

UNITED STATES DEPARTMENT OF COMMERCE

*U.S.* WEATHER BUREAU  
WASHINGTON

May 27, 1959

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. 72)

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. 72

This Climatological Services Memorandum, devoted entirely to activities of State Climatologists, is issued:

- (a) to present a picture of the work done by State Climatologists, as of the end of 1958.
- (b) to stimulate thinking by all concerned regarding the State Climatologists' program and how it could be improved.

Comparisons between various State Climatologist's accomplishments are not possible because the non-climatological responsibilities of State Climatologists vary widely. Also, the length of the story describing a State Climatologist's activities is not a criterion of the importance of those activities. We present these things here so that a better understanding of the work of State Climatologists develops.

We appreciate the good work State Climatologists are doing on items of a routine nature. We also want to encourage non-routine climatological activities of a high standard.

In the ideal case a full-time State Climatologist can perhaps spend 50% of his time on the non-routine climatological program and a small amount of time on research. The remainder will usually be occupied with routine problems.

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.



A handwritten signature in dark ink, appearing to read "H. E. Landsberg".

H. E. Landsberg  
Director, Office of Climatology

WASHINGTON, D. C.  
5-27-59

RECURRING ACTIVITIES OF W.B. STATE CLIMATOLOGISTS

STATE	Estimated number per month										No. of trips last year			Percent of time on					
	Severe Storm Reports	News Releases		Substa. Records Collected		Letters Answered	Visitors	Phone calls - S/C functions	Items added to Bibliography	Climat. Sub-station Summaries		Is monthly Local Climatological Data prepared?	To first-order stations	To cooperating agencies	Other	Routine Climatology	Non-routine Climatology	Non-climatological activities	Research
		Unpublished	Published	Prepared	Under Preparation														
Alabama.....	7	6	8	235	b	b	a	2	8	1	Yes	10	11	6	25	25	50	0	
Alaska.....	2	0	23	135	a	b	c	0	15	2	No	2	15	5	75	24	1	0	
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	2	10	90	No	4	1	0	25	40	5	30	
California.....	7	*	30	572	c	b	c	2	10	0	Yes	3	13	1	60	25	5	10	
Colorado.....	12	2	10	230	a	a	a	2	6	3	No	3	10	1	50	25	20	5	
Conn. & R. I.....	4	3	6	75	a	a	a	2	0	2	No	4	24	5	25	60	0	15	
Florida.....	12	1	11	125	a	a	a	1	6	0	No	5	4	0	35	30	10	25	
Georgia.....	4	2	4	164	a	a	a	0	31	6	Yes	7	8	3	40	35	15	10	
Hawaii & Pacific.....	*	2	650	350	b	a	a	-	1	0	Yes	3	3	4	-	-	-	30	
Idaho.....	6	2	3	135	a	a	a	0	0	0	Yes	1	3	0	50	15	30	5	
Illinois.....	6	1	10	180	a	a	a	0	4	0	No	4	8	5	65	20	0	15	
Indiana.....	12	1	5	115	a	a	a	*	8	0	No	6	4	2	30	40	0	30	
Iowa.....	12	2	35	176	a	a	a	b	3	8	1	No	3	4	9	50	15	25	10
Kansas.....	26	7	39	314	a	a	a	b	10	0	0	No	3	12	1	60	25	10	5
Kentucky.....	15	2	15	149	a	a	a	c	1	0	0	Yes	1	20	0	10	5	80	5
La. & Miss.....	10	2	34	362	c	a	a	b	4	4	2	Yes	4	4	0	25	50	5	20
Md. & Del.....	4	*	28	103	a	a	a	b	10	0	15	No	1	45	0	10	75	0	15
Mass., Me., N. H., & Vt.....	10	3	12	262	c	a	c	c	0	1	No	7	8	1	60	30	5	5	
Michigan.....	1	2	22	189	a	b	c	c	1	18	3	Yes	4	2	0	20	20	40	20
Minnesota.....	9	3	22	195	b	a	a	c	5	3	3	No	5	14	7	21	15	54	10
Missouri.....	20	2	15	290	b	a	a	b	5	0	0	No	3	25	0	25	10	50	15
Montana.....	15	5	7	285	b	a	a	a	2	8	2	Yes	6	8	2	25	20	50	5
Nebraska.....	20	6	5	245	b	b	b	b	3	0	0	Yes	0	10	0	25	25	40	10
New Jersey.....	2	1	6	90	b	a	a	c	1	0	0	No	1	18	3	20	35	35	10
New Mexico.....	5	3	20	241	b	b	c	c	1	5	0	No	4	4	0	50	30	10	10
New York.....	4	2	10	400	b	b	a	a	0	5	0	Yes	0	6	0	60	25	0	15
North Carolina.....	1	10	5	210	b	c	c	c	2	9	1	Yes	4	23	3	40	25	-	15
North Dakota.....	4	5	6	236	b	a	a	b	0	4	0	Yes	1	2	2	25	20	50	5
Ohio.....	3	*	12	186	b	a	a	c	2	8	0	Yes	2	20	10	10	20	25	45
Oklahoma.....	28	*	13	210	a	a	a	a	*	8	2	No	1	21	6	45	25	10	20
Oregon.....	4	4	59	238	c	c	c	c	11	13	1	Yes	7	14	14	40	35	10	15
Pennsylvania.....	8	2	15	300	a	a	a	b	1	0	1	No	8	30	-	40	40	15	5
Puerto Rico.....	1	5	20	125	b	b	c	c	0	0	25	Yes	1	2	5	25	65	5	5
South Carolina.....	5	1	8	114	a	a	a	b	10	18	0	No	3	10	10	40	40	5	15
South Dakota.....	20	4	15	156	a	a	a	b	10	0	6	Yes	3	24	3	50	10	30	10
Tennessee.....	6	*	0	59	a	a	a	a	3	1	0	No	1	20	3	13	67	0	20
Texas.....	40	1	50	750	a	a	a	b	3	5	1	No	2	11	0	45	50	0	5
Utah & Nevada.....	7	*	21	300	c	a	a	c	2	17	17	No	4	10	0	55	30	0	15
Virginia.....	6	2	8	198	b	a	a	c	10	0	2	Yes	3	15	14	5	2	90	3
Washington.....	4	1	15	190	b	a	a	b	6	7	1	Yes	5	10	-	30	50	15	5
West Virginia.....	2	0	4	170	a	a	a	a	0	0	0	Yes	0	3	2	8	1	90	1
Wisconsin.....	4	3	2	188	b	a	a	c	10	0	0	No	2	6	3	50	30	5	15
Wyoming.....	3	0	10	209	a	a	a	a	0	2	0	Yes	0	0	0	20	5	75	0

- Information not available. \* Less than one. (a) Less than 50. (b) 50 - 100. (c) Over 100.

### EXPLANATION AND SUMMARIZATION

Severe storm reports mentioned in the preceding table are those published in Climatological Data, National Summary or in Storm Data; that is, each published item is one report.

Number of letters, visitors, and phone calls are those concerning climatological matters. An explanation of the three categories used is carried at the bottom of the table.

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 is cooperation with other agencies (primarily the Agricultural Marketing Service of the USDA and Extension Service and State Departments of Agriculture) in a joint Weather and Crop Bulletin.

Some of the non-routine activities of State Climatologists are contacts with Universities where cooperative punched card projects are under way; with local and State Civil Defense officials; with those interested in health-climate studies such as air pollution and allergy problems; with the National Inventory of Soil and Water Conservation Needs; with Soil Conservation Service on projects such as the county soil surveys; with Agricultural Research Service, Forest Service and others concerned with problems such as snowfall threshold probabilities, freeze probabilities, soil moisture-evapotranspiration studies, drought and phenological studies.

There have been 171 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, and articles for publication in the Monthly Weather Review, National Weekly Weather and Crop Bulletin, Journal of the American Meteorological Society and similar publications. These are listed by name at the end of the narratives following.

In addition to these papers the narrative text for "Climates of the States" has been revised or rewritten for each state. These descriptions were originally included in the 1941 U. S. Department of Agriculture yearbook "Climate and Man" and will be published in the "Climatology of the U. S." series under the title "Climates of the States".

A state by state account of State Climatologists' activities follows.

ALABAMA

The health-climate studies are being continued in (a) Rural vs. Urban Climate and (b) Radiation effects in the area of minimum temperature forecasts. Considerable work has already been done on these projects and the State Climatologist expects to prepare papers for possible publication within the next 6 months, depending upon time available.

Conferences with the 7 different agencies on weather modification consisted of the State Climatologist furnishing the latest Weather Bureau official position on this problem as well as the latest American Meteorological Society official views. Also, Alabama climatological data were furnished in connection with the above.

Cooperation with both State and U. S. Forest Services consist of furnishing monthly statistics on temperature, precipitation, frosts and freezing each month, for the eight climatological divisions of the State.

Cooperation with Alabama Polytechnic Institute, the State Agricultural College, consists of furnishing climatological data and drought statistics.

Frequent talks on Alabama Weather and Climate are made to schools and civic clubs. Monthly summaries of Alabama weather are also furnished the two Montgomery daily newspapers, Associated Press, United Press International, and the U. S. Geological Survey.

Cooperation with Alabama State Planning Board consists of furnishing frequent climatological data for various Alabama cities.

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.

Long, A. R. A Statistical Analysis of Alabama Precipitation. Unpublished.

Long, A. R. The 82-Year Precipitation Record at Montgomery, Alabama, 1872-1954. Unpublished.

Long, A. R. Weather and the Irish Potato Crop. Unpublished.

Work is going forward on two papers, Some Aspects of the 82-Year Temperature Record at Montgomery, Alabama 1872-1954 and Climatic Trends.

#### ALASKA

A cooperative card punching program with the Matanuska Agricultural Experiment Station is expected to be inaugurated in the near future. During the past year, this group has been assisted with the selection and installation of special weather recording instruments at the experiment farm. The purpose of this special equipment is to record and study the relative importance of local meteorological phenomena upon agricultural activities in the area, including the Knik and Matanuska Valley winds as they relate to agricultural operations and soil erosion. Data collected in this program are now being assembled in tabular form for entry on punch cards. Also, soil moisture and evapotranspiration studies were inaugurated in the summer of 1958 and are expected to be continued this year (1959). The official recording of soil temperatures is planned for the Matanuska Agricultural Experiment Station this year, and the program resumed for the University Agricultural Experiment Station at College during the current (1959) season.

Cooperation has been carried on in a health-climate study involving the investigation of factors affecting atmospheric diffusion from a proposed nuclear reactor at Knik Arm Plant.

For the Soil Conservation Service, in their National Inventory of Soil and Water Conservation Needs, special weather summaries have been prepared for each of the basic unit areas. Assistance was given in determining the boundaries of these basic areas by climatic considerations. Special summary tabulations have also been prepared to provide information for surveys of potential farming areas in Alaska. Completed, to date, are summaries for areas on Kodiak Island and on the Kenai Peninsula.

For the Alaska Market News (a publication of the Department of Agriculture) a monthly summary of weather conditions is prepared for the agricultural areas in that State. Each spring, in cooperation with Civil Defense and other interests, snow cover maps and data just preceding and during the spring thaw have been prepared to assist in anticipating flood developments on Alaska's major river valleys.

Increasing demands are being made for climatological data for both research and operational undertakings. Examples of these requests are: for the Arctic Health Service, environmental and climatic factors affecting natives in a health-climate study; for the Fish and Wildlife Service, climatic data in relation to migratory movements of birds and wildlife; for the Forest Service and Bureau of Land Management, climatic data for developing fire-weather indices for Alaska (after the unusually dry and widespread fires of 1957); for the Bureau of Public Roads, climatic data for the planning and operation of the Alaskan highway system. A close watch of current temperatures in local areas, and their relation to normal, has been found very helpful in realizing an efficient distribution of available equipment just prior to break-up time.

In Alaska, the basic administration of the substation network is handled by the Climatologist. 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. Correspondence to the observers is handled by the Climatologist.

Papers written since January 1954 include:

Watson, C. E. Important Aspects of Alaska's Climate. Not published. Presented at Agricultural Seminar, Agricultural Experiment Station, Palmer, Alaska, 1957.

#### ARIZONA

A cooperative punched card program is carried on with the University of Arizona, Institute of Atmospheric Physics. Punching has been completed and cards are being used for summarization. The Institute, in cooperation with the State Climatologist, is publishing approximately 100 summaries for cooperative stations over the State. The summaries will be published on formats used by the Weather Bureau. The State Climatologist's part in the project consists of the following: (1) compute estimated monthly and annual degree-day totals for each station using the method of H.C.S. Thom, (2) prepare the Station History section and draw lines representing exposure changes in the tables of mean monthly temperature and precipitation from beginning of record through 1957, and (3) assist with writing narrative climatological summaries for each station. The primary reason such a large number of substation summaries will be produced for Arizona is the very active cooperative program carried on with the University of Arizona in Tucson. The University is using the punched cards produced from this cooperative effort to tabulate the substation summaries by machine.

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

A cooperative study on soil temperatures is underway with the Agricultural Research Service at Arizona State College.

The State Climatologist serves as a member on the Arizona Soil and Water Needs Committee.

Data are supplied periodically to Dr. W. B. Steen of the Tucson Clinic, who is studying the relationship between weather conditions and asthmatic attacks of a group of children in Tucson.

Special climatological summaries were made and supplied to radio station KRUX in Phoenix in connection with a public contest to guess the first date in the summer that a temperature of 108 degrees or higher would be recorded at the Phoenix Airport.

As a result of correspondence with the Division of Advanced Research of Hiller Helicopters in Palo Alto, California, contributions by the State Climatologist appear in their Report No. 178, "Experimental and Theoretical Investigation of the Feasibility of Producing Static Lift by Vortex Motion", published last year.

A long-term project that is revived from time to time in the Salt River Valley, is the smoke pollution project carried on in cooperation with Arizona

State University and the City, County and State Health Departments. Meetings are held and proposals are made, periodically, as interest revives, but as yet attending the meetings and helping to write proposals has been the only call on the State Climatologist's time for this project.

An Agricultural Seminar Association has recently been formed among University and State, County and Federal groups engaged in agricultural research in Maricopa County. Meetings are held once a month at the University of Arizona Cotton Research Center. The State Climatologist will attend all meetings and is scheduled to appear on one of the programs later in the year.

The Soil Conservation Service is supplying the Weather Bureau with daily consumptive use figures for publication with other International Geophysical Year data. Some data reduction will be necessary by the State Climatologist as his part in this project.

A large long-term project that will occupy as much time as the State Climatologist can afford, is the computation of daily maximum and minimum temperature "normals" for all cooperative stations in the State with 10 years or more record. The method used will require the computation of the first four harmonics using the 12 monthly average values of each of these two temperature sets. A means of tabulating the data has been worked out that will allow daily values for all stations in the State (for every 5th day) to be tabulated on approximately three mimeographed pages.

A reading program on arid land climatology is carried on, with an indexed set of notes prepared.

The State Climatologist is scheduled to read a paper at the Symposium on Hydrology of Arid Lands, Geological Society of America in Tucson in April 1959, and another at the American Meteorological Society meeting in San Diego in June 1959. Also in June 1959, a one-hour talk is scheduled on the climate of the southwest at the Agricultural Seminar Association meeting in Phoenix.

Papers written since January 1, 1954, include:

Kangieser, Paul C. A Physical Explanation of the Hollow Structure of Water-spout 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, (?) 1959.

Kangieser, Paul C. The Climate of the Southwest. Under review in Central Office for publication by University of Arizona Press with other papers pre-

sented at Symposium on Hydrology of Arid Lands, Cordilleran Section, Geological Society of America, Tucson, April 4, 1959.

Papers mimeographed since January 1, 1956 (beginning of Phoenix, Arizona assignment):

Kangieser, Paul C. Total Monthly Precipitation Expectancy for Phoenix, Arizona.

Kangieser, Paul C. Dry and Wet Bulb Temperature Expectancies for Phoenix, Arizona.

Kangieser, Paul C. Surface Wind Roses for Phoenix, Arizona.

Kangieser, Paul C. Average Monthly Variation of Wet Bulb Temperature and Summer Discomfort Index at Phoenix, Arizona During the Summertime.

Kangieser, Paul C. Daily Probability of Summer Thunderstorm Occurrence, Phoenix, Arizona.

Kangieser, Paul C. Likelihood of Precipitation on Consecutive Days in Phoenix, Arizona.

Kangieser, Paul C. Probability Estimates for the First Date in the Fall and the Last Date in the Spring of Freezing and Sub-Freezing Temperature at Selected Arizona Stations.

Non-routine press-releases published since January 1, 1956 (beginning of Phoenix, Arizona assignment):

Kangieser, Paul C. Arizona Precipitation December 1955 through March 1956. Arizona Republic, April 15, 1956.

Kangieser, Paul C. April 1956 Rainfall and Arizona Range Conditions on May 1, 1956. Arizona Republic, May 1, 1956.

Kangieser, Paul C. Arizona Precipitation During the 1956 Water-Year. Arizona Republic, October 27, 1956.

Kangieser, Paul C. Humidity. Arizona Republic, July 7, 1957.

Kangieser, Paul C. Average Data of the First Temperature of 32 Degrees or Less in the Fall. Arizona Farmer-Ranchman, October 31, 1957.

Kangieser, Paul C. Winter Climate in Arizona. Arizona Republic, November 7, 1957.

Kangieser, Paul C. Variation of Low Temperatures over the Salt River Valley. Arizona Republic, December 1, 1957.

Kangieser, Paul C. Climatological Expectations for Arizona During the Calendar Year. Arizona Republic, January 23, 1958.

Kangieser, Paul C. Weather Records Substantiate Folk Saying. Arizona Republic, December 2, 1956.

Kangieser, Paul C. Arizona Weather During the Calendar Year 1957. Arizona Republic, January 23, 1958.

Kangieser, Paul C. Arizona Precipitation for the First Quarter of 1958. Arizona Republic, April 13, 1958.

Kangieser, Paul C. The Unusual Weather of August 1958 over Arizona. Arizona Republic, September 11, 1958.

Kangieser, Paul C. Arizona Precipitation During the 1958 Water-Year. Arizona Republic, October 12, 1958.

Kangieser, Paul C. Arizona Weather During Calendar Year 1958. Arizona Republic, January 1, 1959.

#### ARKANSAS

A cooperative card punching program is maintained with the University of Arkansas.

Cooperation is maintained with the District Engineer, Corps of Engineers, Little Rock District, in climatological studies relevant to the planning for the construction of flood control and power generating structures and to the 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

A card punching program has been initiated during 1958 with the Department of Agricultural Engineering, University of California at Davis. As a result, several other groups, namely, the Department of Irrigation at Davis, the Agricultural Research Service of USDA and the State Department of Water Resources have shown considerable interest and much information has been furnished these groups to assist them in planning their future weather-card needs. Also, assistance has been given the Southern California Gas Company in making contractual arrangements with the National Weather Records Center for punching selected substations and the Southern Consolidated Edison in setting up standardized procedures in punching weather data at selected points along their system.

The California Climatologist has been serving on an active committee of the Soil Conservation Service, National Soil and Water Conservation Needs. He

has also assisted the state Soil Conservation Service in their plans to include climate in soil survey and land capability classification. Specifically, he has also furnished the group with the Palmer and Havens article on evapotranspiration and later agreed to prepare narrative climatic summaries for county survey reports. Also with the Soil Conservation Service, assistance has been rendered in setting up and administering three watershed pilot projects and data have been furnished to their Hydrologist.

With the State Department of Water Resources, considerable assistance has been given in ferreting out old and current unofficial precipitation records as well as assistance in the selecting of additional State-sponsored substations. Cooperation has existed with the University of California at Davis in an evapotranspiration project where the instrumentation includes atmometers, evaporation pans of various sizes and exposures, etc. A 20-foot lysimeter was under construction in 1958 and should be ready in 1959.

Close liaison has been maintained with the State Department of Air Sanitation and the San Francisco Bay Area Pollution Control District. The State Climatologist has served on the Meteorological Committee for the VIII Olympic Winter Games Committee for 1960. With only limited data (1 1/2 years) at the site of the 1960 Olympics, a special study was made and as a result a printed climatological summary (Climatography of the U. S. series, No. 20-4) has been prepared. Several other examples of service are: climatic data and interpretation thereof for vector control (carrier, the mosquito) to state and county health officials; state survey of areas with 90 days or less "frost free" for the Stanford Food Research Institute; climatic data and special weekly observations of radiation for the Civil Defense Agency, etc.

A specially designed card index system of severe storms in California since 1892 has been partially completed. Arrangements have been made for four soil temperature reporting stations on a regular basis for publication in Climatological Data.

Papers written since January 1, 1954 include:

Dale, Robert F. Importance of Substation Inspection, paper given at Field Aide meeting, San Francisco, September 1958. (Later expanded for the Kansas City, Missouri Field Aide meeting on February 16, 1959.)

Dale, Robert F. Mechanization of the Processing of Climatological Data, paper given at the Proceedings of the 25th Annual Meeting of the Western Snow Conference, Santa Barbara, California, April 1957.

Dale, Robert F. The Climate of the Matanuska Valley, U. S. Weather Bureau Technical Paper No. 27, March 1956.

#### COLORADO

Colorado State University has punched back weather records for 15 stations in the eastern plains of Colorado, with financial assistance by the Soil Conservation Service. Plans have been made, to be carried out when funds are avail-

able, for punching and extensive analysis of records for Fort Collins and an additional network of stations in the northeastern portion of the state. A local conference on air pollution was held last year and data were furnished for a study of the problem in the Denver area. Weather modification, including hail suppression and cloud seeding to increase deficient mountain snow pack, has been discussed with local organizations concerned.

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.

Preliminary discussions have been held with Colorado State University representatives concerning studies of hail occurrence in northeastern Colorado and of radar studies of precipitation intensities in the Denver area. A proposal for, and intensive study of, the hydrology of the Colorado River has been submitted to the State by a group including representatives of Colorado State University, Colorado University, and others. This proposal includes punching and machine analysis of an extensive network of Western Slope stations; punching to be under a WB - State Cooperative Project.

#### CONNECTICUT - RHODE ISLAND

The University of Connecticut has punched the records of nine stations, using the National Weather Records Center facilities. Estimates for data missing in these records preparatory to their analysis have been supplied. Also with this University, the State Climatologist studied the occurrence in Spring of periods with 42° daily mean temperature in different parts of the state, in connection with the important commercial gardening problem of transplanting shrubbery. Participation has been carried on in the weekly rainfall probability study for the state being conducted by Travelers Weather Service and the University.

In cooperation with the Connecticut Agricultural Experiment Station at New Haven and its Tobacco Laboratory at Windsor, studies have been made of heat unit accumulation and emergence of the seed-corn maggot in newly-set tobacco plants; and the concurrent weather during tobacco disease outbreaks.

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 in storage. The cooperative projects with the universities and experiment stations have each involved the following efforts of the State Climatologist: compilation of essential climatological data, investigations to determine new or more effective applications or manipulations of the pertinent climate 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 additional work was done on the freeze-probability statistics for both states. Determination of snowfall threshold probabilities and studies on occurrences of summer maxima of 80°, 85°, and 90° were made for Hartford, New Haven and Providence.

Assistance was given to the NE-35 project on determination of critical temperature occurrences, i.e., first and last dates of minima 0°, 16°, etc.

A climatic summary for Hartford Co., Connecticut, was written for the Soil Conservation Service's county soil survey. A revision of Kirk's "Weather and Climate of Connecticut" (1939) is in process and will be published by the State Geological and Natural History Survey. Along with this an index card file of unusually severe storms and notable weather events in Connecticut and Rhode Island is being compiled.

In cooperation with the Meteorologist in Charge and forecasting staff of WBAS, Hartford, a climatological evaluation for New Haven County, Connecticut, of the Weather Bureau's "30-Day Outlook" is regularly prepared during the crop growing season.

The State Climatologist is a member of the state committee on "National Inventory of Soil and Water Needs" in both Connecticut and Rhode Island, and has attended the two committee meetings recently held. He has also attended two recent meetings of the Connecticut state "Water Resources Survey" committee, of which he is a member.

Future plans include active participation in a study of phenology of tobacco (cigar-types) in relation to weather observations (concurrent) at nearby WBAS, Hartford. This study will be in cooperation with the Tobacco Laboratory of the Connecticut Agricultural Experiment Station.

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. Some Insect and Plant Disease Problems and the Growing Season Weather of 1958 in Connecticut. (In preparation.)

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.

#### FLORIDA

Records for 33 Florida cooperative stations for the period from 1931 or earlier have been placed on punched cards as a result of the Weather Bureau - Florida Agricultural Experiment Station cooperative punched card project. Climatic probability studies and data summaries will be undertaken as funds permit. The Department of Meteorology, Florida State University at Tallahassee has indicated a desire to engage in a similar cooperative project and, if undertaken, will supplement the program being pursued in Gainesville.

The State Climatologist served as the Weather Bureau representative to the Florida Water Resources Study Commission during the preparation of the report "Florida's Water Resources" and has maintained close liaison with the Florida Department of Water Resources, created as a result of the report, by attending state and regional meetings sponsored by that organization and by supplying pertinent data and data interpretations. As a member of the Florida committee on "National Inventory of Soil and Water Needs", the State Climatologist attends meetings of that committee and subcommittees of which he is a member. Other activities in association with the Soil Conservation Service include participating in filed reviews of "Small Watershed Planning Outlines", preparing the climate portion of county Soil Survey Guides and locating pertinent data for the Soil Conservation Service Watershed Planning Party.

The State Climatologist is an active participant in one Experiment Station research project concerned with the effects of climate upon forage production in Florida. A mobile micro-meteorological laboratory is being assembled and observations are being made in the field. In addition the State Climatologist acts in an advisory capacity to other research projects which are affected by weather and climate. In cooperation with the Soils Department, he is currently engaged in the study of the influence of climate upon magnesium content of pecan leaves in Florida.

The Florida Tomato Committee, the Florida State Marketing Bureau and the Agricultural Marketing Service together have expressed an interest in determining more precisely the effect of weather conditions on tomato production. Exploratory investigations have been made and will be continued with the support of those 3 organizations.

About 20 inquiries per week, on the average, are received from out of state prospective vacationers and/or residents seeking the "best" time or place to be in the state. A brochure of climatic information has been assembled to answer these numerous inquiries.

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).

### GEORGIA

Arrangements have been completed with the University of Georgia, College of Agriculture, for a cooperative punch card project. Actual punching of climatological records should begin during the first half of 1959. Several departments of the College, including Extension Service personnel, have shown a keen interest in this program, and an early and extensive use of the punched card data is anticipated.

The State Climatologist is a member of the State Committee for the National Inventory of Soil and Water Conservation needs and also serves as the Weather Bureau representative on the Water Use and Conservation Association of Georgia.

Cooperation with the Soil Conservation Service has included the preparation of climatic data for use in their county soil surveys, and in their small watershed studies. The State Climatologist also lectures to each class of Soil Conservation Service employees that attends their Athens In-Service Training Center. There were nine such classes during 1958 with approximately 200 people representing nine Southeastern States and the Caribbean area.

The State Climatologist has the status of Research Associate on the staff of the Department of Agricultural Engineering in the University of Georgia's College of Agriculture. In this capacity he serves as Climatological Consultant to other staff members and to other departments of the College of Agriculture and the University. Some specific examples of these activities are:

- (1) Lectured to each class in Soil and Water Conservation (usually two classes each quarter).
- (2) Assisted the Horticulture Department in planning a weekly seminar on "Climate as Related to Horticulture" and gave first seminar.
- (3) Prepared data for Poultry Department for use in their research on the effects of air conditioning poultry houses.

- (4) Conferred with and supplied considerable data to Agricultural Economics Department for a study being made of the Southern Appalachian Region.
- (5) Collected and supplied Extension Horticulturist data on accumulated chilling hours through winter and spring season for release to County Agents and peach growers. Also wrote an article on late spring freeze hazard in the peach producing areas of the State for release by the Extension Service.
- (6) Prepared summary data for the Director of Branch Experiment Stations for use in a bulletin covering the activities of the Branch Stations.
- (7) Revised the section on climate in the Georgia Section of "Taylor's Encyclopedia of Horticulture."

Close working relations have been maintained with personnel of the U. S. Department of Agriculture's Southern Piedmont Experiment Station at Watkinsville, Georgia and with other Agricultural Research Service people in the Athens area. Through the cooperation of the Southern Piedmont Station and the local County Agent weekly releases are currently being made by radio and newspaper on (1) rainfall as compared to normal, for the current month and year, (2) soil temperature and, (3) likelihood of another freeze in the Athens area.

Arrangements have been made with the State Department of Agriculture for printing local climatological summaries for all Georgia stations having a sufficiently long period of record. Nine summaries have been printed by the Department and fourteen others are now at the printers. These are in addition to eight summaries that were previously printed through the cooperation of local Chambers of Commerce. Production of this number of substation summaries is possible because most of tabulation work was done by staff of the U. S. Agricultural Marketing Service and the State Department of Agriculture.

The State Climatologist has cooperated with the local Civil Defense Director in a natural disaster preparedness program by appearing on Civic Club programs and showing the tornado film.

Plans for the future include:

- (1) Completing the substation summary program by publishing a summary for each remaining station having sufficient record.
- (2) Assisting in getting the cooperative punch card project off to a good start. This project will be promoted by encouraging and assisting researchers to make full use of the punched card data when it becomes available.
- (3) Preparing an article on Georgia's tremendous poultry industry with emphasis on how it is influenced by weather.

- (4) Preparation of tables and maps presenting Georgia's monthly and seasonal rainfall by percentiles for possible publication as a State bulletin.
- (5) Preparation of a series of State maps showing the 30-year mean data that have been compiled for use in the substation summaries.

Papers written since January 1, 1954 include:

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

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

Carter, H. 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 Georgia Department of Agriculture.

Carter, H. S. Degree Days in Georgia. Mimeographed (reproduced by Georgia Power Company for distribution to their offices over the State).

Carter, H. S. Tornadoes in Georgia. Mimeographed.

#### HAWAII AND PACIFIC AREA

Work with U. S. Geological Survey has included preparation of studies of the climates of Yap, Guam, Tinian, and Truk, as well as continuing liaison work on a variety of problems related chiefly to water supply. A field study with JOINT TASK FORCE SEVEN was made of the microclimates of Eniwetok Atoll. The Area Climatologist was in charge of an Office Naval Research- and National Research Councils-sponsored expedition to Jaluit Atoll to study the effects of a typhoon upon those islets. He is completing a comprehensive study of typhoon effects upon islands, under sponsorship of Office Naval Research. He cooperates in planning agro-climatological investigations, as at the Hawaiian Commercial and Sugar Company Plantation on Maui, T. H. and guides hydrometeorological studies being carried out by a Weather Bureau man on assignment (in leave status) to the Hawaii Water Authority. He acts as principal Weather Bureau liaison to Board of Water Supply, Public Works Officer and Agronomy Department of the U. S. Trust Territory of the Pacific, Public Works and Agriculture Departments, Government of American Samoa, Agricultural Marketing Service, Soil Conservation Service, Hawaiian Sugar Planters Association, Pineapple Research Institute, Cattlemen's Council of Hawaii, Civil Engineer Corps USA, and other private and governmental agencies.

Papers written since October 3, 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 Ocean on Air. A book (completed but not started during this period).

(All the above published or in press.)

#### IDAHO

A cooperative punched card agreement has been in effect with the University of Idaho, Moscow, since February 1957. Six long-time stations (mainly the experiment farm stations) have been punched.

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 Soil Conservation Service has been assisted in the collection and interpretation of climatic data for the county soil surveys.

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 stations; 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" (soon to be released), assistance was given to Tony Horn, State Horticulturist, in delineating climatic zones favorable for the culture of various fruits.

Papers written since January 1, 1954 include:

Stevlenson, D. J. Effects of Climate and Weather on Dairy Cattle. Written and presented during the Agricultural-Meteorology Institute 1957. Not published.

Stevlenson, D. J. Organization and Services of the Weather Bureau. Prepared for a local radio station, 1954.

### ILLINOIS

The cooperative punched card program with the State Water Survey is essentially completed with 63 stations' records punched back to 1900.

Assistance was given in a small preliminary survey of weather data available in the Chicago area for an air pollution study.

Probabilities of snowfall thresholds were published in the "Illinois Engineer". A freeze probability study has been made with the Agricultural Experiment Station. Soil moisture data from 3 locations are regularly forwarded to the Central Office for the National Weekly Weather and Crop Bulletin. A cooperative study is underway with the Illinois State Water Survey on the probability of dry spells; state publication of this study is planned. All "killer" tornadoes in the last 3 years have been field surveyed, plus some others. The State Climatologist has attended the annual October meeting of the NC-26 committee in 3 out of the past 4 years, and has worked closely with the Illinois member. In working with the Illinois State Natural History Survey, he performed a meteorological case-study of the migration of leaf-hoppers.

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. 2:56-63, February 1959. (Conway Publications, Atlanta, Georgia.)

Joos, L. A. Illinois Hail Storm of January 21-22, 1959 (approved for publication in Weatherwise).

Some "press release" type of mimeographed articles intended to have more lasting and general use than an ordinary release: Tornadoes in Illinois, 1956; Climate of Illinois (highlights; summary), 1957; Tornado Alley (12/18/57), 1958.

INDIANA

The State Climatologist is on the staff of the Agronomy Department, Purdue University, which is made up of teaching, research and extension personnel, and located in the largest building in the world devoted to the Life Sciences, and he is unusually situated for the furtherance of applied climatology. Close by are horticulturalists, ecologists, plant physiologists, agricultural engineers, along with the basic sciences and engineering on the campus of Purdue. This land grant college is the state center for agricultural research and instruction.

Purdue University has punched the weather records of 25 stations from the beginning of record to 1948. Ten stations were processed for the NC-26 precipitation probability study sponsored by the Agricultural Experiment Stations of north central U. S. Indiana probabilities will be given wide distribution when received. Other weather data in the state are being reviewed for quality and desirability for punching. A short summary of rainfall frequency at a southeastern Indiana station covering the haying season is planned. Funds are available for a temperature study by the end of the fiscal year. The cards were used to obtain degree hour summations of extreme temperatures which were then related to types of flora in various parts of the state.

Agricultural Engineers used punch card credit at NWRC to obtain hourly cards of three first order stations. These were used to help determine the possibilities of using evaporative cooling in poultry houses and in another study to find the availability of heat in the air for hay drying. Agricultural Engineers are calculating hourly solar radiation data using Indianapolis records for five summers. This work is with reference to solar power for farm operations, such as electric fences, etc.

Eight climatological summaries have been sponsored by business organizations in eight cities of the state. This was accomplished by employing part-time student help in the office (paid directly by the sponsor) for about 32 hours for each summary. Total cost of 2000 copies for printing and student help was \$59.35.

Three climatic summaries for county soil survey reports have been made. More of these will be developed in cooperation with State Soil Scientist, Soil Conservation Service and Agronomy Department, Purdue University.

A publication on Freeze Probabilities in Indiana is under way. This will be an Extension Bulletin of Purdue University written by Dr. F. H. Emerson, of the Horticulture Department, Prof. James Newman of the Agronomy Department and L. A. Schaal, the Weather Bureau State Climatologist.

Three soil moisture reports are furnished monthly for the National Weekly Weather and Crop Bulletin. These may become available more often as the season develops.

The State Climatologist attends the meetings of the state committee for the

National Inventory of Soil and Water Needs. Seminars and lectures in the new Purdue agro-climatological courses are occasionally given. Program material has been recorded for some farm directors of radio stations.

A trip is planned to southern Indiana with Purdue extension personnel to enlist first order stations in a short trial program of weather and haying advisory service.

Papers written since January 1, 1954 include:

Schaal, L. A. Early Weather Records in Indiana. Indiana Academy of Science, Proceedings 1957, Vol. 67, 1958, pages 265-267.

Schaal, L. A. Weather on the Forage Farm. Report of Progress in Research, Southern Indiana Forage Farm, Dubois, Indiana, Purdue University, ID-27 May 1958, page 55.

Schaal, L. A. Agronomy Farm Weather. Agronomy Farm Research, Purdue University, pages 6-7.

Schaal, L. A., Newman, J. E. Soil Temperatures at Corn Planting Time in Indiana. Mimeo AY-135, Purdue University, Agricultural Extension Service, April 1957.

Schaal, L. A., Newman, J. E. Forecast Use in Agricultural Operations. Topics, U. S. Weather Bureau, Forecasters' Forum, Vol. 16, No. 9, September 1957, pages 184-185.

Schaal, L. A., Newman, J. E. Using the 5-Day Forecast in Planning Weekly Agricultural Operations. Forecasters' Forum, U. S. Weather Bureau, Vol. 8, No. 6, October 1956, page 7.

#### IOWA

Cards prepared in the cooperative punched card program are being used in the NC-26 program studying the probability of precipitation in excess of prescribed values for specific periods of time. The cards also provided the means of preparing frequency distributions of soil temperatures; these distributions form the basis of a publication now nearing completion.

Probability of snowfall thresholds were computed for all first order stations in the State.

The probability of freeze dates was worked out both in terms of probability of freeze on given dates and as dates on which specified probabilities would develop.

A study of soil moisture-evapotranspiration has been underway, using both bookkeeping procedures and gravimetric sampling.

In cooperation with the Experiment Station, studies of temperature and wet bulb depression have been related to the problem of drying stored grain by circulating unheated air through it.

Papers written since January 1, 1954 include:

Elford, C. R. Soil Temperature Study (Coauthor).

Elford, C. R. What Makes the Weather, a series in Iowa Farm Science (Coauthor).

### KANSAS

Punched cards are now available at Kansas State College from about 25 cooperative substations' records in Kansas beginning January 1900. Assistance was given this project in selection of stations for areal distribution, length and quality of records. Much of the editing and interpretation of the records was done by the State Climatologist's office. Cards from 10 of these stations were used in the NC-26 Rainfall Probability Study.

A monthly weather release for the state is prepared for the Associated and United Press Associations for distribution to newspapers and radio stations over Kansas. Approximately 125 Commercial, Agricultural, Federal and State interests subscribe for this bulletin. Weather significant to agriculture is emphasized in these releases. Special bulletins or releases on outstanding phases of weather, as the drought, are also prepared as needed.

In cooperation with the Agricultural Marketing Service a map showing the date of the 50% and 10% chance of freezes plus the earliest freeze date in the fall together with a short summary was issued September 30, 1958, to the subscribers of the Weekly Weather and Crop Bulletin and the news agencies of the State. A similar bulletin carrying spring data is planned for issue at an early date.

Some initial work has been done on preparation of a Crop Calendar but as yet little more than average planting dates for some crops are available.

A weather summary for Hamilton County, Kansas has been completed for the Soil Conservation Service and more such summaries are anticipated.

Several times in the last two years engineers from the Soil Conservation Service have been in the office to copy detailed data from our station compilations.

Charts and graphs have been prepared from the record of approximately 1800 tornadoes in Kansas since 1859, showing the period of year and time of day when tornadoes are most likely to occur. Several talks have been made to local Service Clubs, in which these charts were found helpful.

The State Climatologist is a member of the following committees:

National Inventory of Soil and Water Conservation Needs, of Soil Conservation Service. Meetings are held as needed.

Agricultural Agencies Committee, composed of heads of Federal and State Agricultural Agencies of Kansas, meetings are held bimonthly. Weather appears to be a factor in most of the accomplishments of the agencies.

Weather Committee of Kansas State College, occasional meetings are held to determine and recommend to the College Authorities the data needed, location and type of stations needed at Experimental Fields, or Farms, and possible uses of data.

The feature writer of the Kansas Government Journal, published by the League of Kansas Municipalities, was furnished considerable material and assistance including the list of tornadoes mentioned below and the frequency charts of tornado occurrence in preparation of an article intended to arouse the interests of City Authorities in local Storm Warning Networks. This is to be published in the latter part of March 1959.

In addition to the news releases of the last year 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 since used with additions by The Fidelity State Savings Bank of Topeka, and reprinted in part in a feature item in the Weekly Kansas City Star Farmer, Kansas City, Missouri, March 18, 1959.

Robb, A. D. Outstanding Tornadoes in Kansas 1887-1958. A listing of the important tornadoes of the state that have had one or more of the following features: travelled a path of 50 miles, killed 10 or more persons, or caused at least \$50,000 damage.

#### KENTUCKY

The State Climatologist's office has worked on air pollution studies at the local level and with the U. S. Public Health Service at Cincinnati; there is monthly liaison on allergy-climate problems with the Kentucky representatives of the American College of Allergy. The State Climatologist is a member of the state committee on Water Resources Survey, and has provided Soil Conservation Service with assistance and advice in setting up two watershed precipitation networks. A study on freeze probabilities is now under way.

A summary of tornadoes that have occurred in Kentucky from 1890 through 1958 has been prepared with the project now under way to summarize these data for possible publication.

LOUISIANA - MISSISSIPPI

Health-climate studies have been undertaken in cooperation with Public Health Service and local Chamber of Commerce.

In cooperating with the State Conservationist, Soil Conservation Service, county climatic summaries for Claiborne and Tippah counties, Mississippi, and Acadia and Bossier parishes, Louisiana, have been prepared. A standard format for this type summary has been devised and data needed for the narration has been compiled. An analysis of precipitation records is underway in an effort to establish (a) the best substitute station record for counties where no long-term records are available and (b) to determine whether a recent short-term record of precipitation extremes (wettest year and driest year) can be reliably assumed to represent values for a much longer period of time.

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 ( $32^{\circ}$ ) 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 1916-57 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  $90^{\circ}$  or higher,  $32^{\circ}$  or lower, and chance of temperature  $20^{\circ}$  or lower occurring at least once during the winter;
4. Maps and histories of tropical storms affecting each state.

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 State Climatologist cooperates with Louisiana Experiment Stations in measurements of soil moisture and will begin collection of data in 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.

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.

#### MARYLAND - DELAWARE

Direct supervision is given the two punched-card cooperative programs with the Universities of Maryland and Delaware. Equipment and personnel are in the State Climatologist's office. Over 600,000 cards have been punched for Maryland and more than 100,000 for Delaware.

An auxiliary office is maintained at the University of Maryland, where the State Climatologist is present several days monthly for consultation with faculty members having research problems involving climatology. Visits are made monthly to the University of Delaware, where there is also active research in soil moisture and irrigation problems. In cooperation with specialists at both Universities, and with the Hydrologic Services of the U. S. Weather Bureau, programs for the IBM 650 electronic computer have been written and tested for daily computation from climatological data of the quantities involved in the soil moisture-evapotranspiration problem (see No. 2 and No. 3 in list of papers below).

Liaison is maintained with the Soil Conservation Service, Office of the State Conservationist; also with developments having climatological implications at the Beltsville, Maryland, headquarters of the Agricultural Research Service. Close cooperation is carried on with the Delaware Basin study of the Soil Conservation Service. Discussions have been held with representatives of the Water Resources Survey on county climatic summaries.

Work has also been done on snowfall threshold and freeze probabilities; drought occurrences; phenological data; survey of all tornado occurrences in Maryland and Delaware.

Papers written since January 1, 1954 include:

Engelbrecht, H. H. The Application of High Speed Computers in Irrigation Research. 1958. (Being submitted to the Bulletin of the American Meteorological Society.)

Engelbrecht, H. H. An IBM 650 Program for Computing Soil Moisture Deficiencies According to the Kohler Method. 1958. (Being submitted to the American Geophysical Union.)

Engelbrecht, H. H. Manual for Use of IBM 650 Program HHE001 - Potential Evapotranspiration (Thornthwaite or Penman) and Soil Moisture Accounting (Various methods). 1958.

Engelbrecht, H. H. Manual for Use of IBM 650 Program HHE002 - Potential Evapotranspiration and Soil Moisture Accounting (Kohler Method). 1958.

Engelbrecht, H. H. and Brancato, G. N. World Record One-Minute Rainfall at Unionville, Maryland. 1958. Submitted for publication in Monthly Weather Review.

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

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

Engelbrecht, H. H. Speed up Irrigation Research with High Speed Computers. 1958. (Mimeographed for local distribution.)

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

#### MICHIGAN

11 stations have been completed in the cooperative punched card program; 2 more are planned.

A winter wheat-weather relationship study is under way. 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," listed below. 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. Two more articles, based on these data, will be published this summer (1959) in the Michigan State University Agricultural Experiment Station Quarterly Bulletin. These are co-authored by R. Z. Wheaton and E. H. Kidder, MSU Agricultural Engineering Department, and are titled: (1) "Preliminary Report of Excessive Precipitation over Sloan Creek, a Small Watershed," and (2) "Variation in Summertime Rainfall in South-Central Michigan."

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 last summer to determine difference in wind velocities over the gages. These data are now being studied by this office and the Hydrologic Division.

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. 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.

MINNESOTA

Eight stations have been processed in the cooperative punched card program. This program has been inactive since 1953 but at present is being revived through the Director, Agricultural Experiment Station, Institute of Agriculture, University of Minnesota.

Data and comments were given to the air pollution study completed by State Public Health Service for City of St. Paul. Assistance in instrumentation and installation also given to Minneapolis Air Pollution Engineer in setting up his sampling stations. Groundwork for a histoplasmosis study to begin the spring of 1959 has been started with the Minnesota Public Health Service. Advice based on Weather Bureau records has been given to Minneapolis City Engineer in planning his snow removal budget, as well as use of degree days in computing fuel use for city buildings and institutions. The Park and Recreational Departments of both Minneapolis and St. Paul have been exposed to the completeness of Weather Bureau records, greater use of our data is now being incorporated in their programming.

A general weather narrative, similar to LCD Annual, and/or Climatological tables, has been furnished for approximately six county summaries.

Cooperation has been carried on with Soil Conservation Service on 5 projects; with the Agricultural Marketing Service and the University of Minnesota in a freeze probability study; with the Agricultural Research Service, University of Minnesota and Green Giant Company in a study of soil moisture and evapotranspiration; with the University of Minnesota in drought studies; with the Minnesota Highway Department and Minnesota Division of Waters in precipitation studies and with the University of Minnesota in a study of the growth of algae in the Mississippi River.

A study of Minnesota tornadoes 1916-1957 has been made in cooperation with the Minneapolis Naval Air Station.

The following paper has been written since January 1, 1954:

Strub, J. H., Jr. Disastrous Tornadoes Can Occur in Minnesota. Minnesota Municipalities, Volume XLIV, Number 4, April 1959.

MISSOURI

Cooperative punching of cards at the University of Missouri has been completed for several years. Major efforts are now directed toward encouraging use of the data in this form.

The State Climatologist has had an appointment as Research Associate in the Soils Department (where Climatology is housed) for the past three years, and works with Dr. Wayne Decker in his soil moisture-evapotranspiration study. A radar-climatology study has been started.

The State Climatologist will be coauthor with Professor Don Brooker, of the University of Missouri Agricultural Engineering Department, of a study of the climatology of grain drying, which is about ready to be submitted for publication.

The University of Missouri Agricultural Economics Department has begun a study of "The Effects of Climate on Resource Use and Enterprise Combinations on Missouri Farms," in which the State Climatologist is taking an active part. This study will examine the economically important decisions a farm manager must make, and devise ways in which both climatological expectancies, and short term weather forecasts can be more effectively used in farm management.

Stories have been issued through the facilities of the Extension Service during periods of critical weather. These have been concerned with drought, heavy rains, 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)

#### MONTANA

A cooperative punch card project has been in operation with Montana State College, Bozeman, for the past several years. About 100 stations are scheduled for card punching and currently over one-third of this goal has been accomplished. Assistance has been given in the editing and interpreting of the records. Cooperation has been carried on with Montana State College in an expanded phenology survey of that State. The year 1959 will be the third year for this survey, which now has been expanded to cover eleven western states. A third activity with Montana State College has been assistance with the preparation of a Montana Crop-Weather Calendar (published as Circular 22, Agronomy and Soils Department), assistance involving helping with questionnaire development and analysis, and meeting with the Extension Service to work out methodology for the survey.

A Water Resources Survey for each county of the State is under way by the State Engineer. For this project, the Montana Climatologist is preparing county climatic summaries, 22 of which have been written to date.

Probability of freeze data (both spring and fall) have been prepared for 26 representative points over the State; these data were released as a supplement to the Weekly Weather and Crop Bulletin once in the spring and once in

the fall. Special accumulations of precipitation (monthly, seasonal, and annual) are also prepared and released as supplements to this bulletin.

Active cooperation exists with the National Park Service in a series of continuing studies on the Grinnell and Sperry glacier in Glacier National Park. A new report is now being prepared which will bring these studies up-to-date. This will be in the form of a U. S. Geological Survey Professional Paper.

The State Climatologist cooperates with the State Snow Survey leader at Bozeman and in return the Weather Bureau obtains both soil temperatures and soil moisture measurements on a weekly basis throughout the year. The Agricultural Research Service is planning to install a neutron scatterer soil moisture set-up in the State College weather instrument enclosure, and a report on comparisons between this instrument and the existing resistance blocks is planned.

On a regular but routine basis, about 75 of the substations mail their monthly reports directly to Helena in order that special precipitation reports can be compiled for the River Forecast Center and Water Supply Forecast Unit.

Local climatological summaries, for Montana cities, have been prepared in cooperation with local Chambers of Commerce or service groups, based upon climatological station records for 30-year periods.

Papers written since January 1, 1954 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.

#### NEBRASKA

The cooperative card punching program is active, with some 20 station records all punched.

County climatic summaries are prepared for Soil Conservation Service. Material for a hurricane forecast guide has been prepared; also a statistical article on tornadoes in Nebraska.

Some work has been done to determine maximum range that may be expected in 30-year normals at Lincoln and at North Platte.

Papers written since January 1, 1954 include:

Stevens, W. R. Tornadoes in Nebraska. Bulletin of Nebraska Chapter of the National Council of Geography Teachers, Volume XXIII, No. 3, January 1955.

Stevens, W. R. Some Causes of Drouths in the Great Plains. Journal of Geography, Volume LIV, No. 6, September 1955.

#### 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 are now under way. Work has been carried on with members of the meteorology and chemical engineering departments at Rutgers on air pollution studies. Frequent contacts have been had with the New Jersey Department of Health on various climate-health problems.

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.

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.

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.

#### NEW MEXICO

The New Mexico College of Agriculture and Mechanic Arts has completed the punching of records for five stations in eastern New Mexico. This project was financed by the Soil Conservation Service in connection with the Great Plains program.

A ten year record of all blowing dust in the local area has been analyzed and

the storms classified as to severity. Average monthly and maximum daily duration of blowing dust was determined. The information is used extensively in answering inquiries where dust is a health or industrial problem.

Cooperation with the Soil Conservation Service includes some technical advice on climate in connection with the National Inventory of Soil and Water Conservation Needs, and in supplying precipitation data used in connection with their snow survey program.

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 U. S. Forest Service and the Soil Conservation Service.

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

A display of weather information was prepared for the 1958 annual convention of the New Mexico Cattle Growers Association. This display consisted of graphical representations of various climatic features of New Mexico, including an isohyetal map, seasonal distribution of rainfall, annual variation of rainfall, and normal temperature distribution. Several pertinent map-back articles were displayed along with samples of the various bulletins published by the Weather Bureau. The display received much favorable comment.

About five years of hourly wind records at sixteen hourly reporting stations in New Mexico have been analyzed. Wind roses and tabular data from this analysis will be published for these stations.

Under way is a study of daily solar radiation records for Albuquerque for an eight-year period. The relationship of cloud cover and sunshine to solar radiation is being investigated. This study will be presented in a paper at a future date.

A project is started to put important and frequently asked for State, National and World climatological data on cards for a visible card file. Such a file will make the information readily accessible for answering inquiries, and will be particularly useful when someone not familiar with the climatological files is called on to supply information.

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. Temperature Variability. Unpublished.

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.

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

Conferences on air pollution have been held with various state representatives interested in this field.

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. A publication on freeze probabilities (now in preparation) is to be issued jointly with Cornell University and 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. Mimeographed.  
Albany Weather Bureau Staff. New York State Weather. Conservationist -  
Vol. 11, No. 5, April-May 1957.

#### NORTH CAROLINA

A North Carolina Air Pollution Survey has just been completed, and is soon to be published. The State Climatologist's office prepared the meteorological and climatological portions of this report.

There is extensive cooperation with Civil Defense officials; fallout plots have been prepared from climatological data; both the State Climatologist and the Assistant State Climatologist are staff members of the North Carolina Civil Defense Organization and members of the State Radiological Fallout and Monitoring Committee, and take part in periodic Civil Defense exercises.

The State Climatologist is a member of the Soil Conservation Service Water Resources and Uses Committee.

Frequent consultations are held with the North Carolina Department of Conservation and Development; data and technical assistance are furnished in connection with industrial expansion projects.

The State Climatologist collaborated in the preparation of the North Carolina Hurricane Project report, which included information on the characteristics and paths of hurricanes which have affected or threatened the State.

There is close cooperation with the North Carolina Board of Water Commissioners; a text on North Carolina rainfall was prepared for their recent survey report.

One county soil survey is now in progress in cooperation with the Soil Conservation Service; the section on climate will be prepared by the State Climatologist's office.

The State Climatologist's office provides consultation service and data as required to various departments of the University of North Carolina, and North Carolina State College.

A listing and brief account of North Carolina hurricanes is being prepared, also a listing and brief account of North Carolina tornadoes.

Monthly (and annual) stories on the previous month's (and year's) weather are regularly prepared for publication in the Raleigh Times and the Durham Sun.

Annual reviews of the preceding year's weather are prepared for the Associated Press; these reviews are published by many newspapers in North Carolina and elsewhere.

Annual year-end reviews of the year's weather are broadcast over radio station WPTF.

Negotiations are under way for the installation of soil temperature measurements at the Research Farms of the North Carolina Department of Agriculture Division of Research Station.

The State Climatologist gives periodic lectures to graduate students in Sanitary Engineering at the University of North Carolina, and to various departments at North Carolina State College. Occasional lectures are also delivered to special groups meeting at these institutions.

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.

#### NORTH DAKOTA

Twenty station records have been transferred to punch cards by N. D. Agricultural College at Fargo.

Ozone observations are made three times daily.

Slides are exposed for rust spore studies; air samples are taken for the Atomic Energy Commission at times and fallout readings are made weekly.

Work is done with the Corps of Engineers on heavy rainfall problems, also on water content of snow; with Agricultural Marketing Service Statistician on freeze probability studies; with State Water Commission on drought studies and with North Dakota Crop and Livestock Reporting Service.

The following paper has been written since January 1, 1954:

Bavendick, F. J. F. J. Bavendick, North Dakota Climatologist, Points Out That Basin Has All Kinds of Weather. Williston Basin Oil Review, March 1958.

#### NORTHERN NEW ENGLAND

(Maine, New Hampshire, Vermont, Massachusetts)

The NE-35 cooperative project in agricultural climatology is active in all four states. Eleven stations have been card-punched in Maine; four in New Hampshire; five in Vermont; eleven in Massachusetts. The State Climatologist and his assistant are engaged in interpolating missing data to get these records ready for tabulation by electronic computers.

Visits are made to the State Universities, and by correspondence and in-person discussion, cooperation has been carried on in several research projects. Examples are a soil moisture-evapotranspiration study at the University of New Hampshire; a forecast from antecedent winter temperatures of the incidence of Stewart's disease in the sweet corn areas of Massachusetts; with the University of Vermont, research into weather factors in maple sap yield.

A study in medical climatology (the relationship between climate and multiple sclerosis) has been begun. Advice has been given to state and local officials in New Hampshire and Massachusetts on weather modification possibilities. Freeze-probability and drought studies have been made. A special study of New England tornadoes has been made and cooperation carried on with the Radar Weather Unit of the Air Force's research group at Blue Hill, Massachusetts Observatory in the investigation of severe local storms from the viewpoint of their climatological distribution.

Cooperation is also carried on with Civil Defense units and with Soil Conservation and Agricultural Research Service work in the area of responsibility.

Climatological Summaries for several cooperative substations are being planned. These are to be printed by the Universities of Massachusetts and New Hampshire.

The State Climatologist is a member of the state committees in New Hampshire and Massachusetts for the National Inventory of Soil and Water Conservation Needs.

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.

### OHIO

The first stage (for which money was appropriated) of the cooperative punched card program has been completed with the punching of records for 8 stations, all of which covered the period 1894 to date. The cooperator has been the Ohio Agricultural Experiment Station. Negotiations are now under way with another state agency for continuance of the project; and if requested appropriations are forthcoming, it is planned to punch records for at least another 25 stations.

A preliminary study of Cooling Degree Days and Discomfort Index has been completed; and arrangements have been made to collect energy consumption data for large air-conditioning installations in Columbus.

The principal project being pursued is the study of evapotranspiration and soil moisture, the object being to keep a running account of changes in available moisture. A new method has been developed for computing "actual" evapotranspiration from meteorological factors; and this is being subjected to continuing field testing.

An agricultural weather station is being operated on University Farm where soil temperature, soil moisture, evaporation and low-level wind are recorded in addition to the usual meteorological observations.

A comprehensive freeze probability study has been completed, and material presented for publication as an experiment station bulletin.

A program of routine soil moisture determinations at 5 experiment farms over the state has been inaugurated through the cooperation of the Ohio Agricultural Experiment Station. Using Coshocton-type blocks, moisture determinations are made weekly to a depth of 3 feet, and reported by card form to this office where the conversion is made from electrical resistance to soil moisture. This special network of moisture stations is amplified by similar observations made by the Agricultural Research Service in Coshocton, and by this office on University Farm at Columbus. Reported values are periodically checked for accuracy against gravimetric determinations made during the growing season. Evapotranspiration is routinely derived from these moisture

values thus obtained, and this is used to verify results obtained from the computing procedure mentioned above.

Papers written since January 1, 1954 include:

Pierce, L. T. Seven popular articles for Ohio Farmer magazine - three on Freeze Probabilities, one on unusual aspects of the 1958 summer, one on use of weather forecasts by farmers, and two on timely topics.

Pierce, L. T. Probability of Spring and Autumn Freezes. Ohio Agricultural Experiment Station Bulletin (in press).

Pierce, L. T. Seasonal and Short-term Fluctuations in Evapotranspiration from Meadow Crops. Bulletin of the American Meteorological Society, Vol. 39, No. 2, pages 73-78, February 1958.

Pierce, L. T. Effect of Crop Stage on Meadow Evapotranspiration. Manuscript.

#### OKLAHOMA

The cooperative punched card program with Oklahoma State University is temporarily inactive after having punched period of record for 24 stations. There is continued interest and almost certain future development. Data for 4 stations were used in a drought probability study in a paper on the economics of irrigation.

The State Climatologist is a member of the State Committee on the National Inventory of Soil and Water Conservation Needs and has attended two meetings covering organization, plans and procedures. Data has been furnished to several county work groups and in one instance hail probabilities were figured, average wind speeds estimated, and frequency of tornadoes were included.

Tables of long term means including the computation of mean maximum and mean minimum temperatures, and maps of average temperature, precipitation, and spring and fall freeze dates were furnished to 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 furnished to a local power company. They are presently using average dry and wet bulb temperatures for estimating load demands and have agreed to test the application of the sentient temperature approach. The State Climatologist has made some graphic comparisons between kilowatt hours used for air conditioning and sentient temperature cooling degree hours. Data will be furnished again in 1959 and correlation computations are planned at the end of the 1959 season.

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

Card punching has just been completed for the first such cooperative project with Oregon State College. This is a part of a planned "Weather-Herbage Yield Forecast Study." Results derived from this initial study may well be extended to other range areas of eastern Oregon. Other cooperative activities with Oregon State College have resulted in the establishment of a solar radiation station and the reporting of soil temperatures for publication. In addition, publication of data from three other soil temperature stations has been arranged.

The Oregon State Climatologist is a member of the Soil Conservation Service State Committee on Soil and Water Conservation Needs and in that capacity has provided lists of material available to the State Committee and has provided a unit kit of published or mimeographed data, pertinent to each county, to the county chairmen for their use in completion of the basic survey forms and charts.

Considerable liaison activity has been carried on with the State Water Board, Fish and Wildlife Service, State Board of Natural Resources, county-wide grain growers' associations and other groups concerned with the investigation of weather effects on their special interests, particularly where a much more dense network of data collecting stations is needed than is afforded by standard Weather Bureau practices. In these cases the State Climatologist has assisted in finding sources for purchase of instruments, establishing standard formats for recording data, made all reasonable effort to assure approved observational procedures are followed, aided in establishing a care of instrument program, arranged to receive one copy of all data collected and processed and has had Standard Description forms 531-1 prepared for all such supplemental stations. As a result the Portland State Climatologist office is now receiving (for other than Weather Bureau approved stations) hourly rainfall data sheets from 3 stations; once each 24 hours rainfall measurements from approximately 35 locations; hourly wind velocities from 2 locations, and three times daily wind velocity and direction from a third; daily maximum and minimum and in some cases hourly temperature from 7 radio stations; soil temperature from 1 and frost depth data from approximately 11 locations. Negotiations are now under way with the U. S. Air Force District Office in Portland to try to secure regular observations of hourly wind data (or on as frequent a basis as can be

regularly provided) from the several Air Force radar stations in Oregon atop high mountain peaks or ridges. No such information from locations of this nature in this State are available, but it is in frequent demand by a number of interests: e.g., The Pacific Telephone and Telegraph for construction of microwave tower networks over the State; Bonneville Power for construction of new high voltage transmission lines; various other tower construction work.

Participation of the State Climatologist in activities of the American Meteorological Society includes holding of office and membership on the executive committee of the Oregon Branch; active participation in a workshop of that group on the climate of smog in the Willamette Valley, and representing the workshop group in meeting with the Oregon State Director of Air Pollution Committee.

To supplement the climatic data already available for the State, the following additional mimeographed material has been prepared:

Oregon sub-freezing temperature data.

Monthly and annual average relative humidity at Weather Bureau and CAA stations in Oregon.

Maximum snow depths across central Oregon.

Index of Oregon weather stations by counties.

Studies underway in various stages of completion include: the probability of various snowfall amounts for representative stations, the probability of spring and fall freeze for all areas in the State, compilation of a statewide heating degree day paper, a tabulation and indexing of all major Oregon storms and a "Weather-fuel Consumption Study" which has been started by collection of detailed fuel records from a large apartment house along with complete weather records.

Papers written since January 1, 1954 include:

Sternes, G. L. Oregon Sunshine. Paper submitted to National Weekly Weather and Crop bulletin for publication.

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

A cooperative punch card program was started in 1956 with the Pennsylvania State University. Thirty-eight station records have been punched for the period 1926-1948. Selection of stations and interpolation of missing data has been completed. Analysis work is progressing in accordance with the NE-35 Program and discussions are underway concerning other projects for which the cards might be used.

Efforts are underway to establish a plan for collecting frost depth data from all sections of the State. Cooperation has been established with members of the Pennsylvania Cemetery Association for supplying average and maximum depth data for each winter season. A statewide map of mean depth penetration will be produced from the supplied information.

A plan for machine preparation of data for Substation Climatological Summaries has been worked out with the Pennsylvania State University and one summary has been prepared as a pilot project.

A cooperative project with the State representative of the American Academy of Allergy has been started on the possible relationship between asthmatic outbreaks and weather in the Pittsburgh area.

At the beginning of the 1959 maple season a successful plan was worked out with the growers in Somerset County for special maple weather forecasts supplied by WBAS, Harrisburg to be distributed by the local radio station throughout the maple season.

Periodic assistance is given to the Agricultural Extension Service of the Pennsylvania State University by supplying information that makes possible a seasonal forecast for the following summer, of the presence or absence of bacterial disease throughout the State.

Successful efforts have been made with the Pennsylvania Department of Internal Affairs for including climatic data in their annual publication, "Pennsylvania Statistical Abstracts."

Considerable climatic information was supplied to the Aero Service Corporation for use in a publication, "Teaching Pennsylvania Geography."

Cooperation is carried on with the state Civil Defense organization, Soil Conservation Service and U. S. Geological Survey. Contacts are maintained with the state Department of Forests and Waters, Pennsylvania Bureau of Community and Industrial Development and the state Vacation and Travel Development Bureau.

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

No cooperative punched card program is in effect although the Experiment Station is definitely interested in one.

There has been limited cooperation on an allergy study with the Veterans Administration Hospital and with the University of Puerto Rico School of Tropical Medicine on the effect of wind and rainfall on sand flea activities.

There has also been cooperation with the Agricultural Experiment Station on the raising of cantaloupes in Puerto Rico; with the Federal Experiment Station in Mayaguez in the development of an instrument to measure duration of dew in regard to Sigatoka disease of bananas; with the Puerto Rico Agricultural Experiment Station in the planning and setting up of more complete climatological stations at each of five experimental farms; and with the Puerto Rico Water Resources Authority in the establishment of observational facilities and in the tabulation and presentation of the data collected at two sites in the western portion of Puerto Rico in anticipation of the construction of a nuclear reactor for power production.

Cooperation exists with the Puerto Rico Nuclear Institute at the University of Puerto Rico in Mayaguez in the processing of data from a rather complete station that they have recently established. Work has been done with the Institute of Marine Biology of the University of Puerto Rico in Mayaguez, and with the Science Department of Interamerican University in San German.

A project is under way to take a census of all of the rain gages located on the Island.

The Soil Conservation Service has recently begun a Watershed program in Puerto Rico and is currently working in the Añasco Valley and have contacted us for assistance in collecting the required information.

The U. S. Geological Survey is quite active in Puerto Rico and the Virgin Islands in ground and surface water surveys. Water supplies constitute a recurring problem in the Virgin Islands and in several sections of Puerto Rico, primarily in the southwest where increased industrial activity has greatly increased the demand for water.

Liaison is maintained with Army, Navy and Air Force installations and with the Puerto Rico Water Resources Authority. Recently, a program for the distribution of trees was prepared by the U. S. Forest Service on the basis of rainfall data.

Increased industrial expansion, engineering and construction work accounts for a large number of requests by private concerns.

The Territorial Climatologist is now serving his second term as President of the San Juan branch of the American Meteorological Society.

Several trips have been made to the Virgin Islands to reactivate the substation network there. Work has been done with the Virgin Islands Chamber of

Commerce to obtain more adequate climatological publications; arrangements have been made for supplemental climatological tabulations for two locations in the Virgin Islands.

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.

#### SOUTH CAROLINA

Eighteen substation summaries were prepared in cooperation with state and local Chambers of Commerce, state and local Boards of Development, other government and private agencies which helped by defraying the cost of printing and sometimes helped in the labor of preparation. These summaries were furnished to all Weather Bureau stations in and around South Carolina. These were prominently featured in brochures designed to attract industry.

Close cooperation was developed with Clemson Agricultural College. Conferences have been held about 2 to 4 times yearly, with members of the South Carolina Experiment Station and the Agronomy Department. An agreement was reached, in which common efforts would be pooled for developing and publishing climate and crop climatic studies. So far, 2 such papers have been published, 1 on the general climate and the 2nd on freezes (see listing of papers). About 3000 copies of Climatic Series #1 have been distributed to private and governmental agencies, as well as to libraries of secondary and higher schools. Climatic Series #2 on "Freezes", being more technical, received a distribution suitable for industrial, agricultural, commercial and governmental use. It is planned to publish several others during 1959.

Developed conversion tables and charts for potential evapotranspiration, based on Penman Formula for the use of Clemson College. This was needed by the soil scientists for soil moisture studies. For the past three years daily potential evapotranspiration was published during the crop year. Experiment stations often request climatic data for special local studies and these are furnished promptly.

A study was made of frequencies of wet and dry bulb combinations and effective and sentient temperatures. With the use of the new discomfort index, it is planned to devise conversion schemes. These matters were discussed with several air-conditioning and consulting engineers and allied interests.

A paper, recently submitted for editorial release, titled "Climate and Corn Yield in South Carolina" has been tested during the 1958 crop year by the Crop Reporting Service. Significant estimate results were obtained.

Papers written since January 1, 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. and Purvis, J. C. Climatic Data for Air-Conditioning in South Carolina, October 1957 - Mimeographed - Distributed by the Weather Bureau to State and Area Climatologists, as well as to interested engineering establishments.

Kronberg, N. Climate, Kind and Bracing. 1957 Yearbook, S. C. Department of Agriculture, pages 25-30.

Kronberg, N. S. C. Climate for 1958 Yearbook to be published during April 1959.

Kronberg, N. and Purvis, J. C. Climate of South Carolina, Series 1. Published by S. C. Experiment Station, July 1958.

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

Kronberg, N. and Purvis, J. C. Freeze Analysis for South Carolina, Climate of South Carolina, Series 2. Published by South Carolina Experiment Station, December 1958.

Kronberg, N. and Purvis, J. C. Corn and Climate in South Carolina. Submitted for editorial clearance to Central Office 3/13/59.

Purvis, J. C. Peach Hazards in South Carolina. Will be submitted to Central Office for editorial release before April 15, 1959.

Kronberg, N. and Purvis, J. C. Precipitation Frequencies in South Carolina. Will soon be revised for editorial release. Expected publication, October 1959.

Kronberg, N. and Purvis, J. C. Climate and Cotton in South Carolina. Preliminary stage, material being surveyed. Publication not expected before end of year.

SOUTH DAKOTA

A cooperative punched card program was started with South Dakota State College in 1952, and the full record has been punched cooperatively for about 60 stations. Partial records are available for about 10 others. Hourly cards for Huron have been punched beginning with 1940.

Weekly summaries of weather data were made for individual stations and also for seven specific areas. Occurrences of last spring and first autumn temperatures of 32°, 28° and 24° were tabulated for 58 stations. Frequencies of maximum and minimum temperatures in 5° class intervals were studied.

Daily estimates of evapotranspiration and soil moisture have been made using an adaptation of the Thornthwaite method, for 25 stations having records of about 50 years. From these, an attempt was made to define the frequency of agricultural drought. An estimate of the mean variation of soil moisture through the year was obtained.

Apart from the punched card project, a study of blizzard deaths is underway. Steps leading to fatal exposures are being statistically analyzed. Another study, almost completed, is the summarization of 55 years of river ice thickness at Huron. Ice accretion has been related to the weekly mean temperature, and dates of freeze-up and break-up were studied.

Climatological statistics have been used to prepare local forecasting methods for predicting maximum temperatures and the occurrence of precipitation.

The State Climatologist serves also as the Weather Bureau's State Civil Defense and aviation liaison official. Other agencies have been given assistance with the weather portions of studies relating to wind game, animal husbandry and water supplies.

TENNESSEE

The State Climatologist has taken part in both local and statewide air pollution studies. He has served as consultant to Dr. L. D. Zeidberg of Vanderbilt University, director of 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. He 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 by

Mr. R. C. Wanta of Weather Bureau Research Station, Cincinnati, 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 Dr. Pickett, Head of the Horticulture Department in the preparation of a paper on freezing temperatures in Tennessee. This will be published as a bulletin of the Agricultural Experiment Station. 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. Assistance has been provided the Agricultural Experiment Station in a number of projects having climatological implications including (a) a forecasting scheme for tomato late blight, (b) the relationship of army worm outbreaks to drought and (c) a Solar Poultry House. This assistance has consisted of discussing the relation of climatological variables to the problem, making available the required climatological data and providing, where needed, references to literature. Considerable interest has been shown by Experiment Station personnel in a punched card program, and a small program will probably be entered into within the next year. Since lengthy records for 21 Tennessee locations are already available on punched cards as a result of Tennessee Valley Authority and U. S. Department of Agriculture studies, a most important consideration is utilization of these existing 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, 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 Water Resources Division, responsible for investigation of water resources in the State, is also interested in the use of the Weather Bureau's punched card resources. Climatological analyses dealing with the feasibility of artificial lakes in certain parts of the state have been furnished to the Tennessee Fish and Game Commission. Discussions have also been held with the Wildlife Investigations Leader of the Fish and Game Commission on the use of climatological data in quail population and in squirrel food supply investigations. In cooperation with the Soil Conservation Service, climate sections of future county survey reports are to be 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.

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 provides 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 will be included in a forthcoming State Department of Agriculture publication. Monthly and annual heating degree days have been computed for a network of 35 stations across the state. As one of a series sponsored by the University of Tennessee Botany Department, and dealing with the physical nature of the Southern Appalachian area, a lecture was given on the "Climate of the Southern Appalachians". An outgrowth of this has been the preparation of a paper "Some Climate - Altitude Relationships in the Southern Appalachian Mountain Region" which considers temperature, daily temperature range, growing season, potential evapotranspiration and snowfall. 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) and "Tennessee Tornado Fact Sheet" (published as W. B. Letter Supplement 5907).

Papers written since January 1, 1954 include:

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? Accepted for publication in Monthly Weather Review, January 1959.

Dickson, R. R. Some Climate - Altitude Relationships in the Southern Appalachian Mountain Region. Accepted for publication in the Bulletin of the American Meteorological Society.

Dickson, R. R. Meteorological Factors Affecting Particulate Air Pollution of a City - A Solution by Graphical Correlation (will be submitted for publication after modification and inclusion of additional data).

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.

TEXAS

The State Climatologist has served as a consultant to the authors of "An Appraisal of Air Pollution in Texas", published by the State Department of Health. This has entailed furnishing advice on climatological matters, participating in planning conferences, and making interpretations.

The concept of discomfort indices, climograms, and possible influences of different meteorological variables on the variability of growth rates of children at five Texas locations was introduced and explained to Dr. Jessie Whitacre, Texas A&M Department of Home Economics. The State Climatologist assisted in collecting required data, reviewed and commented on the completed manuscript.

"Late Spring and Early Fall Low Temperatures in Texas" has been prepared in cooperation with the Texas A&M Experiment Station. This study for some 92 stations includes maps of probabilities of occurrence at the 5, 20 and 50 per cent levels.

Investigations with the Agricultural Marketing Service on methods to improve yield predictions of major crops are being made. Computation of the relative variability of rainfall for selected stations is underway.

The State Climatologist serves as one of two Weather Bureau representatives on the State Committee, National Inventory of Soil and Water Conservation Needs.

Discussions have been held with Soil Conservation Service personnel responsible for the supervision of the county surveys. County climate summaries have been reviewed, changes and additions suggested and additional information provided.

The Texas A&M Department of Economics and Sociology has issued three publications relating farming and ranching risks to rainfall. The State Climatologist has provided rainfall data and discussed with various members of the department characteristics of rainfall regimes in Texas.

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

The U. S. Geological Survey and the Texas Board of Water Engineers have consulted with the State Climatologist about various climatic classification systems. Discussions of major classification systems with both groups have been held.

The Bureau of Reclamation has become interested in mapping dew frequency and amounts. The State Climatologist has reviewed the available literature and advised them of the paucity of information available in the southwest. He also provided them with appropriate references to investigations being conducted elsewhere in the world. The Bureau of Reclamation has been provided

with extensive climatological data.

Guidance has been given various Weather Bureau offices in preparation of crop calendars. These have been reviewed and suggestions made for some modifications.

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

Weather statistics were updated and the weather copy of the climatological section of the Texas Almanac was prepared.

During the past three summers the State Climatologist has conducted a training program for university meteorology students in Climatology.

Regular climatological station data, as well as precipitation data from the Hydrologic Bulletin, have been placed on punch cards under the cooperative agreement with the Texas Board of Water Engineers.

The following paper has been written since January 1, 1954:

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

#### UTAH - NEVADA

Two cooperative punched card projects, one with Utah State University at Logan and one with the University of Utah at Salt Lake City, have been completed. Several weather-crop summaries for locations in Utah are planned for publication by Utah State University, using the punched cards. Work has been done with the Utah Department of Health in an allergy study in Salt Lake Valley, and arrangements were made for 35 storage gage stations of the Soil Conservation Service to be brought into the Weather Bureau network in 1957. The State Climatologist served on the climate committee of the Western Regional Technical Work Planning Conference for Soil Survey; and is a member of the Sevier River Basin study group, a group of Federal, State, and University representatives set up to study water problems in the Sevier Basin of Utah.

The State Climatologist works closely with the Chief Hydrologist and the Research Forecaster at Salt Lake City on projects of mutual interest, and writes county Soil Survey reports for the Soil Conservation Service, upon request.

Papers written since January 1, 1954 include:

Brown, M. J. The Relation of Climatic Factors to the Yield of Winter Wheat in Boxelder County, Utah. Accepted for publication in the Monthly Weather Review.

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. Use of Weather Data in the Heating and Air Conditioning Industry. Not published.

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.

### VIRGINIA

There have been a number of exchange visits between this office and the divisions of Virginia's Land-Grant College, Virginia Polytechnic Institute, at Blacksburg, Virginia. Interest (especially within the departments of Agronomy Agricultural Engineering, Agricultural Economics, Horticulture, and the Extension Service) has increased as we have been able to provide them with information and data for their publications and/or use in their research and studies. Two major items include (1) the Weather Data Section of the 1959 Agronomy Handbook which was reworked and brought up-to-date by this office; and (2) isoline charts for Virginia were furnished on request for distribution to the divisions as follows:

- a. Mean Maximum temperatures for January 1931-1952
- b. Mean Maximum temperatures for July 1931-1952
- c. Mean Minimum temperatures for January 1931-1952
- d. Mean Minimum temperatures for July 1931-1952
- e. Highest temperatures of record
- f. Lowest temperatures of record
- g. Average last Spring date temperature 32° or lower, 1931-1952
- h. Average first Fall date temperature 28° or lower, 1931-1952
- i. Average number of days between mean date last freezing temperature in Spring and first in Fall (growing season) 1931-1952
- j. Annual average precipitation 1931-1952
- k. Average precipitation April through September 1931-1952
- l. Average annual snowfall 1931-1952
- m. Tracks of principal tropical storms moving through or near Virginia

(These charts were printed through the courtesy of the Virginia Water Resources Board in exchange for copies for their use.)

Interest has increased in a cooperative punched card program.

The Weather Data Section was prepared for the 1957 Virginia Farm Statistics, a bulletin published by the Agricultural Statistician and the Crop Reporting Services (Virginia Dept. of Agriculture and U. S. Dept. of Agriculture).

The Soil Conservation Service is being assisted in the collection, checking and preparation of climatic data for Virginia soil surveys.

Monthly Climatological Summaries for Richmond are prepared for release to

Press and other information agencies at the end of each month, covering the new month.

Work continues toward expanding the narrative and chart sections of the Climate of the States for Virginia for local consumption.

Aviation studies started but incomplete:

1. Extension of available frequency distributions of ceilings and visibilities at Richmond's Byrd Field, 1938-1957
2. Extension of Windrose Summary (16 points) for Richmond's Byrd Field, 1938-1957
3. Frequency distribution times beginning of thunderstorms, Richmond's Byrd Field, 1938-1957.

Lectures were prepared and delivered for two Virginia Aviation Workshops. Civic Clubs, schools, Civil Air Patrol groups, were among those extending invitations for appearances to present aspects of weather and Virginia Climatology. Field trips were for the purpose of discussing climatological subjects of interest to county agents, agricultural experiment station personnel, as well as State and Federal agencies in Commerce, Marketing, Water Resources, and Aviation.

#### WASHINGTON

Cooperative punch card projects have been initiated at the University of Washington, Seattle, and the State College of Washington located at Pullman. Both projects are rather small in scope, with five stations punched at the University of Washington and one at the State College. Editing of the records and the preparation of instructions have been done by the State Climatologist. Assistance was given the State College in the analysis of the Prosser Experiment Station record (the one station punched) 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 will be used to assist agricultural engineers in the proper design of sprinkler irrigation equipment. At the request of Agricultural Marketing Service, the Agricultural Extension Service and the Agricultural Experiment Station, three detailed publications have been prepared on the probability of freezing temperatures (for all critical temperature levels) for all sections of the State. Brief excerpts from these publications are released in the spring and fall through a supplement to the Weekly Weather and Crop Bulletin. In addition, special temperature and precipitation tabulations are prepared and released through this publication when deemed advisable by Agricultural Authorities.

For the State and U. S. Department of Health, assistance has been given in the preparation of a preliminary report on air pollution problems in the State of Washington. Through cooperation with the U. S. Geological Survey, snow and precipitation reports are being obtained from a number of remote mountain locations, several of which are now being published in the Washington Climato-

logical Data. Arrangements were made with the State College and Agricultural Experiment Stations for the installation of soil temperature equipment at four key points and the publishing of this information in the Washington "Climatological Data."

Assistance was given the State College in establishing a solar radiation station to be included in the network of stations published by the Weather Bureau.

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

A listing of all climatological records by counties is being prepared.

Future plans include:

Computation of the normal heating degree days for stations in the State where "temperature normals" for the period 1931-1955 are available.

Preparation of a card file listing severe storms which have occurred in the State.

Preparation of a Climatological Summary for the Puget Sound area, going into some detail on those features of the climate which are of major interest to business and industry in planning future developments.

Papers written since January 1, 1954 include:

Phillips, E. L. Probable Occurrence of Freezing Temperatures in the Walla Walla and Yakima Valleys of Washington. Mimeographed, February 1958.

Phillips, E. L. Probable Occurrence of Freezing Temperatures in the Wenatchee-Okanogan Fruit Producing Area in Washington. Mimeographed, February 1958.

Phillips, E. L. Probable Occurrence of Freezing Temperatures in Washington During Spring and Fall. Mimeographed, April 1957.

#### WEST VIRGINIA

Twenty-four stations have been punched for the period 1926-1956 in cooperation with West Virginia University.

#### WISCONSIN

NC-26 weekly summaries for eleven Wisconsin stations have been completed with the University of Wisconsin.

Allergy studies have been carried on with the University of Wisconsin Hospital; a study of mongolism and cataract incidence with weather with the University of Wisconsin Diagnostic Center; freeze probabilities study for the Cranberry Bulletin, in cooperation with the Wisconsin and U. S. Departments of Agriculture; study of agro-climatic relations with the University of Wisconsin; study of incidence of outstanding tornadoes for the Wisconsin Department of Education and, in progress, a "Climatology of Outstanding Wisconsin Tornadoes."

Papers written since January 1, 1954 include:

Bryson, R. A., Lahey, J. F., Waite, Paul. September Rains in the Upper Midwest. Unpublished.

Waite, Paul. Wisconsin's Average Winter Snowfall. Wisconsin Academy Review, Winter 1958.

Waite, Paul. Cranberry Weather Hazards. In special bulletin No. 70, Cranberries of Wisconsin, December 1957.

#### WYOMING

A cooperative punch card project has been in operation with the University of Wyoming for the past three years. During this period, a total of 18 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 is under way on freeze probabilities and a rainfall probability paper has been prepared.

A solar radiation station has also been arranged with the University and data are being furnished the Weather Bureau for publication.