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**A SUMMARY OF 1994 COOPERATIVE EFFORTS
BETWEEN THE NATIONAL WEATHER SERVICE AND
THE UNIVERSITY COMMUNITY**

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NATIONAL WEATHER SERVICE

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NATIONAL WEATHER SERVICE AND THE UNIVERSITY COMMUNITY**

EXECUTIVE SUMMARY

In this paper, the status in 1994 of the wide variety of collaborative activities between the National Weather Service (NWS) and the university community is presented. These activities are geared towards enhancing scientific interactions among the participants, with an overall goal of developing understandings and improved forecasting techniques that are in concert with the goals of the NWS Modernization and Associated Restructuring (MAR). The total amount of NWS funding in fiscal year (FY) 94 for these efforts are given in the paper.

- 1) Cooperative Institutes are long-term agreements with financial commitments on the part of NWS and a university to share administrative and faculty costs for accomplishing a limited number of agreed-upon research topics. **Cost - \$832,000**
- 2) A variety of education and research efforts were supported by the NWS via the Cooperative Program for Meteorology, Education, and Training in Boulder, Colorado. **Cost - \$3,393,000**
- 3) The NWS continued with its ongoing commitment to assist with the establishment and/or progress of meteorology programs within Historically Black Colleges. **Cost - \$ 16,000**
- 4) Efforts were carried out via Interagency Personnel Agreements to have NWS (university) scientists work at a university (NWS) facility for an extended period. **Cost - \$ 125,000**
- 5) The San Jose State University provided classes for NWS meteorological technicians that equipped them with the meteorology credit hours required for them to cross over into meteorologist positions within the NWS. **Cost - \$ 168,000**
- 6) The NWS University Assignment Program allowed NWS employees to take full- or part-time job-related courses at colleges and universities. **Cost - \$ 50,000**
- 7) NWS meteorologists and hydrologists were supported in taking university courses in hydrometeorology to support the MAR. **Cost - \$ 78,000**
- 8) NWS Regional Offices supported field office personnel taking courses at local universities. **Cost - \$ 76,000**
- 9) The NWS' National Meteorological Center is supporting a number of research projects and supplying data to universities. **Cost - \$ 372,000**
- 10) The NWS formed Regional Climate Centers at universities across the U.S to provide regionalized climate data and information. **Cost - \$2,735,000**
- 11) Collaborative space and computers are being planned for many NWS field offices - **Cost not available**
- 12) Other cooperative activities also received NWS funding in FY 94 and are described in detail in the paper. **Cost - \$ 129,000**

**The total university-related activities supported by the NWS
in 1994 are estimated at \$7,974,000**

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A SUMMARY OF 1994 COOPERATIVE EFFORTS BETWEEN THE NATIONAL WEATHER SERVICE AND THE UNIVERSITY COMMUNITY

1. Introduction

The National Oceanic and Atmospheric Administration (NOAA) has been involved in a number of activities with colleges and universities over the years. As the Modernization and Associated Restructuring (MAR) of the National Weather Service (NWS) progresses¹, the number and types of interactions have been growing steadily. This report provides a summary of all FY 1994 activities. These activities ranged from one-on-one interactions between individual university professors and NWS forecasters, to larger scale projects between an entire NWS Forecast Office (WSFO) and a university department, to cooperative activities among the NWS, other NOAA components and an entire university, among others. The level of NWS funding of each effort in 1994 is also estimated.

All efforts are geared towards enhancing scientific interactions among the participants. The goal of these interactions is to develop understandings and improved forecasting techniques based on the use of data sets from new technologies (such as the Automated Surface Observing System and the new NWS Weather Surveillance Radar [1988 Doppler], known as the (WSR-88D). These new technologies are rapidly being deployed by the NWS across the country.

In the modernized era, cooperative, operationally-oriented research ventures between NWS and the university community will be strongly emphasized. These ventures will consist of activities funded directly between NWS and university facilities, as well as activities funded through the Cooperative Program for Meteorology, Education and Training (COMET) in Boulder, Colorado (a component of the University Corporation for Atmospheric Research - [UCAR]). See Auciello² (1993) for the preliminary strategic plan for collaborative research activities between the NWS and the university community.

2. Cooperative Institutes (CIs) - Total 1994 NWS funding: \$831,900

CIs are generally long-term agreements with financial commitments on the part of NOAA and a university to share administrative and faculty costs. The purpose of a CI is to

¹ See Friday, Dr. Elbert W., 1994: The modernization and associated restructuring of the National Weather Service: An overview. Bull. Amer. Meteor. Soc., **75**, 43-52, for details.

² Auciello, E. P., and R. L. Lavoie, 1993: Collaborative research activities between National Weather Service operational offices and universities. Bull. Amer. Meteor. Soc., **74**, 625-629.

develop an overall theme that is centered around a limited number of agreed-upon research topics as set forth in a Memorandum of Understanding. In some cases, CIs are collocated with WSFOs.

CIs should be structured to include a director, a council, an advisory board, and a staff that includes NOAA, university scientists and visiting researchers.

The CIs involving the NWS in 1994 follow:

a) The NWS has established the CI for Applied Meteorological Studies (CIAMS) between Texas A & M at College Station, Texas and the NWS Southern Region Headquarters. The focus of CIAMS is: 1) To determine how to use the NWS WSR-88D in a marine environment; 2) To study the influences of the Gulf of Mexico on coastal and marine convection; 3) To enhance the understanding of thunderstorm structure and evolution using concurrent radar and lightning data; 4) To calibrate the WSR-88D rainfall algorithm and to use the resulting precipitation estimates in crop and pest management models; and 5) To develop and evaluate weather inputs to crop growth models. NWS 1994 funding for CIAMS was \$180,000.

b) The NWS has established a CI for Tropical Meteorology (CITM) between Florida State University (FSU) at Tallahassee, Florida, the NWS Southern Region Headquarters and the NWS' National Meteorological Center (NMC) (including the National Hurricane Center). The focus of CITM is: 1) To improve numerical model initialization and prediction through the medium range, particularly in the tropics; 2) To develop methods to integrate observations and numerical guidance effectively into operational forecasting in tropical regions such as the Caribbean Basin; 3) To develop a methodology for archiving and annotating WSR-88D cases of interest; and 4) To evaluate the utility of operational WSR-88D algorithms and the applicability of new algorithms to local radars. NWS 1994 funding for CITM was \$180,000.

Both CIAMS and CITM train NWS meteorologists in applying research results and new technology to operational forecasting.

c) In January 1993, the NWS established a tropical meteorology research theme with the University of Hawaii's (UH) Joint Institute for Marine and Atmospheric Research (JIMAR). JIMAR was established in September 1977 to increase the effectiveness of oceanic, atmospheric and geophysical research by promoting close, multi-disciplinary collaborative research between UH and NOAA's Environmental Research Laboratories' Pacific Marine Environmental Laboratory (PMEL).

Within this broad umbrella of research activities, NOAA's involvement in JIMAR has expanded to include the National Marine Fisheries Service, Sea Grant, the NOAA Climate Office and now the NWS Pacific Region. Under the new JIMAR tropical meteorology

research theme, collaborative research to further the development of techniques to improve meteorological and oceanographic forecasts for the NWS Pacific Region and WSFO Honolulu will occur. During FY 1994, this program provided support for two graduate assistantships at the UH/Department of Meteorology. The assistantships cover two academic years and the intervening summer. FY 1994 funding for this effort was \$63,500.

d) The CI for Climate Studies (CICS) includes NMC; NOAA's National Environmental Satellite, Data, and Information Service; and the University of Maryland at College Park (UM). The purpose of CICS is to foster collaborative research between NOAA and UM in studies of satellite climatology, climate diagnostics, modeling, and prediction. The goal of this research is to increase the understanding of the earth-ocean-atmosphere system, climate modeling & prediction, and satellite climatology. NWS 1994 funding for CICS was \$408,400.

3. COMET Activities - Total 1994 COMET funding: \$3,393,427

COMET is a cooperative effort between the NWS, and the academic and research communities. COMET programs provide NWS personnel with a unique opportunity to gain the benefits of cutting-edge advances in the hydrometeorological sciences. At the same time, academic and research participants learn about the unique needs of NWS forecasters and gain an understanding of the operational aspects of their science within the modernized NWS. All involved have the opportunity to make significant gains.

COMET has three major programs designed to enhance scientific education. These are 1) the COMET Residence Program, 2) the COMET Distance Learning Program, and 3) the COMET Outreach Program. COMET is funded by the NWS but is also co-sponsored by the Air Weather Service and the Navy. A description of each Program and a breakdown of 1994 NWS funding follows:

a. The COMET Residence Program

The purpose of the COMET Residence Program is to provide advanced, graduate-level courses, each specially tailored to provide information on the latest scientific theory, to provide the opportunity for students to become familiar with these new topics via hands-on experience with data sets from the new technologies using advanced workstations, and/or to raise awareness as to how the new data sets and workstations can be effectively integrated into the modernized NWS field concept.

Courses range from 1-8 weeks in length, and are geared for students ranging from NWS upper management to personnel at the field level. These courses utilize university professors (some on sabbatical) as lead instructors. All courses are taught in a specially-designed, lecture-laboratory classroom at the COMET facility in Boulder, Colorado. COMET 1994 funding for the Residence Program is \$1,010,504.

b. The COMET Distance Learning Program

The objective of the COMET Distance Learning Program is to develop and distribute multimedia, highly-interactive, Computer-Based Learning (CBL) modules to NWS offices on a variety of topics related to operational forecasting. These lessons, which are pressed on laserdiscs and played on specially-designed personal computers, take about 3-8 hours to complete on average, and are focussed on a single subject. The modules are devised as a one-on-one education tool and can be taken in segments by the user. University experts are used as subject matter experts in modules, and UCAR offers the modules to the universities for purchase at cost. COMET 1994 funding for the Distance Learning Program is \$1,742,849.

c. The COMET Outreach Program

The objective of the COMET Outreach Program is to increase opportunities for mesoscale and synoptic-scale education and research, and improve local forecasts by fostering professional interactions between NWS forecasters, and university faculty and students. COMET Outreach activities are distinct from CI activities in that funding for COMET Outreach activities is obtained through a competitive, peer-reviewed process, with funding provided by COMET, while CIs are funded directly by the NWS. The total COMET 1994 funding for the Outreach Program is \$582,075.

Two types of Outreach programs exist:

Cooperative Programs: A broad cooperative activity between a university department and a NWS office. Programs of this type may be related to specific short term objectives; however, they also are likely to involve the establishment or expansion of long-term relationships between a university department and a NWS office.

Partners Programs: A cooperative effort between an individual NWS forecaster and a researcher focused on the study of a particular forecast problem. Partners Programs are generally of limited duration, use locally available data, and lead to the preparation of a joint paper and/or adoption of a new forecast technique.

In 1994, direct COMET Coop and Partners proposals funding through COMET to universities was approximately \$406,000. Average funding for a Cooperative Project in 1994 was about \$25,600, while the average Partners Program project was funded at about \$4,500.

The NWS spent about \$40,000 in 1994 to support publication costs and associated travel expenses. The NWS also spent \$18,000 in 1994 to support a Naval Postgraduate School (NPGS) project that could not be legally funded by COMET. The project involves cooperation between NPGS and the WSFO at Denver, Colorado, to evaluate satellite-based observations of troposphere-level thermal anomalies to improve the nowcasting and forecasting of extratropical cyclones.

1. 1994 Cooperative Projects:

The University of Alaska and the WSFO at Fairbanks, Alaska are investigating the possibility of implementing a high-resolution numerical model in the NWS Alaska Region. Efforts are underway to assess the utility of the model as assimilation and forecast tools and to improve the model for use in an arctic atmosphere. COMET 1994 funding was \$35,391.

The Desert Research Institute and the Weather Service Office (WSO) at Reno, Nevada, are developing an important hydrometeorological database for input to mesoscale models. WSR-88D data are also being utilized to investigate the meteorologically diverse and topographically complex area in the state of Nevada. COMET 1994 funding was \$9,627.

The Colorado State University and WSFO Phoenix, Arizona are collaborating on a project to study storm electrification and to determine if there is any correlation between lightning frequency, density, intensity and monsoon convective activity. COMET 1994 funding was \$4,995.

FSU and the WSO at Tallahassee, Florida, have a number of efforts underway to investigate severe storms in the southeastern U.S. Conceptual and numerical models are being evaluated to determine the critical parameters involved in various precipitation elements. COMET 1994 funding was \$18,604.

The University of Hawaii and the WSFO at Honolulu, Hawaii, are cooperating to investigate theoretical tropical meteorology in the forecast setting in order to improve understanding of atmospheric processes in this region. COMET 1994 funding was \$40,481.

Iowa State University at Ames, Iowa and the WSFOs at Des Moines, Iowa; Minneapolis, Minnesota; Topeka, Kansas; and Chicago, Illinois are observing and documenting interactions between the Great Plains low-level winds and nocturnal thunderstorm activity, especially in well-organized thunderstorm

systems called Mesoscale Convective Complexes. COMET 1994 funding was \$18,076.

The North Carolina State University and the WSFO at Raleigh, North Carolina, are working together to enhance the understanding as to how thunderstorms initiate and evolve along the land-sea interface in the southeastern U.S. COMET 1994 funding was \$26,211.

The University of Oklahoma and the WSFO at Norman, Oklahoma, are investigating weather phenomenon associated with persistent weather features that occur across the southern plains by using new hydrologic algorithms and the new Oklahoma Mesonet, which blankets the state with observations of surface weather conditions. COMET 1994 funding was \$39,956.

The St. Louis University and the WSFO at St. Louis, Missouri are cooperating to develop a systematic approach to advance the understanding of severe thunderstorm structure and associated severe weather events, with an emphasis on heavy rain. COMET 1994 funding was \$17,589.

The University of Wisconsin and the WSFO at Sullivan/Dousman, Wisconsin, are cooperating to provide the WSFO with advanced meteorological information to aid in the forecast process. COMET 1994 funding was \$29,446.

The University of California (Scripps Institute) and the WSFO at Anchorage, Alaska, are using the Department of Defense's Meteorological Satellite System to obtain satellite information that is unavailable with NOAA satellite systems for use in polar regimes. COMET 1994 funding was \$23,690.

The University of Utah and the WSFO at Salt Lake City, Utah are investigating the utility of a numerical weather forecasting model to forecast detailed weather features with high resolution in the WSFO operational setting and, in turn, to improve upon this model based on the test results. COMET 1994 funding was \$23,969.

The University of Washington and the WSFO at Seattle, Washington, are cooperating in an effort to resolve the complex, detailed, small-scale meteorological forecasting problems of the Pacific Northwest. COMET 1994 funding was \$41,094.

The University of Virginia and the NWS Ohio River Basin Forecast Center are investigating the application of a probabilistic river stage forecast system based on advanced statistical techniques. COMET 1994 funding was \$29,992.

2. 1994 Partners Projects:

The University of Alaska at Fairbanks and the WSFO at Fairbanks, Alaska, have been studying the use of artificial intelligence techniques in evaluating data and forming forecasts. This particular study has focused on the use of artificial intelligence in predicting lightning strikes in the interior of Alaska. COMET 1994 funding was \$1,429.

The University of Alaska at Fairbanks and the WSFO at Anchorage, AK. are collaborating on a project involving the use of synthetic aperture radar products to enhance nearshore wave forecasts and the design of coastal facilities. COMET 1994 funding was \$7,500.

The University of California at Los Angeles and the Nome, Alaska, WSO are conducting a study geared towards attaining a better understanding of Bering Sea storms that cause extensive damage to the shoreline on the Seward Peninsula, and especially the city of Nome. COMET 1994 funding was \$7,500.

The University of Washington and the WSFO at Juneau, Alaska, are working on techniques to improve the prediction of topographically enhanced coastal winds in the eastern Gulf of Alaska. COMET 1994 funding was \$5,487.

The University of Kansas and the WSFO at Topeka, Kansas, are studying the use of excess rotational energy within very small-scale storms as a tornado predictor. COMET 1994 funding was \$4,960.

St. Louis University and the WSFO at St. Louis, Missouri, are collaborating on a study of the propagation and evolution of Mesoscale Convective Systems producing flash floods. COMET 1994 funding was \$3,227.

North Carolina State University and the WSFO at Raleigh, North Carolina, are examining the prediction of rainfall amounts associated with Gulf Coast hurricanes after landfall. COMET 1994 funding was \$4,998.

The State University of New York at Albany and NMC have been working on a project to study the lower Mississippi Valley rainstorm and severe weather event of 15-16 November, 1987. COMET 1994 funding was \$2,656.

The University of South Carolina and the WSFO at Columbia, South Carolina, are collaborating on an effort to develop a prototype system to integrate topographic, hydrologic and climatic data with WSR-88D precipitation data in the Edisto River Basin. COMET 1994 funding was \$4,964.

Texas A & M university has three Partners projects, all in conjunction with the WSFO at Houston, Texas. The first one is a study of WSR-88D precipitation products. COMET 1994 funding is \$4,256. The second project is a Doppler lightning study of the April 19, 1992 severe storm outbreak. COMET 1994 funding is \$3,917. The third project is a study of the left-moving thunderstorms of May 26-27, 1992. COMET 1994 funding for this project was \$4,474.

4. NWS Interactions with Historically Black Colleges - Total 1994 NWS funding: \$16,165

A. Jackson State University

The NWS played an important role in the establishment of an Atmospheric Sciences Program at Jackson State University in Mississippi. This program was established in 1978 under the Department of General Science and was eventually transferred to the Department of Physics and Atmospheric Science. The Department currently offers 12 courses in meteorology, sufficient to prepare students to be eligible for meteorologist intern positions in the NWS upon graduation. NWS participation was to contribute an employee on Interagency Personnel Agreement (see Section 6) from NMC from 1978 through 1982 to help spin up the program. The department currently boasts 20 students and two faculty members. Two students will graduate this fiscal year and these two have already secured jobs as meteorological interns within the NWS. These two positions, including benefits, cost the NWS \$15,165 in 1994.

B. Clark Atlanta University

As part of their effort to establish an Earth Science Systems Program, the NWS has loaned Clark Atlanta University a Professional Development Workstation (PDW) via a Memorandum of Understanding between Clark and the NWS. The PDW, a specially-equipped personal computer, is designed specifically to utilize COMET's CBLs. The NWS sent a representative to Clark in November 1993 to present a seminar on the use of the PDW to students and faculty, and to brief students as to the structure of and employment opportunities available within the NWS.

As of this writing, the PDW is still on loan at Clark. It is being used in the classroom and to facilitate independent use by students in their laboratory facility. The students have access to all current modules, supplied free of charge by COMET. The cost of workstation to the NWS is approximately \$1,000 per year.

5. Interagency Personnel Agreements (IPAs) - Total 1994 NWS funding: \$124,600

An IPA is an arrangement made between the NWS and a university to have one or more NWS (university) scientists visit a university (NWS) facility for an extended period. The purpose of these visits can range from assisting with establishing meteorology programs at universities to having university researchers with specific subject matter expertise work on problems in their area of expertise at an NWS facility.

Dr. James Almazan of the Office of the Federal Coordinator for Meteorology is working in the Provost's Office at the University of Texas at San Antonio on a 2-year IPA assignment. His title is Senior Advisor for Minority Initiatives (special Assistant to the Provost). Dr. Almazan's efforts are to establish a solid foundation for long-term programs in recruiting, retaining, and graduating students, particularly in science, engineering, and mathematics. NWS 1994 funding towards this effort was approximately \$45,000.

In addition, one IPA arrangement exists between the Colorado State University and the NWS where a professor from the university is working at NWS Headquarters. This professor is utilizing his expertise in Sociology and Human Resources to assist the NWS with Warning Program Effectiveness. NWS 1994 funding for this scientist was \$79,600.

6. San Jose State University - Total NWS funding: \$168,000

The San Jose State University (SJSU) offered a summer course that provided 18 NWS meteorological technicians with 12 semester hours of undergraduate education in Synoptic and Dynamic Meteorology to assist them in crossing over into meteorologist positions within the NWS. SJSU had offered this course every other summer, with the final one being offered in the summer of 1994. Applicants were selected by a competitive process within the NWS and had to complete SJSU pre-course requirements. In 1994, the NWS provided tutoring, tuition, books, travel, and room and board for NWS employees at a cost of \$168,000.

7. The University Assignment Program - Total NWS funding: \$50,000

The University Assignment Program provides a means for NWS employees to take job-related courses at colleges and universities (support includes full- or part-time tuition, and funding for books, fees, and travel reimbursement). Selection for the program is through a competitive procedure, where each applicant's academic record, proposed program, and supervisors endorsement are part of the criteria for evaluation.

In 1994, the NWS supported 32 employees to take part in full- or part-time education. For the most part, employees take courses at local educational institutions; however, at least three employees are involved in full-time studies at schools away from their offices. Total funding, not including salaries, benefits and any costs associated with reassignment was approximately \$50,000.

8. Hydrology Training for Meteorologists; Meteorological Training for Hydrologists - Total NWS Funding: \$78,000

In the modernized NWS, meteorologists will need to acquire a basic working knowledge of hydrology, and vice-versa. This will be necessary due to increased coordination between WFOs and RFCs, and the fact that all RFCs will be collocated with a WFO. The NWS is supporting this effort by sending meteorologists to courses in hydrology and hydrologists to courses in meteorology at universities. NWS funding for this effort was \$78,000 in 1994.

9. NWS Regional Funding of Cooperative Activities - Total NWS Funding: \$75,500

Support of NWS-university interactions are not limited to national-scale activities. NWS Regional Offices also support such interactions out of their own resources. In general, this support is for NWS personnel to take job-related courses at universities, either to provide supplemental knowledge for the student or credit hours to facilitate qualifying for new positions within the NWS. A summary of the funding provided for these efforts from the individual regions follows:

Eastern	\$10,000
Central	\$18,500
Southern	\$20,000
Western	\$12,000
Alaska	\$ 5,000
Pacific	\$10,000

10. Agreements Between NMC and the University Community - Total 1994 NWS funding: \$372,000

NMC and UCAR have a contract for a Visiting Scientist Program in force that permits university and UCAR scientists (predominantly post-doctoral students) to visit NMC for up to a year for the purpose of working on topics related to numerical weather prediction. Such visits enhance interactions between the NWS and the entity from which the student is resident. Most of the 1994 NWS IPA funding has gone through UCAR towards supporting international graduate students, post-doctoral students and senior scientists/professors. Most of these personnel are located in NMC's Development Division, working on enhancing and improving computer simulations of the atmosphere; however, two of these international scientists are located in NMC's Climate

Analysis Center, where studies on long-term trends in global climate are pursued. Funding for all 16 of these visitors, including housing and living stipends, was approximately \$372,000 in FY 94.

NMC is proposing to support the university community in providing access to NMC computers. In particular, NMC would donate up to 50% of the CRAY YMP computer's time for cooperative climate studies. Personnel from NMC's Coupled Model Project and Development Division would collaborate with university personnel who have access to the CRAY. NMC's Automation Division would administer the allocation of computer time, passwords and other logistical details. The total cost to the NWS in 1994 was significant but not calculable.

Members of NMC's Transition Project, who are responsible for developing modernized National center Advanced Weather Interactive Processing Systems (N-AWIPS) for NWS National centers are providing support for distribution of N-AWIPS software to UNIDATA (a component of UCAR), who in turn is distributing these data to 75 universities. NMC is also planning to supply specialized N-AWIPS applications to these universities as well. N-AWIPS and its related applications enables users to utilize real-time meteorological data from NMC numerical models to create their own products for display and research purposes. There is no cost involved in providing this software, other than the time of NMC personnel.

**11. NWS Collaboration with Regional Climate Centers -
Total NWS Funding: \$2,734,999**

The NWS provides support for several Regional Climate Centers across the U.S. In general, these Centers provide regional climate data and climate products for users in public institutions and private industry on matters related to energy, agriculture, water resources, transportation, tourism and health. These centers also monitor climate conditions over their area of responsibility and assesses their impacts.

To perform these functions, the centers maintain a large, historical climate data base of weather and weather-related elements, as well as the computer facilities for accessing these data either internally or externally by clients. They also conduct and support applied climate research on regional problems and issues in support of the services function. Some specific functions for each are given below:

The Northeast Regional Climate Center (NRCC) at Cornell University is developing atlases for wind and soil freezing depths, works with a daily solar radiation computer model, projects operational crop yield and soil moisture by using CAC Outlooks and crop process models, and maintains a synoptic climatology of the Northeast U.S. NWS 1994 funding for the NRCC was \$455,000.

The Midwestern Climate Center (MCC) at the Illinois State Water Survey, University of Illinois is working to develop improved models and assessments of soil moisture status, and corn and soybean yield potential; is developing a climatology of large storms over the Great Lakes; is analyzing the frequency of flooding along the Mississippi River Basins; is utilizing satellite data in the development of a system to estimate daily incoming solar radiation; and is developing applications for water managers in the Midwest. NWS 1994 funding for the MCC was \$455,000.

The High Plains Climate Center (HPCC) at the University of Nebraska, Lincoln is developing a method of estimating soil water under varying topographic conditions for crops encountered in the High Plains, is utilizing climate data to evaluate key fish species for aquaculture development in the High Plains, is formulating a numerical model to predict food intake by feedlot cattle based on a variety of climatic factors, and is developing a technique to improve the estimate of effective water applied through irrigation methods. NWS 1994 funding for the HPCC was \$454,999.

The Southern Regional Climate Center (SRCC) at Louisiana State University is studying the magnitude and frequency of excessive rainfall events in the South Central U.S., and on the use of water budget components for monitoring environmental and economic impacts of precipitation; is developing useful forecasts of temperature anomalies for climate impact studies; is acquiring, quality controlling and standardizing Gulf of Mexico data; and is developing relationships between climate and human mortality in the Southern U.S. NWS 1994 funding for the SRCC was \$460,000.

The Southeastern Regional Climate Center (SERCC) at the Department of Natural Resources (formally the South Carolina Water Resources Commission) in Columbia, SC is developing:
1) A decision support system to provide short- and long-term forecasts of the impact of changing climate on irrigation water requirements in the southeastern U.S.; 2) An operational computer program for annual peach development, peach maturity forecasts and the impact of climate change on peach production in the southeastern U.S.; 3) A Geographic Information System for performing Regional analysis of climate variables such as temperature, precipitation, evaporation, soil temperature, wind, and solar radiation. NWS 1994 funding for the SERCC was \$455,000.

The Western Regional Climate Center (WRCC) at the Desert Research Institute, University of Nevada is developing:
(1) a method to predict weather events one season in advance over the Western U.S. based on the occurrence of an El Nino event,
(2) a time saving technique for mapping the spatial distribution of precipitation over the mountainous western states (3) an operational procedure that uses a vegetation index derived from

from satellite data as input to rangeland growth models used by ranchers and land management agencies in the West, and (4) a model to predict precipitation in Arizona during the monsoon season one to two seasons in advance. NWS 1994 funding for the WRCC is \$455,000.

**12. NWS Weather Forecast Offices With Extra Facility Space -
Total 1994 NWS funding: Cost Unavailable**

As the NWS modernizes, many new facilities are being built to house the new, combined Weather Forecast Offices (WFOs) that will replace the existing WSFO-WSO office structure. Some of these WFOs are being built with extra facility space to provide the opportunity for university faculty and students to work at the WFO on specific collaborative projects. In addition, extra Advanced Weather Interactive Processing Systems (AWIPS) consoles will be purchased at these NWS sites starting in 1996.

The NWS has already contributed financially to build the extra workstation space required to house these consoles, but as these costs are spread out over a multi-year period, cost estimates for 1994 are not available. However, the list of offices that will be built with extra facility space is given below:

**SITES WITH EXTRA FACILITY SPACE
AND EXTRA NWS COST FOR AWIPS CONSOLES**

NWS SITES

WSFO Albany, NY.	WSFO Anchorage, AK.
WSFO Atlanta, GA.	WSFO Boston, MA.
WSO University Park, PA.	WSFO Denver, CO.
WSFO Fairbanks, AK.	WSFO Indianapolis, IN.
WSFO Lubbock, TX.	WSO Melbourne, FL.
WSFO Miami, FL.	WSFO San Francisco, CA.
WSFO New York, NY.	WSFO Norman, OK.
WSFO Phoenix, AZ.	WSFO Raleigh, NC.
WSFO Rapid City, SD.	WSFO Reno, NV.
WSFO Salt Lake City, UT.	WSFO Seattle, WA.
WSO Tallahassee, FL.	WSO Tampa, FL.
WSFO Tucson, AZ.	WSO Cincinnati, OH.
WSFO Fargo, SD.	WSFO New Orleans, LA.
WSFO Portland, OE.	WSO Tulsa, OK.
WSFO Juneau, AK.	WSO Sacramento, CA.
WSFO Honolulu, HI.	

13. Other Cooperative Activities - Total NWS Funding: \$129,000

Two NWS sites have been provided access to Internet and gridded numerical model data sets from NMC via modem connections to nearby universities. Memoranda of Understanding were signed between NMC, WSFO Philadelphia, and Drexel University, and between NMC, WSFO Boston and MIT for this purpose. Limited collaborative research activities have taken place with these institutions. No NWS funding is involved in this activity.

The NWS Office of Hydrology's (OH's) Hydrologic Research Laboratory (HRL) has continued coordination with the Massachusetts Institute of Technology in 1994 to work on developing a distributed hydrologic model for use in flash flood forecasting. HRL also expects to use 1994 funds to continue cooperative efforts with the Universities of Iowa and Arizona, but their proposals had not been received by HRL as of this writing. NWS funding for this effort in 1994 was \$24,000.

NMC's CAC and the University of Chicago are working to establish ozone and temperature trends in the mid and upper stratosphere by using available data and computer algorithms written by a statistician at the university's Business School. The goal of this collaboration is for CAC to take over responsibility for evaluating these data and updating the trends by 1996. NWS funding for this project in FY 94 was \$40,000.

The NWS OH Nile Project has a Grant with UM that extends from November 1, 1991 through December 1, 1994. The purpose of the Grant is to develop a relationship between geographic parameters in the Nile River such as soil type, stream slopes, elevations, or vegetation with hydrologic model parameters. The university assists in training Egyptian Engineers who were designated to operate the Nile Forecast Center. NWS 1994 funding for this Grant was approximately \$65,000.

Many other one-on-one activities are taking place that are important but do not involve major funding.

14. Summary

The number and variety of collaborative activities between the NWS and the university/research community have been described. As the importance of scientific research achieves greater emphasis via the interactive efforts of NWS Science and Operations Officers, and as personnel in the university/research community become more familiar with the operations of the modernized NWS, the number and variety of these activities will continue to increase.

15. Acknowledgements

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