

SWS Contract Report 339

**REGIONAL
CLIMATE
COORDINATING
OFFICE
RCCO**

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by

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INTRODUCTION

The Regional Climate Coordinating Office (RCCO) was established in Champaign, Illinois, in September 1981 as part of a plan devised by the North Central Regional Research Committee, "Characterization of the Climate and Assessment of its Impact on Agriculture and other Renewable Resources." This committee, identified as NC-94, developed a regional intergovernmental climate program within an existing institutional framework for a 12-state region (Fig. 1). The overall goal of the NC-94 Plan, entitled, "A Regional Intergovernmental Climate Plan for the North Central United States," was to develop an infrastructure to coordinate climatic studies, advisory services, and data management activities in several states. The key components of this plan are 1) the 12 State Climate Centers in the North Central Region, and 2) the Regional Climate Coordinating Office. The funds for the RCCO are provided by the National Climate Program Office (NCPO) and the State of Illinois.

The State Climate Centers are the foundation of the regional program. They are the primary contact between the users of data and information and the NCPO, National Weather Service (NWS), and other federal and state agencies. They are able to focus their efforts on the user needs to obtain the maximum local benefit. The main program components of each State Climate Center are: 1) advisory services; 2) acquisition of data; 3) expansion of climatic data bases for special studies and special needs; and 4) involvement in climatic impact assessment and research.

The primary purposes of the RCCO are 1) to improve the efficiency and effectiveness of the State Climate Centers, and 2) to offer a means for all federal agencies involved in climate to have a focal point for communications

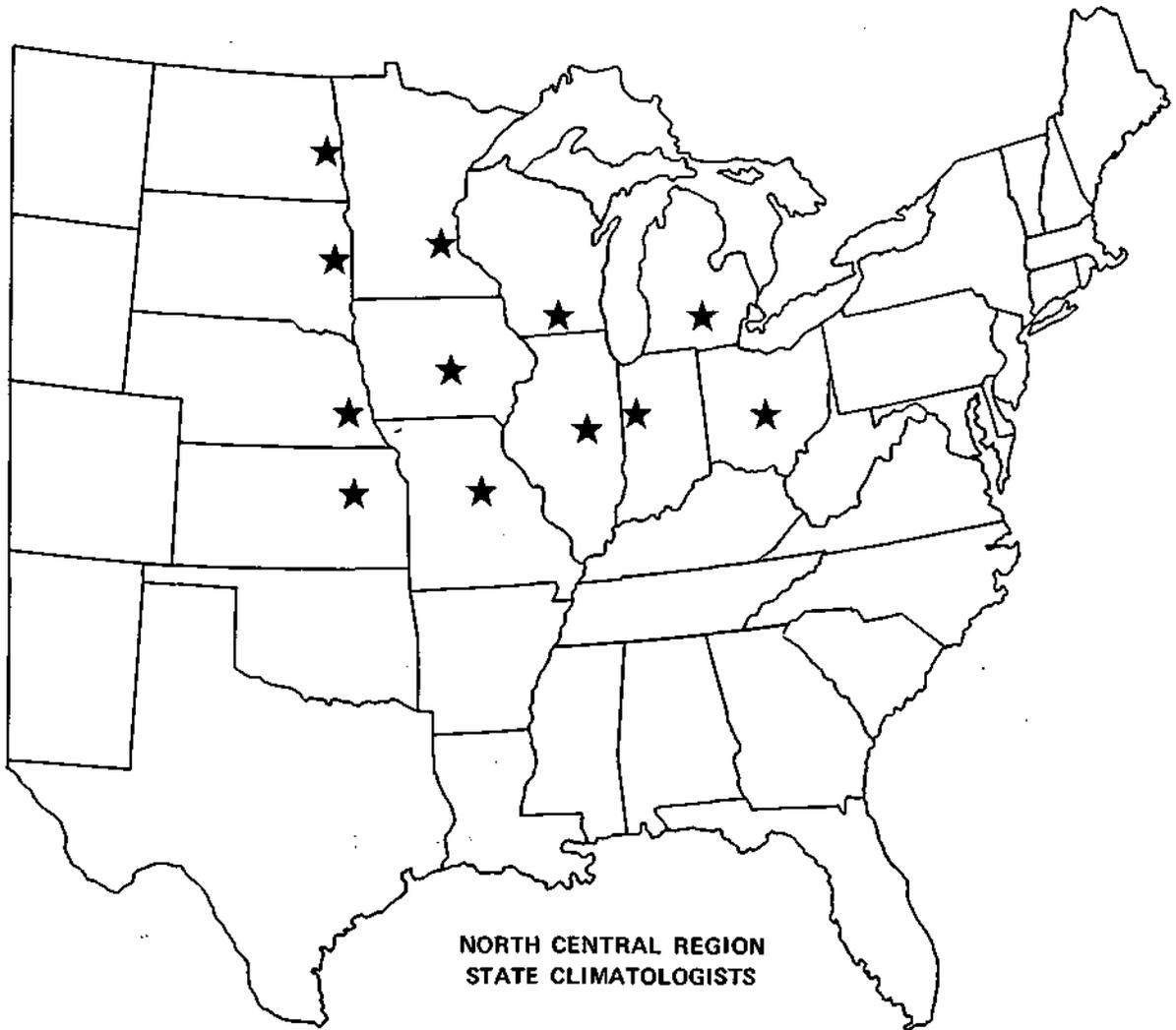


Figure 1. North Central Region and locations of State Climate Centers

and cooperation with the states (Fig. 2). The major tasks or responsibilities of the RCCO are: 1) program management of projects and funds allocated from federal and other non-state sources for regional work; 2) management of regional climate data, special data networks, and the near real-time collection of climate data; 3) development, promotion, and coordination of regional climatic research and impact studies; and 4) liaison with federal, state, regional, and private groups within and outside the North Central Region. The RCCO performs the management and the coordinating roles for the regional research committee, and obtains guidance and oversight from NC-94.

The RCCO is part of the 4-year climate project designed by the NC-94 Committee: 1) to upgrade the climatic services and research within the North Central Region; and 2) to demonstrate the feasibility of the regional approach for the coordination of state climate services. The funds for RCCO are provided by the NCPO and the State of Illinois.

This report summarizes the accomplishments of the RCCO in its second year (1 September 1982 to 31 August 1983) by reviewing the progress the RCCO has made in the four major tasks assigned by the NC-94 Climate Plan. A summary of the benefits of the RCCO in the past year are also presented.

SUMMARY

The RCCO during the past year has visited and worked with many federal, state, and private agencies and groups within and outside the North Central Region. This work has been summarized using the responsibilities defined by the NC-94 climate plan. A general philosophy which has evolved in the first two years of the RCCO is that the Center is a facilitator to help transfer in-

PROPOSED LINES OF COMMUNICATION

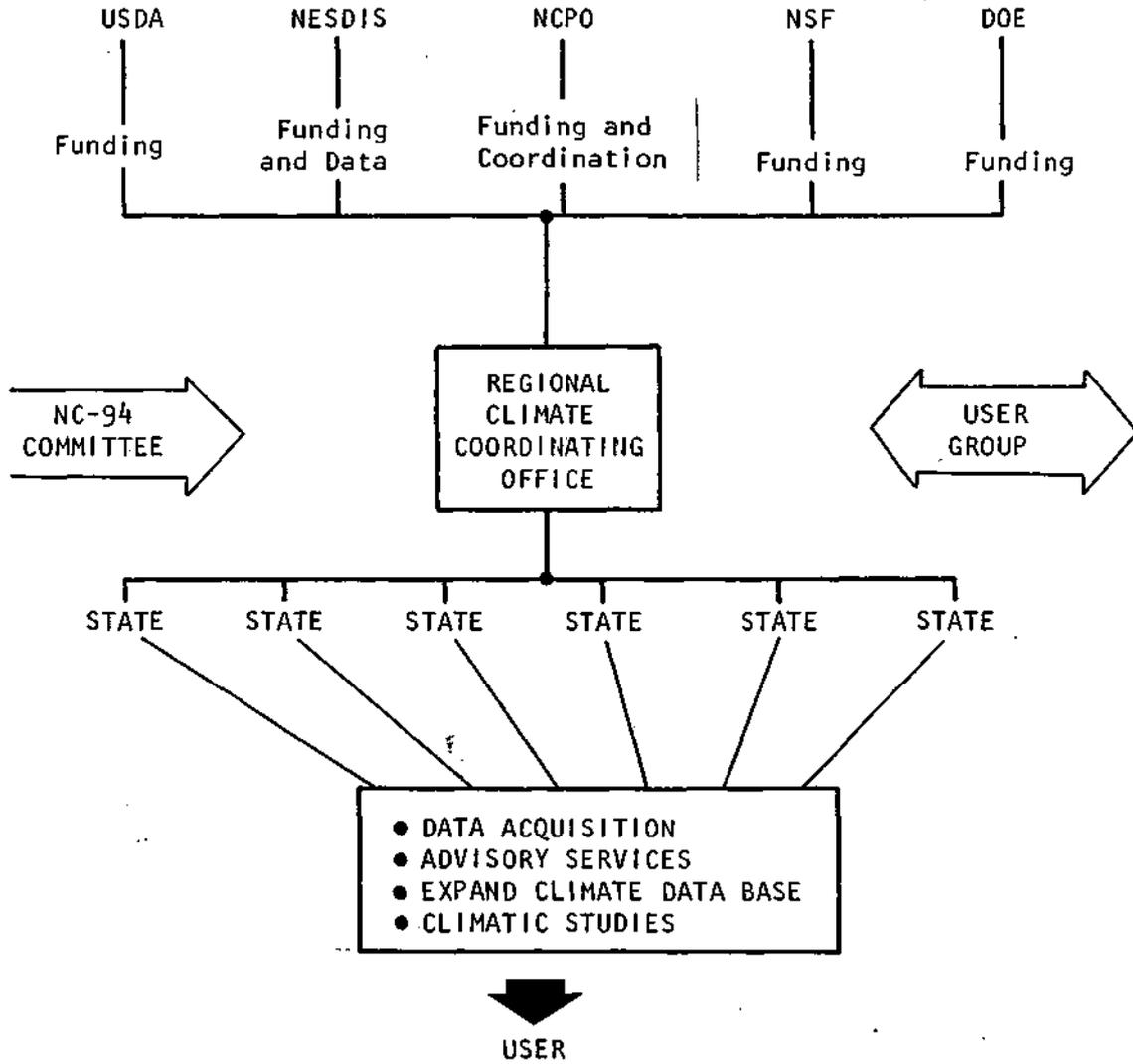


Figure 2. Lines of communication and structure of State Climate Centers at conclusion of NC-94 Climate Plan.

formation, ideas, and advice. It is a clearinghouse of not only data and data sources, but of concepts and plans. The RCCO is able to summarize ideas and present them to involve groups. To this end, we the RCCO is not just a generator of routine climatic products, but rather a facilitator and source of ideas, information, and plans, and an innovator of raw techniques and systems.

Benefits during the past year have accrued from many different groups and in many different forms. Table 1 summarizes some of these benefits and activities according to various sectors and by general topics. Detailed information about the various ways in which the RCCO has interacted with the various groups are given in the body of this report. The numbers after item, refer to pages in this report referring to these activities.

The activities of the RCCO have impacted greatly on the activities of the NC-94 committee which is addressing "Characterization of the Climate and Assessment of its Impact on Agriculture and other Renewable Resources" in the 12-state region. This committee serves as a body to approve of the activities of the RCCO, and helps make RCCO activities accountable in the region. In fact, one of the four objectives of the NC-94 committee is to "Implement these aspects of the National Climate Program that Pertain to Agriculture and Renewable Resources." These activities are primarily vested with the Regional Climate Center which is located at the Illinois State Water Survey in cooperation with NC-94. The NC-94 provided a subcommittee which was chaired by Professor Wayne Decker of the University of Missouri and State Climatologist of Missouri, to directly oversee the RCCO activities and to provide advice and guidance.

The NC-94 has three other objectives that are all being served partially by the RCCO. The first of these is "Use of Available Data to Characterize the

Time and Space Distribution of Climatic Parameters that Relate to Agricultural Production." Seven of the 12 states in the region have work in progress toward this objective. A variety of activities involving the provision of data and information to scientists and to other agricultural users in the region were performed during this period. Some of the data provided were furnished to the states by the RCCO.

The second NC-94 objective is to "Extend and Improve the Climatic Data Base as a Means to Increase the Efficiency of Agricultural Production." All 12 states had activities that addressed this objective during this year. For example, Kansas added 9 automatic weather stations, Ohio had 8 operational automatic weather stations, and Nebraska operated 17 such stations. In addition to automatic stations, near real-time operational climatological data systems were expanded and improved in Illinois, Minnesota and Missouri. The integration of these activities, including the beginning of a set of guide lines as to how to properly expose and operate these networks, so as develop unified data bases was aided by RCCO.

The third objective of NC-94 is "To Organize Project Results and Information into Forms Readily Available to Users." Ten of the 12 states sponsored activities that addressed this objective. The primary activities were AGNET in Nebraska, the FACT system in Indiana and CLASS in Illinois. The entire ROSA effort of RCCO and the National Weather Service is a part of this general objective.

Table 1. Summary of RCCO Activities in 1983.

- A. Educational Assistance to States and Climatologists in Region
 - * Programming for climate service and research (9,18)
 - * Data analysis techniques (9,18)
 - * Briefings on current events and new findings (16,25)
 - * Visits to state universities and staffs (9,13)
- B. Increase Understanding of Regional and State Climates, and Climate Impacts
 - * Article on unusual winter 1982-83 climate written (23)
 - * Article on unusual summer 1983 climate written (24)
 - * Normal maps for North Central Region being prepared (20)
 - * AAAS symposium on climate inputs on agriculture arranged (27)
- C. Assistance to Industry and Commerce
 - * Study of climate change in hail for CHIAA (16)
 - * Act as a clearinghouse of information (18)
- D. Assistance and Advice to Government
 - * State Climatologists data, analysis techniques, ROSA (9-13,14,17,25)
 - * Federal agencies and congress (9,16,25,26)
 - * State Universities (9-13,25)
- E. Advice to Regional Research Programs
 - * Pest and Weather (NC-166) Corn Group (24)
- F. Organization of Regional Research and Services in Key Issues
 - * Integrated pest management (20)
 - * Climate change (21)
 - * Soil moisture (20)
 - * Missouri-Illinois data exchange (23)
- G. Advise and Facilitate National Weather and Climate Programs
 - * Central Region (16,26)
 - * NESDIS - NEDRES (16,24,26)
 - * NCDC (26)
 - * NCPO (26)
 - * USDA (26)
 - * Provide testing site for users (CAC) (9)
 - * Clearinghouse for regional information on data and people (17,26)

PROGRAM MANAGEMENT

The RCCO responsibilities in program management are to 1) evaluate and monitor regional programs, 2) monitor the activities of State Climate Centers, and 3) prepare requests for regional funds. During the past year the RCCO has continued to maintain contact with the 12 State Climate Centers within the North Central Region, and prepared or began the preparation of requests for funding of research and a data inventory project.

The RCCO monitored the activities within State Climate Centers by letter, phone, memos, and some visits during the second year. A visit to each of the 12 states, as was done during the first year, was not considered to be productive at this time. However, the RCCO was willing to visit any state that might require assistance from the RCCO. Some of the climate-related activities within the 12 State Climate Centers in the North Central region are given below. Activities for 1982-1983 are given in Vogel et al. (1982).

Illinois - On 1 March 1983 the Illinois State Water Survey formed the Climatology and Meteorology Section under the direction of Wayne Wendland, and the Climate Information Unit under the direction of John Vogel. The objectives of the Climatology and Meteorology Section are to better understand the dynamics, causes, and distribution of meteorological and climatic features. The goals of the Climate Information Unit are to archive and provide climatic data and information, to develop a better description of the Illinois climate, and to develop statistical methods and evaluation techniques for use in atmospheric-hydrospheric problems. Service work in Illinois is funded by the State of Illinois.

The Illinois Climate Center is establishing the CLimate Assistance Service (CLASS). This system is a computer-oriented information delivery system. Observations will be collected in real-time from approximately 30 cooperative weather observers in the state, and additional information and products are obtained from the Climate Analysis Center (CAC) to provide a real-time climatic data base for monitoring and assessing the current climatic conditions of Illinois. The users (state governmental offices, federal offices, agricultural extension offices, and the private sector) will be surveyed to determine their use and the adequacy of the climate-derived products. This work is being supported by funds from the NCPO, CAC, and the Illinois Department of Energy and Natural Resources. In addition, impact studies of the winter of 1981-1982 (Hilberg et al., 1983), and the floods of winter and spring 1982 (Changnon et al., 1983) were completed.

Indiana - Larry Schaal retired as the State Climatologist from Indiana during the summer of 1982, and James Newman became the Acting State Climatologist during the fall of 1982. The Indiana State Climate Center is continuing to work with the NWS Midwest Agricultural Weather Service Center at West Lafayette, Indiana, to upgrade the availability of near real-time climatic and weather data. The NWS at West Lafayette has obtained a Data General S-140 computer which has access to AFOS by an asynchronous line from Indianapolis. It is anticipated that AFOS and ROSA (Remote Observation System Automation) data, will be available to the State Climate Centers in the North Central region through this computer. The Indiana Climate Center is preparing software for the transmission of the National Weather Service data to the North Central region. The RCCO visited with the NWS and Indiana group to discuss the system, and to help attain its completion. The most recent year of daily data will be

maintained by the RCCO for use by other states in the North Central region.

Iowa - Paul Waite, Iowa State Climatologist, obtained funding from the National Science Foundation in the past year to study hail storms in the Upper Midwest. The RCCO maintained contact throughout this period and assisted in providing information concerning location of data repositories, and possible analysis techniques. Service work at the State Climatologist office is funded by the Iowa Department of Agriculture.

During the past year Robert Shaw resigned as the NC-94 representative, and was replaced by Richard Carlson of the Meteorology-Climatology Department at Iowa State University. This group has continued to work on the Iowa evaporation pan study, and are making plans to make this a North Central Regional study. Work has begun on establishing a soil-moisture climatology for Iowa using soil moisture observations obtained from 1954-1982. This work was sponsored by the Iowa Tax Commission.

Kansas - Dean Bark continues to expand and upgrade the 10-station network of real-time climatic stations in Kansas. This data base is being funded by the Agricultural Experiment Station at Kansas. In fall 1983 the Kansas Climate Center began working with this data in near real-time via AGNET with the cooperation of the Nebraska Climate Center, and with funding from the NCPO. The RCCO staff visited Kansas in October 1983 as part of the Annual NC-94 meeting.

Michigan - During the 1982-1983 year, Fred Nurnberger served as the President of the American Association of State Climatologists (AASC). He worked closely with NESDIS to prepare a survey of the resources and computer capabilities at all State Climate Centers. Results from this work were presented at the NCPO meeting in March 1983 at Tallahassee, Florida, and at

the AASC Annual Meeting in August 1983 at Asheville, North Carolina. The Michigan State Climate Center, which is funded by the Michigan Department of Agriculture, continues to work at digitizing and extending the climatic data sets for the state, and providing state service. Stuart Gage began a sabbatical during the summer of 1983, and Dean Haynes replaced him as the NC-94 representative for Michigan.

Minnesota - Earl Kuehnast, State Climatologist, has completed correcting the 1951-1980 average temperature normals for Minnesota based on the time of observation using the method developed by Baker (1975). The 1951-1980 temperature normals for Minnesota were all corrected to an 0800 observation time. This time was chosen because it coincides with the most frequent time of observation of the real-time University of Minnesota Cooperative Agricultural Weather Advisory Program. In addition, climatologies on the duration and depth of snow cover (Kuehnast et al., 1982), and wind and wind power (Baker, 1983) were developed. Funds for there work are derived from the Minnesota Department of Natural Resources, the Agricultural Experiment station and the Cooperative Extension Services. The RCCO staff visited the Minnesota State Climatologist and staff during the year.

Missouri - Wayne Decker, State Climatologist, and Vernon Jones have continued work on the development of climate/integrated pest management relationships. Primary activities in the past year have been the expansion of the real-time climate/weather data availability. Some of these data are transmitted by telephone to a TI-990 computer located at Columbia, Missouri. Other data were collected from the Purdue University archives available through the Midwest Agricultural Service Center. These data are then merged with the integrated pest management program at the University of Missouri to provide

climatic information for real-time decision making. The research is being sponsored by the Missouri Agricultural Experiment Station.

Nebraska - The Nebraska Climate Center (Ken Hubbard, State Climatologist) is continuing to expand the near real-time climate network which was established in Nebraska during the past 3 years, with funding from the NCPO. The Nebraska network now includes 17 stations, and is expanding to obtain data from Kansas and South Dakota with funding from the NCPO. They have demonstrated the applicability of this network to irrigation scheduling and agriculture (Rosenberg et al., 1983).

North Dakota - John Enz, State Climatologist, has been upgrading and collecting hail data for the weather modification group in Bismarck, North Dakota. This work is aimed at providing a climatology of hail for use in weather modification work within North Dakota. A staff member from the RCCO visited the state and provided advise on hail analysis.

Recently, a study of streamflow variability on the Goose, Park, and Knife rivers was completed (Vining et al., 1983). This study suggests that the increased flooding since 1960 in eastern North Dakota could be caused by increased runoff due to human activities. In the fall of 1983, an IBM Personal computer was purchased with University funds to establish the capability of obtaining real-time climate data.

Ohio - The Ohio State Climate Center (John Rayner, State Climatologist), after receiving recognition from the State of Ohio in 1982, formed an advisory group. This committee will formulate and establish a viable state climate program. Bruce Curry (Ohio Agricultural Research Station, Wooster) has continued the management of the 8-station near real-time weather/climate network in Ohio, which provides hourly measurements of temperature, humidity, wind,

radiation, soil temperature, and precipitation. This network is supported by the Ohio Agricultural Experiment Station. Radiation data from this network as well as companion climatic measurements are being provided by John Klink to the CEAS group in Columbia, Missouri, to verify satellite-derived measurements of radiation. Work has continued in Ohio to establish standards for automatic climate/weather networks in the North Central States.

South Dakota - The South Dakota Climate Center (William Lytle, State Climatologist) is establishing a network of climate/weather stations with the assistance of the Nebraska Climate Center. This is a joint project with the NCPO. These data will be available on the AGNET computer system to South Dakota agricultural groups and other interests.

Wisconsin - Val Mitchell retired as State Climatologist during the summer of 1982, and Douglas Clark became the new State Climatologist in early December 1982. Support for this State Climatologist office comes from the Wisconsin Geological and Natural History Survey which is funded by the University of Wisconsin Extension. During the first year as State Climatologist, Clark has concentrated on computerizing the Wisconsin climatic data set. Computer hardware has been purchased and the associated software has been developed to allow the acquisition of climatic data from the National Climatic Data Center by computer communications. He is working with the Agricultural Experiment Station and Extension Service at the University of Wisconsin to obtain data from the various sites located on experiment station farms. A member of the RCCO staff visited with the Wisconsin State Climatologist to discuss data bases.

DATA MANAGEMENT

The RCCO has four responsibilities under the heading of data management. They are: 1) to monitor and supervise data collection and data management programs adopted by the Regional Research Committee; 2) to coordinate special observational programs; 3) to design compatible formats for climatic data; and 4) to design systems for the near real-time collection and exchange of weather and climate data between state climate centers and national groups. Little effort has been expended thus far in the design of compatible formats for the transmission and storage of climatic data. However, as other activities proceed, the design of compatible formats for the exchange of near real-time weather/climatic data will be required.

Data Collection - Several data collection or data management programs have evolved in the past year. At the October 1982 NC-94 meeting, the RCCO requested all NC-94 representatives to contact County Extension Agents in their states to enlist their help to aid the Illinois State Water Survey, in identifying a group of volunteer contrail observers whose observations would help determine the areal extent and density of persistent contrails during the four seasons. The topic was discussed, and accepted. The NC-94 representatives asked the Cooperative Extension Groups to disseminate this request to their County Agents. Responses from about 60 volunteer observers have been received in 7 of the 12 states, indicated on Fig. 3. The RCCO contacted each of the volunteers in mid-June, sending them an observation form with instructions, and return stamped envelopes for their July observations. Observations were taken again in October 1983 and January 1984, and will be taken in April 1984. The RCCO is working through the newly formed Association of American Weather Observers to further improve the observation coverage.

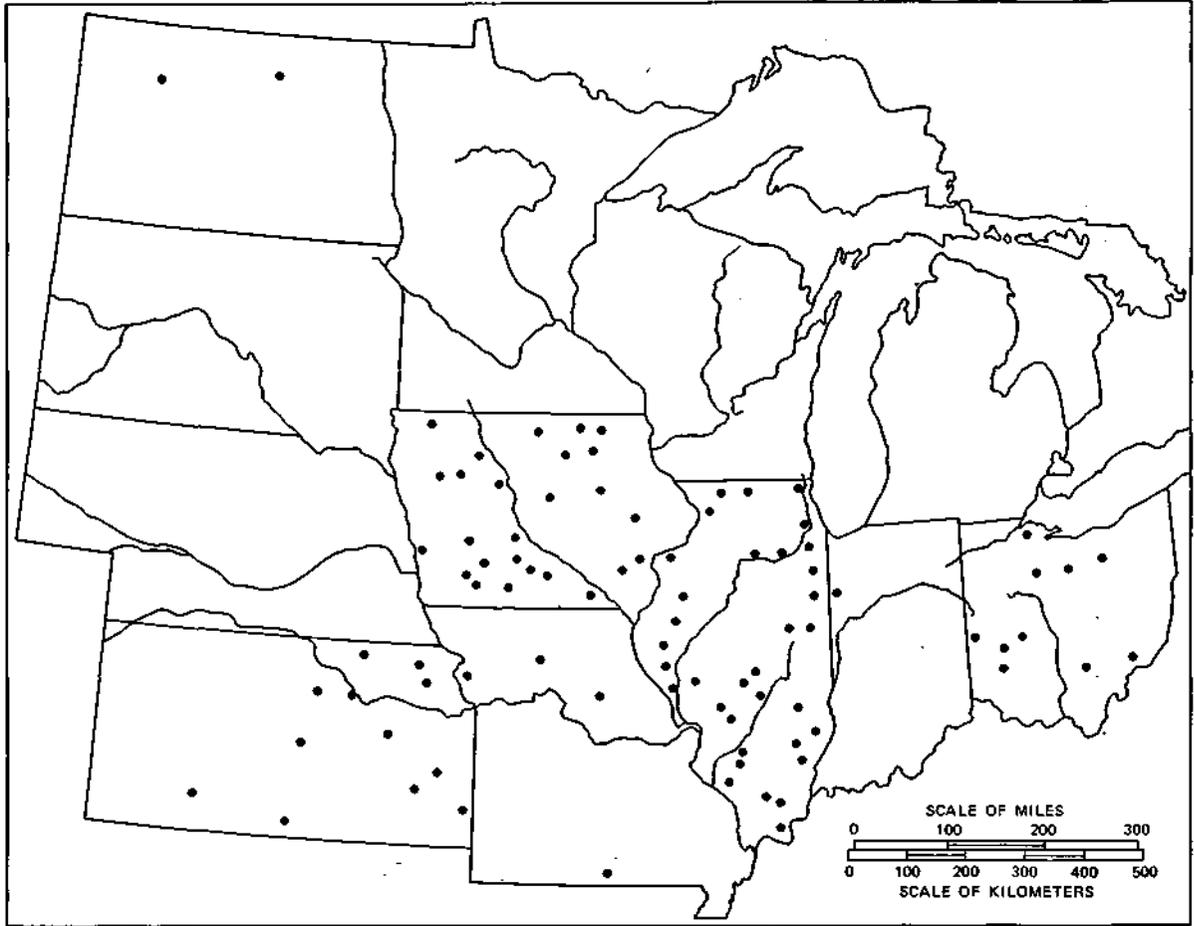


Figure 3. Contrail observers

The Crop-Hail Insurance Actuarial Association (CHIAA) would like to determine if the distribution of hail in the Upper Midwest has changed in the past 20 years. The RCCO has collected data, with the assistance of participating State Climate Centers, and has conducted the analysis of hail data from Illinois, Iowa, Minnesota, Nebraska, North Dakota, and South Dakota. The results indicate that most of the study area has above normal hail frequencies in 1961-1980, and that the 1961-1965 period was an extremely high hail incidence period. This study also identified 9 areas of maximum hail activity in the 6-state region.

In August NESDIS and the RCCO began to explore ways to prepare an inventory of atmospheric data sources available within the North Central United States for inclusion into the National Environmental Data Referral Service (NEDRES). At the annual American Association of State Climatologists meeting in August 1983 (Asheville), the RCCO contacted six State Climatologists (Illinois, Iowa, Michigan, Minnesota, Nebraska, and Wisconsin) to inquire about their willingness to participate in this project. These six State Climatologists agreed that this project would allow them to establish direct contact with various weather/climate data gatherers within their state. Subsequently, the RCCO conferred with the NC-94 committee at their meeting in Manhattan, Kansas, in October 1983, and the NC-94 group agreed that this project should be pursued within the North Central Region. A proposal for the collection of these data for NEDRES has been circulated to the 12 State Climate Centers and NC-94 members. It is anticipated that the inventory of these important atmospheric data sets in the North Central Region will begin during 1984.

Coordinate Observational Programs - The NC-94 committee under the leadership of Bruce Curry (Ohio) is developing a set of guidelines or standards for

the collection of general purpose weather/climate data gathered by State Climate Centers, so that there is compatibility and consistency between observations. Various equipment and sampling protocols are being used (Rosenberg, 1983; Hendrie, 1983; Curry et al., 1981; Seeley, 1982) in the North Central regions. The RCCO has been cooperating with this NC-94 committee in the preparation of these guidelines. The set of standards being assembled addresses 1) desired measurements, 2) measurement quality, 3) instrument placement, 4) minimum calibration procedures, and 5) minimum-data sampling. A draft of these standards has been circulated within the North Central Region, and after comments have been received, the set of standards will be adopted by the NC-94 group for the North Central Region. Other items that remain to be treated are 1) data processing, 2) data storage, 3) data sharing, and 4) data transmission. In addition, the RCCO is working with Professor Joseph Russo of Pennsylvania State University to coordinate similar activities in the northeast United States.

The NWS Central Region Headquarters in February 1982 initiated a request for the development of the ROSA system to gather and transmit data from Cooperative Observers and other atmospheric observers utilizing present computer and communication technology. Such a system would substantially reduce present communication cost, and would improve the efficiency of data transmission. Data from the Cooperative Observers and others are to be transmitted by special encoders to a central minicomputer. These data will then be formatted and transmitted on the AFOS system every 15 to 20 minutes. The Central Region of the National Weather Service requested that the State Climate Centers identify cooperative observing sites to report on a daily basis to the ROSA system. These data can be retrieved for near real-time use from the Data General

S-140 computer at the Midwest Agricultural Weather Service Center. The RCCO obtained a list of those stations identified as a daily reporting stations from the 12 State Climate Centers, and forwarded this information to Harold Bogin of the NWS Central Region. At the present time, it is anticipated that cooperative stations will be added to the AFOS system very slowly beginning in the spring of 1984. Each state center selected 8 to 10 stations for the initial daily collection of data via ROSA, and their locations are shown in Fig. 4.

Design Systems for Collection and Exchange of Data - During the past year the RCCO began developing plans to obtain regional data to be available from an AFOS node from the Midwest Agricultural Weather Service Center in West Lafayette. The near real-time data will be available for use by other State Climate Centers. The RCCO is planning to upgrade the memory and operating capabilities of an ALTOS 8600 minicomputer so that data can be collected, stored, and transmitted. The preliminary plans for a regional data acquisition system were presented at the 14th Conference on Forest and Agricultural Meteorology at Fort Collins, Colorado in April 1983 (Vogel et al., 1983).

The RCCO is also participating in the development of a prototype system for obtaining weather/climate data on a daily basis from Cooperative Observers in Illinois. These data are being collected and are available for users in Illinois as part of the Illinois CLimate Assistance Service (CLASS), a computerized system designed to provide climatic data and information to a wide variety of users. It is anticipated that this prototype system could be adopted by other states. Many of the problems that have been encountered during the development of the Illinois system could thus be avoided elsewhere. Support for this work is coming from the NCPO, CAC, and the Illinois Depart-

ment of Energy and Natural Resource.

COORDINATION OF RESEARCH STUDIES AND INVESTIGATIONS

The RCCO is involved with research studies and investigations which involve more than one State Climate Center or are being undertaken at the direction of the NC-94 committee. These include: 1) the development and promotion of climatic research; 2) the encouragement of climatic impact studies; 3) the administration and review procedures; and 4) monitoring of regional funds. Most of the work that the RCCO has undertaken in the last year has been focused toward the development and promotion of climatic research, and the encouragement of climatic impact assessment studies.

Survey of Research Interests - A questionnaire was developed in the fall of 1981 by the RCCO and distributed to the NC-94 members to determine regional research projects with the greatest interest. The survey identified the interaction of climate with 1) integrated pest management programs, and 2) soil moisture modelling as the research topics with greatest interest. The identification of these two common research topics placed investigators from the various states in contact with each other.

Regional Normal Analysis - The RCCO obtained a tape of the 1951-1980 normals from the National Climatic Data Center so that a common set of normals for the North Central Region could be obtained. Monthly and annual maps of the 1951-1980 normals are being prepared for daily maximum and minimum temperatures, heating and cooling degree days, and precipitation. Presently, the observation time for cooperative observers varies over virtually all hours of the day. As a result, monthly and annual temperature-related normals vary

considerably only because of differences in the time of observation (Mitchell, 1958; Baker, 1975; Dale and Schall, 1977). The RCCO is studying a corrective factor to be applied to observations to yield a midnight-to-midnight normal. To accomplish this task, the RCCO has compiled the observational times and any changes that have been experienced in the 30 year period from 1951 to 1980 for all cooperative observing stations in the 12-state region for which normals were prepared by NCDC. Initial normal maps will be prepared by the RCCO and distributed to the State Climate Centers for verification. After all maps have been verified they will be compiled and published for North Central Region. An example of the 1951-1980 normal precipitation for July is presented in Fig. 5.

Investigation of Observation Time Impacts - The RCCO also initiated work with David Head, a Geography graduate student at the University of Illinois-Champaign, to investigate the effect that various observational times have on the maximum, minimum, and daily mean temperatures. This investigation is using hourly temperature data from first order weather stations throughout the North Central Region to determine a correction to the temperature as a function of time of observation, and the number of years required to determine a stable correction for monthly and annual normals.

Climate Change Proposal - During 1983 a research proposal to investigate climate change over the Upper Midwest during the last 100 years was developed. This proposal will use long-term climate data from the 12 State Climate Centers to specify variability of temperature and wind direction. Previous studies have either studied climate change from a large scale (hemispheric) or small scale, local (single station) perspective. This proposal will concentrate on mesoscale anomaly patterns of temperature and wind which will be used

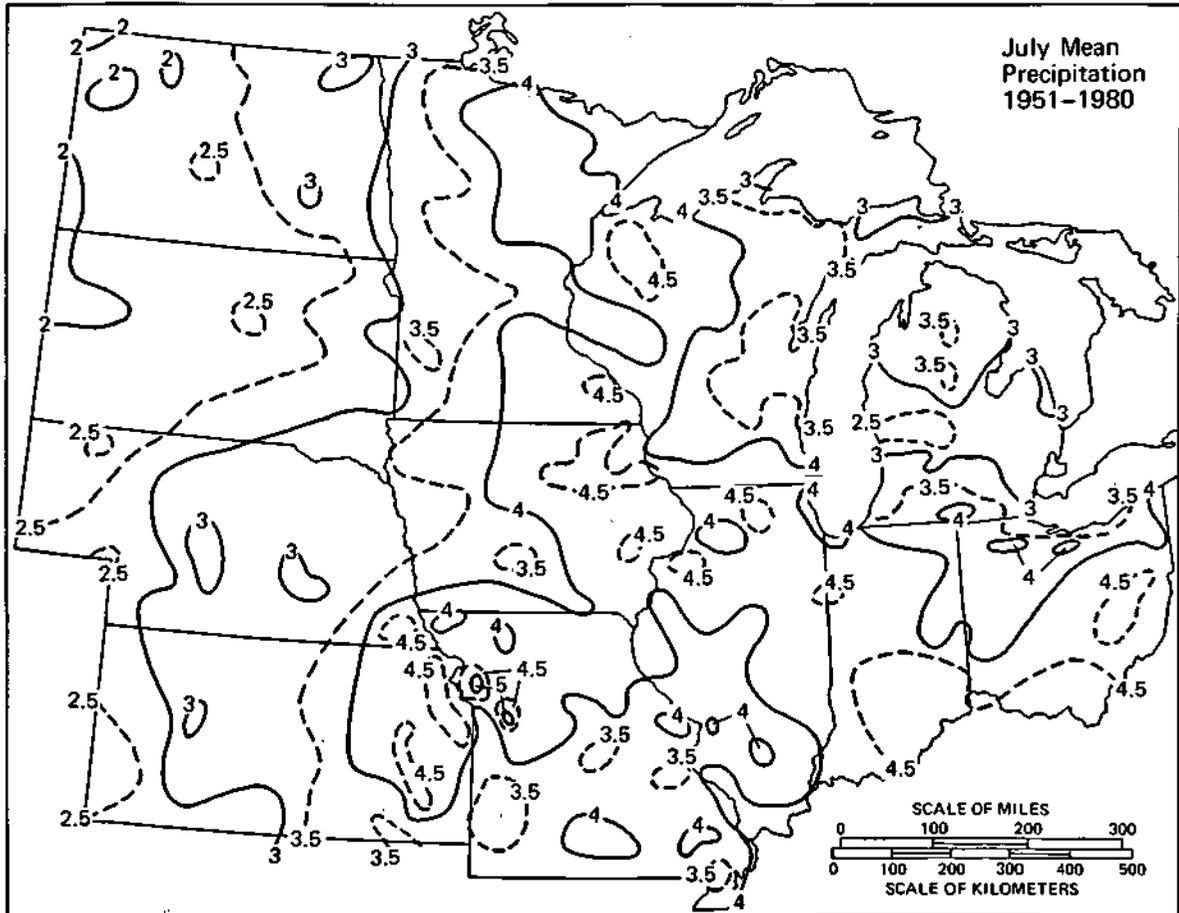


Figure 5. July normal precipitation, 1951-1980

to identify the composition duration of airmasses over each station (from temperature data), and modal fronts within the area (from winds). Ten to 15 stations from each of the 12 states in the Upper.Midwest will be used to form the data base of this research. Some of these data are available in a digital format from NCDC and the states, however, other stations are only available in paper copy, and will have to be digitized. Digital files of long-term climatic stations will be produced from E-15 forms or their equivalent. These data will be shared with the NCDC, permitting their digital records to be extended further back in time than presently available.

Joint Data Gathering - Missouri and Illinois have agreed to cooperate in the gathering of climate and integrated pest management data during the 1984 growing season. Both states are presently involved in integrated pest management programs which combine climate and pest information to provide information about various pests which are detrimental to agricultural interests in both states.

Studies of Anomalous Climate Events - Since the winter of 1976-1977 the Upper Midwest has experienced four exceptionally cold winters (1976-77, 1977-78, 1978-79, and 1981-82). The winter of 1982-1983 was exceptionally mild in sharp contrast with these previous winters. The RCCO with the cooperation of the 12 State Climate Centers investigated the impacts of the mild winter of 1982-1983 upon the region. This cooperative effort culminated in an article published in the Bulletin of the American Meteorological Society (Wendland et al., 1983). This article highlighted some of the unusual characteristics of that winter and contrasted them with other years. The summer of 1983 saw a return to drought conditions across much of the Midwest, and had a major impact upon the region on agriculture and energy demand. As a result, the climatic,

agricultural, and energy use data from June, July, and August 1983 were gathered and another article was prepared which analyzes the climate impacts of the summer of 1983 (Wendland et al., 1984).

Exploring Possible Climate Impact Studies - During August 1983 the RCCO, with the Center for Environmental Assessment began exploring ways in which the State Climate Centers could assist in the assessment of the economic impacts that climate has upon the nation. We anticipate that at first this work will involve two adjoining states. Impacts on a local and state scale, both short-term and long-term, will be studied.

Interaction with other Regional Committees - The North Central Regional Committee for Integrated Pest Management (NC-166) has recently initiated a series of studies concerning the effects pests have upon corn, potatoes, and livestock. The group associated with the study on corn consists of five states: Illinois, Iowa, Indiana, Kansas, and Missouri. This group has been consulting with the RCCO to determine the availability and the types of climatic information which might be used in this study.

LIAISON WITH GROUPS AND AGENCIES

An important function of the RCCO is liaison with the State Climate Centers and other groups and agencies within and outside the region. During the first year of the RCCO, we visited with many state, regional, and federal groups to inform them of the RCCO objectives, and to offer our help in coordinating transfer of data, information, and methodology. This work continued in the second year as new contacts were made.

During the past year we have talked with many State Climate Centers about data and services. We have consulted with the Ohio Climate Center on the establishment of an advisory committee. This group is developing an active State Climate Center. Iowa sought advice about the acquisition of synoptic data from the NCDC, the procedures of preparing research proposals to the National Science Foundation, the use of hail insurance data from the Crop-Hail Insurance Actuarial Association for hail studies, and advice on instrumentation. Those State Climate Centers that are participating in the evaluation of hail climate changes in the Upper Midwest were provided with advice on how to use historical records. Several states were visited, and discussions focused on analytical techniques that might be incorporated into climatic studies. Each State Climate Center was provided with information on procedures for establishing a winter preparedness program within their state. Such educational programs prepare and educate residents in the survival techniques to be used during blizzards and severe winter storms. This packet not only included materials that were used in a similar program in Illinois, but also indicated how such a program provides direct exposure for a State Climate Center with users and with state government agencies.

The RCCO Newsletter provides a way of briefing the State Climate Centers on current events affecting their operation and potential situations (particularly from the federal level) that may be occurring which could impact their operation. Two issues of the Newsletter were published in the past year.

During much of the past year the RCCO engaged in a dialogue with the NCDC and NESDIS about the flow of climatic data/information within the United States. Discussions were held on ways to improve the flow of information from the cooperative observers, first-order weather stations, and other data

sources at the federal level to the state level. In addition, discussions were held on ways in which the states might be able to assist the federal government in improving the productivity of the present climatic data system. At the present time, climatic data from the first order and cooperative stations are relayed to the State Climate Centers (paper copy) within 1 to 1 1/2 months of the date of observation. However, with the advent of computers it has become important that this information/data be made available on a more timely basis to decision makers at the state and private levels. "Now-only data", i.e., data that are required on a scale of days to a few weeks after collection, needs to be made available to the public for the proper evaluation of the present state of the climate. These data need not be quality controlled to the same high degree as historical data from the NCDC, nor do they have to be of the same density. At the time these discussions began, digital data were usually only obtained one year to 15 months after the time the observations were made. However, the NCDC accelerated a program whereby monthly climatological data could be made available by computer-to-computer communications. These high quality data are now available within 2 to 4 months after the time of observation, and form the historical climatic data base.

During the past year we have continued to communicate with the NWS Central Region Office, NESDIS, NCDC, NCPO, and the USDA. Through some of these communications we provided information and advice on possible ways of facilitating national weather/climate programs. The RCCO serves as a sounding board that represents the interests and views of the State Climate Centers within the North Central Region.

The American Association for the Advancement of Science has accepted the proposal from the RCCO to develop a symposium on the impacts climate anomalies

on agriculture at their 1984 meeting in New York. The RCCO leadership has organized this symposium. The continuing RCCO interactions with members of the agricultural sector helped the RCCO make the contacts necessary for preparing and assembling this symposium.

The RCCO has continued to be a clearinghouse for regional information on data and resources within the North Central Region. Contacts have been made by various groups either requesting information from within their state or from within the region. The RCCO either answers directly, or refers the person to the correct State Climate Center or group.

PLANS

During the second year, the RCCO consulted with the NC-94 Advisory Committee to discuss possible changes in the perspective of the operation of the RCCO. Advice was also sought from the NCPO. Certain changes in the objectives of the RCCO are perceived during the immediate future. It was decided that 1) computer expertises should be available from the RCCO to assist State Climate Centers in the establishment of real-time data information systems; 2) methods should be established to collect and transmit climatic data bases; 3) cooperation between State Climate Centers should be developed for the exchange of climatic data; and 4) the RCCO should explore offering limited climatic services to those states unable to provide such services.

In an effort to make better contact with the private sector of meteorology and climatology, it was decided that an advisory group of users would be established. The primary thrust of the users advisory committee are: 1) to understand the objectives of the RCCO; 2) to evaluate the activities of the

RCCO; and 3) to provide advice as to improving the activities and the responses of the RCCO and the State Climate Centers to private users. It was anticipated that this panel would meet annually to review the RCCO and associated state center activities of the past year, and to recommend future activities. Composition of this group would be primarily from industry, and would provide a means of promoting the State Climate Centers and the RCCO, and would also provide information about the kinds of climatic data and information that are desired by private industry.

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