Resources of the Nooksack River Basin".

At present, the State Climatologist is serving as a consultant on climatological problems involved in a research project at Washington State University "A Statistical Examination of the Effects of Weather Modification Activities in the State of Washington". This research project is sponsored by the National Science Foundation.

Climatological data tables were prepared and furnished the Division of Industrial Research at Washington State University for the publication "State of Washington Engineering Soils Manuals" published for 8 counties.

Arrangements have been made with the State of Washington Department of Commerce and Economic Development to publish the local climatological summaries prepared for substation in the State. A total of 29 substation summaries have been published to date.

Work is in progress on a bulletin "Spring and Fall Freezing Temperatures in Washington" being prepared in cooperation with the Washington State Agricultural Experiment Station.

Other publications prepared are:

Heating Degree Days for Selected Stations (70) in Washington, prepared in cooperation with the Oil Heat Institute of Washington.

Wind Rose - Boeing Field, Seattle, Wash. 1950-59, Frequency of Occurrence of Wind Direction and Speed. Mimeographed for local distribution.

Wind Rose - Seattle-Tacoma International Airport, Seattle, 1950-59, Frequency of Occurrence of Wind Direction and Speed. Mimeographed for local distribution.

Climatography of the United States No. 60-45, Climates of the States-Washington, text prepared.

Climatic Guide for Seattle. (In cooperation with Office of Climatology and National Weather Records Center).

Summary of Evaporation Data Recorded in Washington. Mimeographed for local distribution.

WEST VIRGINIA

The West Virginia State Climatologist is located in Room 207, 211 Sixth St., Parkersburg, W. Va.

The cooperative punched-card program with the Agricultural Experiment Station, West Virginia University, has resulted in the preparation of card-decks for twenty-four stations distributed over the State. The standard period for these records is 1926-1955. The punched cards have been used to obtain information on spring and fall low temperature conditions, weekly rainfall probabilities, and heating degree-days. They will have further uses within the State and also in the NE-35 regional project on agricultural climatology.

WISCONSIN

The Wisconsin State Climatologist is located at 443 Science Hall, University of Wisconsin, Madison, Wisconsin.

The State Climatologist was active in the group that organized the Wisconsin Phenological Society. He serves as permanent chairman of the Constitution Committee and is a member of the Research and Analyses Committee. He planned and helped establish a network of stations for Project Cocoon. This is a phenological study sponsored by the Wisconsin Department of Agriculture, Plant Industry Division.

The State Climatologist cooperated with the University of Wisconsin Agriculture Extension Service and the Wisconsin Crop Reporting Service in establishing a state-wide observing network for observing frost penetration.

He is consultant for the Ground Water Branch, U.S. Geological Survey, for their Little Plover Hydro-Cycle Study.

He prepares special studies for State Agencies. Some examples are: climate of Racine for Division of Industrial Development; rainfall probability of the Lake Winnebago area for the Highway Commission; climate of Horicon National Wildlife Refuge for Conservation Department; climate of Flambeau River State Forest for the Park Division.

Arrangements have been made to prepare narrative climatic summaries and tabular data for the Soil Conservation Service, County Soil Surveys.

A series of Substation Climatological Summaries are being prepared in cooperation with the Wisconsin Crop Reporting Service. The goal, where records are available, is a station summary in each county of the state.

Data and interpretations of data are furnished to students and University Departments. Some of the larger requests have included information concerning: a nuclear reactor site, Climatic Atlas of South America, Bibliography of Agricultural Meteorology, Phyto-Climate of Wisconsin.

Burley, Marvin W. Spring and Fall 32° freeze charts for four dates in each season. Wisconsin Weekly Crop Market and Weather Report Supplement. April 1961.

Probability of 1 inch or more precipitation in a 7-day period and probability of a dry week for 13 summer weeks. Wisconsin Weekly Crop Market and Weather Report Supplement. July 1960.

Average length of growing season chart. 1959 Wisconsin Annual Crop Summary. Wisconsin Crop Reporting Service, Madison. April 1961.

Burley, Marvin W., and Wang, Jen Yu. Table and map of all Wisconsin precipitation stations for period of record. The Phyto-Climate of Wisconsin, Moisture: Normals and Hazards. Research Report 7-A.

Data are being collected on snow. Included is an indexed reference of the state's major snowstorms, probability of winter's first one inch or greater snowfall for 82 stations, and average monthly snowfall maps.

WYOMING

A full-time Climatologist was assigned Wyoming in mid-1960. He is located at the Weather Bureau Airport Station at Cheyenne, Wyoming.

A cooperative punch card program continues in operation with the University of Wyoming. A total of 25 stations have been punched and verified. The Cheyenne office has performed the editing of the records prior to punching and has assisted in two research projects at the University using the punched card weather data.

A study on freeze probabilities for Wyoming is nearing completion in cooperation with the University of Wyoming. Programming for the Bendix computer at the University of Wyoming has been completed for 1, 2 and 3-week precipitation probabilities.

A large expansion and revision of the weather portion of the Weekly Weather and Crop Bulletin for Wyoming has been completed.

A study of the drought situation has been kept current for the Drought Disaster Committee. Active participation with the SCS County Soil Summaries has been initiated, however, no early target date on publication is anticipated.

Preparatory work is under way towards publishing 25 substation summaries.

Active cooperation with Mr. Bruce Jones, Chief of Water Development, Wyoming Natural Resource Board, has been established.

Active cooperation with Mr. George Fisser, University of Wyoming, on a dense precipitation network study on the Big Horn-Wind River mountain slopes has been established.

The Wyoming climatological network has been reviewed and efforts are being made to get equipment and establish new climatological stations in accordance with the approved network. Two stations were thus established in 1960 and three are anticipated in 1961.