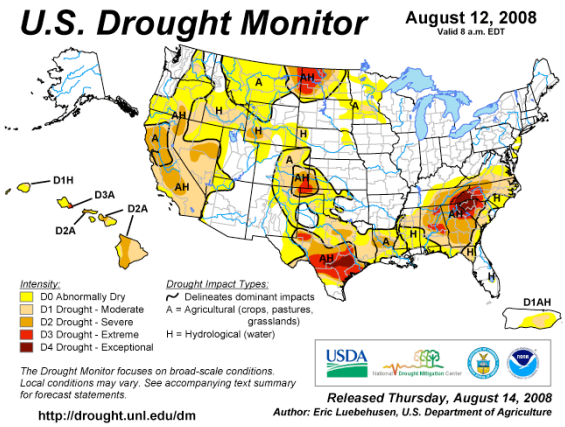
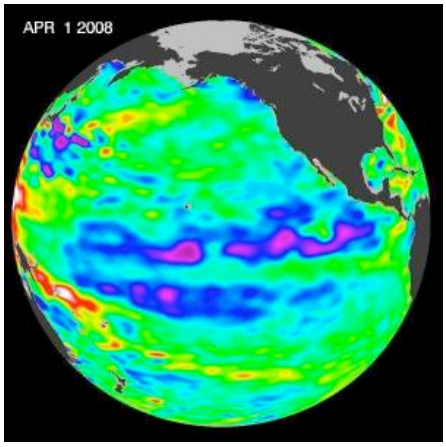
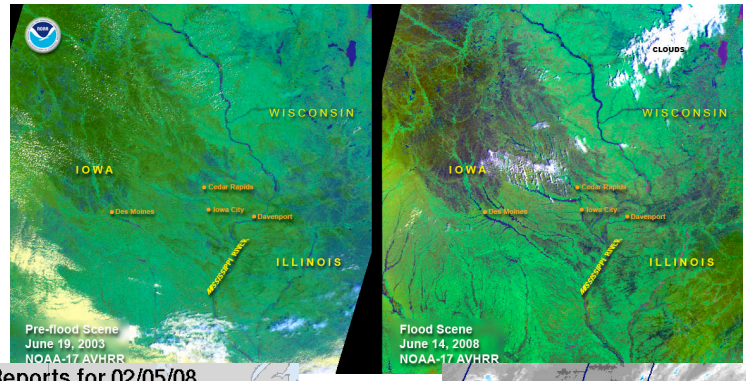
# THE STATE CLIMATOLOGIST

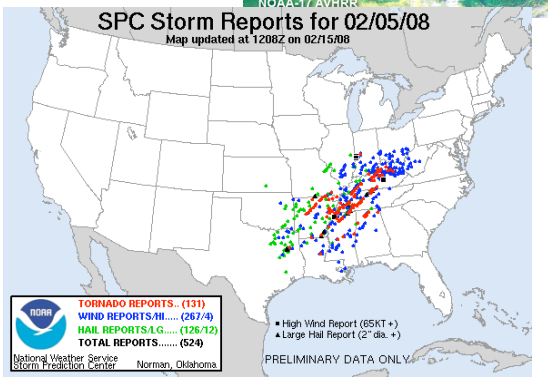
2008 Annual Summary

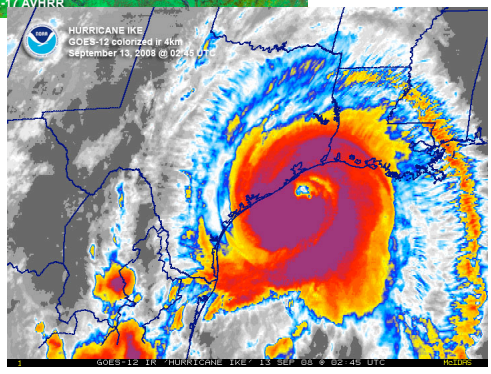
Volume 27, Issue 1




***The State Climatologist*** **is a publication of the American Association of State Climatologists**

Nolan Doesken, President, Colorado State Climatologist

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| Harry Hillaker, Secretary/Treasurer<br>Iowa State Climatologist | David Robinson, ARSCO Coordinator<br>New Jersey State Climatologist | Melissa Griffin, Editor, *The State Climatologist*<br>Florida Climate Centers |
| Marjorie McGuirk, Ex-Officio Member<br>National Climatic Data Center | Ahsha Tribble, Ex-Officio Member<br>National Weather Service – Climate Services Division | Jan Curtis, Ex-Officio Member<br>NRCS –National Water and Climate Center |

# Editor's Note

*The State Climatologist* is an annual report of the activities of the members of the American Association of State Climatologists. It has been a pleasure to be the editors of this year's edition, spanning the period of January – December 2008.

We would like to express appreciation to all of the state climate offices, regional climate centers, AASC partners and others who contributed to this year's edition.

Melissa L. Griffin
Florida Climate Center
Florida State University

June 8, 2009

# Table of Contents

## About the American Association of State Climatologists

The American Association of State Climatologists (AASC) is a professional scientific organization composed of state climatologists (one per state), directors of the six Regional Climate Centers and associate members who are persons interested in the goals and activities of the Association. State Climatologists are individuals who have been identified by a state entity as the state's climatologist and who are also recognized by the Director of the National Climatic Data Center of the National Oceanic and Atmospheric Administration as the state climatologist of a particular state.

State Climatologists currently exist in 47 states and Puerto Rico. They are typically either employees of state agencies or are staff members of state-supported universities. Associate members may be assistant state climatologists or other climatologists under the employ of the state climatologist, representatives of federal climate agencies, retired state climatologists, or others interested in climate services. The total membership of the Association is approximately 150. For more info, see

http://lwf.ncdc.noaa.gov/oa/climate/stateclimatologists.html.

## ARSCO

A state climate office may gain status as the AASC-Recognized State Climate Office (ARSCO) by providing:

1. A document detailing current and planned activities meeting ARSCO requirements;
2. A letter of support from the state's Regional Climate Center Director;
3. A letter of support from at least one National Weather Service Forecast Office serving the state.

Candidate offices must demonstrate the following capabilities:

- Communication capabilities – the office must be able to communicate with its clientele via multiple media, including telephone, Internet, mail, E- mail, and fax;
- Information services – the office must be capable of providing a range of data and information;
- Research – the office must conduct research on climate and human activities;
- Outreach – the office should design products and services for education, climate information, awareness, and the media;
- Monitoring and assessments – monitoring climate conditions, evaluating future impacts, and providing historical context to events are activities conducted by ARSCOs.

Upon receipt of the materials and approval of the AASC Executive Board, a Memorandum of Agreement (MOA) with the National Climatic Data Center shall be issued. Currently, 37 states have received ARSCO status.


Summer, 2009

Dear Fellow Climatologists, Partners and Friends of the AASC,

I am pleased to submit to you the annual report of the American Association of State Climatologists. This collection of short reports briefly summarizes our accomplishments of the past year. The depth and breadth, creativity and productivity of our collective climate monitoring, research, education, service and collaboration is really quite remarkable.

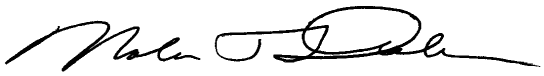
As you review these reports, you will see that our programs and priorities necessarily differ from state to state. Our nation is large and diverse -- characterized by huge regional differences in climate, natural resources, population and socio-economic activity. Still the relevance of our work is clear as we cope with the variations and extremes of our dynamic climate system.

This has been both a great and a difficult year for us. Climate and natural resources are near the forefront of public discussion, policy and political debate. There is a demand for climate data and expertise locally, nationally and globally like never before. Progress towards the formation of a National Climate Service is drawing us together. At the same time, the 2008-09 economic recession is causing serious budget cuts for most states and is having a direct and immediate impact on state government and university budgets that threaten to undermine our good intentions and our best work.

In 2008, the AASC received a sizable increase in NOAA support through our State Climatologist Exchange Program (SCEP). The AASC executive committee quickly moved to develop a mechanism for receiving and reviewing proposals and disbursing funds. Many states have been able to participate and benefit from this federal partnership. More states are working to become AASC Recognized State Climate Offices (ARSCO's). We are grateful to our federal sponsors, as the timing for this outside help was perfect and will hopefully continue.

It is indeed a pleasure to serve as Executive Officer for this organization and I look forward to our progress this next year.

Sincerely,



Nolan J. Doesken
Colorado State Climatologist
President, American Association of State Climatologists

# Written Testimony to the Committee on Science and Technology, Subcommittee on Energy and Environment United States House of Representatives

# Expanding Climate Services at the National Oceanic and Atmospheric Administration (NOAA): Developing the National Climate Service

**May 5, 2009**

Nolan Doesken
President, American Association of State Climatologists
Colorado State Climatologist
Department of Atmospheric Science, Colorado State University

Thank you very much for this opportunity to share a state perspective on climate services

**Background**

Prior to 1973, each state had a state climatologist as a part of a long-standing climate program within the Department of Commerce, U.S. Weather Bureau. When that program was abolished in the early 1970s, states – as they were able over a period of years – established their own offices to carry on the functions of state-specific climate monitoring, research, education and service. NOAA's National Climatic Data Center (NCDC) was an early partner in fostering state-based climate activities. NOAA data, particularly temperature and precipitation data from the National Weather Service Cooperative Observer Network and more detailed Surface Airways observations, were the primary data sources at that time for almost all U.S. ground-based climate monitoring, research and service. NCDC still remains a strong partner supporting state efforts, facilitating access to data, and enlisting our expertise in a variety of ways.

The American Association of State Climatologists (AASC) was established in the mid 1970s to professionally link the efforts of these emerging state programs, and to offer a forum for Federal partners to more easily communicate and work with states on climate-related issues. AASC is an effective organization for communicating Federal-level climate services, through State Climatologists, to the citizens and local stakeholders that we serve, within our states. It has also been an appropriate forum to communicate state-level data and information needs back to Federal agencies. While there is so much climate diversity across our country, and the challenges faced by individual states vary greatly, we share many common interests and concerns that are best addressed together. For example, access to reliable long-term climate data, best practices in data analysis, applied research strategies, means of identifying and assessing state and local climate

variability and change, effective means of outreach, and means of engaging stakeholders and assessing the impact of our efforts.

Recognizing the important role of State Climatologists, the National Climate Program Act of 1978 included language that requested federal funding for State Climate Offices to improve the consistent delivery of critical climate information to the citizens of the United States. Funds for individual state activities were never appropriated then. Still, state climate offices independently developed. The National Climate Program Act of 1978 did not directly help state climate service efforts, but it did lead to the eventual formation of Regional Climate Centers (RCC's) which have been excellent partners and assets to state climate services ever since.

Currently 48 states have State Climate Offices. Some are housed within state agencies, but most are affiliated with state universities. The majority, such as my host institution, are at Land Grant universities. Most State Climatologists are actively involved in research and teaching – collectively mentoring hundreds of future scientists and educators each year. Many of us are well connected or directly a part of our state Extension programs adding further to our outreach effectiveness.

**Activities of State Climate Offices**

State Climatologists (SC's) are experts on the climate of our respective states -- seasonal cycles, geographic variations and year-to-year variability. We are familiar with the climate data resources of our states over the period of instrumental record -- typically back to the 1880s. Some of us have expertise in paleoclimatology which helps provide longer perspectives about climate variability. Nearly all SC's have additional areas of expertise ranging from observation systems, agriculture, and remote sensing, to hydrology, climate modeling and climate change. We enjoy helping others find the data and information they need to address their challenges and opportunities. We often operate on a "grass roots" level, providing personalized and localized climate information to a wide range of businesses, individuals, and organizations. We don't often have the luxury of focusing our efforts on the needs and climate-affected decisions of specific user groups. Instead, we work with diverse groups -- state and local government, utilities, large and small businesses, engineers, architects, builders, consultants, attorneys, researchers, educators, media and many others -- and we do so with a local understanding of the climate and an appreciation for the needs and applications of the customers.. Rather than just providing requested data, it is customary to ask "How will you be using this information?" That simple question so often results in better service, greater trust, frequent opportunities for applied research, and better information about the types of data, models and other decision-making tools, monitoring systems, forecasts and projections needed to answer important questions.

A typical day in the life of a State Climatologist may go something like this. We may brief state agencies in the morning, do a media interview at lunch, teach a class and answer a variety of climate information requests during the afternoon, and then give an invited talk to a community organization during the evening. We are typically passionate

about our work and love sharing information with others. Our products, services and approach to outreach vary somewhat from state to state, and are customized to meet specific local needs. Products typically include addressing weekly or monthly climate monitoring and reporting (to state and federal agencies, media, etc), drought and water supply monitoring, agricultural decision support, historic climate trend analysis, information sources and tools for engineering, architecture, design and related consultants, and consultation to emergency management and law enforcement officials and to the legal profession. Some state offices have actively provided climate data and information supporting renewable energy planning for over 30 years.

Here are a few examples of specific state activities, showing the breadth of our services.
http://www.nc-climate.ncsu.edu/
http://www.ndsu.nodak.edu/ndsu/ndsco/
http://climate.rutgers.edu/stateclim/
The AASC website provides quick-click access to all State Climate Office websites
http://www.stateclimate.org/

State Climate Offices are both users of existing federal climate data sources and providers of unique local data. State climate offices continue to rely on the National Weather Service Cooperative Network data because it is the best source for high-quality nationwide temperature and precipitation data, the only source for nationwide snowfall data, and the only source of relatively consistent century-long nationwide data on the scale of individual counties. But we are interested in any well documented, verifiable data source to help us track specific elements of the climate within our states. We are currently partnering with NOAA to improve state-level data accessibility and information products for the new modernized Historical Climate Network (HCN-M) and the recently deployed Climate Reference Network (CRN).

Driven by ever-growing demands for instantaneous weather data at a high-spatial density, many SCOs manage and maintain specialized observing networks. Best known is the Oklahoma Mesonet http://climate.ok.gov/mesonet/ But many other state climate offices are also involved in aggressive data collection efforts to meet a variety of decision support functions. Even low tech approaches like the volunteer "Community Collaborative Rain, Hail and Snow network" http://www.cocorahs.org are helping gather important data while helping educate the general public about climate. The potential exists to integrate public and private data sources to achieve a national "mesonet" to serve both instantaneous weather and longer term climate service and research needs.

Real time weather data for forecasting and operations have great value but are not always suitable for climate analysis and research. The exact location of weather stations and how well they are maintained make a big difference to climatologists. Therefore, State Climate Offices give much attention to data quality and the development of quality control procedures and tools. We inform NOAA regarding our standards and expectations for climate data and information products. We also work with other federal agencies involved in climate monitoring and research. Stream flow measurements by the USGS, mountain snow accumulation, snow water content and soil moisture measured by

the USDA-Natural Resources Conservation Service, and fire weather conditions monitored by the U.S. Forest Service and Bureau of Land Management all feed in to effective climate monitoring at the state and local level.

State Climatologists receive frequent requests for statewide or more localized information and interpretation of seasonal climate forecasts and climate change projections and potential impacts. Because of the huge scale and magnitude of these efforts, most states rely on the National Weather Service Climate Prediction Center for seasonal forecast information. For climate change projections and impacts, we typically turn to the resources of the Intergovernmental Panel on Climate Change (IPCC) and the Climate Change Science Program (CCSP) as well as other state and regional assessments by public and private entities. We then communicate this information to our more localized audiences adding our knowledge and local perspective.

**State Climate Office relationships with existing NOAA climate service programs**

As stated earlier, the AASC has worked with NOAA's National Climatic Data Center from our very beginning and appreciate the support that has been provided to our members. We also enjoy close working relationships with Regional Climate Centers. Some State Climate Offices are co-located with RCCs. Some RCC staff have previously worked in State Climate Office settings and understand our needs. RCCs have helped State Climate Offices by reducing the need for each of our states to maintain our own independent climate databases for NOAA and other agency climate data resources. The wide variety of information available from the Western Regional Climate Center website is a good example. http://www.wrcc.dri.edu/
Our concerns regarding access to climate data and analysis are usually heard and often addressed. For example, the RCCs are currently developing a climate data access system specifically for State Climate Office needs based directly on specifications developed by our organization

National Weather Service climate service activities have, in recent years, become much more active and visible ranging from drought monitoring, to dissemination of seasonal forecasts to timely web-accessible local climate information. Because of their public visibility and accessibility, the NWS is often the first stop on first-time users' quests for climate information. Traditionally, the NWS major field-level role in climate service was climate data collection including the operation of their nationwide Cooperative Observer Network and airport weather data collection. This has been essential for basic climate monitoring and research. With data analysis support provided through the RCCs, NWS Forecast Offices have greatly improved their own local climate service potential in recent years. This has beneficially taken some of the load off SCOs in terms of routine individual climate information requests.

AASC collaboration with Regional Integrated Sciences and Assessment teams (RISA) is a work in progress but with much potential for further enhancement. Up to this point, most states have not had RISA teams with which to partner. RISAs have benefited from the ability to focus on particular environmental applications and selected decision

makers. This is in marked contrast to State Climatologists who must address the diverse needs of all stakeholders and citizens within their states. Nevertheless, where RISAs have been active for several years, including where I work in Colorado, we are finding many and effective ways to partner to improve climate services, including customized climate education, and focused research and data product development needed to address the questions of specific decision makers. A 2008 report sponsored by the Colorado Water Conservation Board, "Climate Change in Colorado – A Synthesis to Support Water Resources Management and Adaptation", is an example example of RISA-enabled state partnerships.

The presence and activities of the National Climate Program Office (NCPO), while well known at the national level, are not routinely evident at the individual state level. The NCPO has reached out to the AASC and invited our participation in several national-level planning and evaluation meetings (e.g. climate services; drought). We are represented on NOAA's Climate Working Group, their lead external advisory body, which evaluates and recommends future directions for all NOAA observing, research and outreach endeavors related to the climate system. Indirectly, we also benefit from the NCPO's support of RISAs and their sponsorship of other applied research endeavors.

The National Integrated Drought Information System (NIDIS) is a relatively new program but one that may have a large impact on State Climate Office activities. Drought-related efforts at the state level are often the most time consuming and important of all of our multi-faceted endeavors. AASC collaborations with NIDIS may have substantial mutual benefits. Here in Colorado, NIDIS is offering our office a lead role in shaping a portion of the Upper Colorado River Basin NIDIS pilot project with a focus on the drought early warning needs of several specific user groups.

**The American Association of State Climatologists and the National Climate Service**

In 2008, the AASC prepared a statement expressing our interest and identifying our potential role in a developing and evolving National Climate Service.
http://www.stateclimate.org/publications/
Our Association looks favorably on the establishment of the National Climate Service. A well-organized National Climate Service has considerable potential to focus federal resources on global, national, state and local climate challenges. We see NOAA as a logical agency to lead this effort and we look forward to doing our part. We have much to offer and much to gain. Because we work most effectively on the state and local level, and have a finger on the pulse of what many decision makers require, the AASC can add a credible local presence and voice to complete an effective National Climate Service. We are counting on NOAA, and other federal partners needed to construct an effective service, to work well together and to recognize the essential and foundational nature of systematic climate monitoring -- maintaining and enhancing climate observing networks that simultaneously meet many needs (energy, water, agriculture, transportation, commerce, public safety, etc.)

**A concluding story**

In conclusion, I would like to tell a short personal story. Over 20 years ago when "Global Warming" was first appearing regularly in the national press, I was invited to speak to a meeting of the "Colorado Young Farmers" organization. These farmers were mostly in their 40s at that time and well educated. They politely listened to the presentation where we showed upward trends in greenhouse gases and discussed the possible implications and some early climate model projections of warming. Then we showed graphs of 100 years of observed data over eastern Colorado. As dryland farmers on the Great Plains, they were intimately familiar with climate variability and its impacts on their lives and livelihoods. After the formal presentation ended and as we sipped hot coffee, one of the leaders of the organization came up to me (and I will never forget this). "I guess we should take climate change seriously. When I look back at my grandpa and how he farmed I think we can change – we will change. We've already changed our farming practices so much. But this darn year-to-year variability . . . . that's what kills us. We appreciate what you scientists are learning about climate change, but if you can do anything to help us deal with the big changes we see from year to year, we'll be very grateful"

With that in mind, we (the AASC) appeal to you to seriously consider the full range of potential benefits of a National Climate Service across a variety of time scales. With growing concern regarding climate variability and change in a vulnerable society, the needs for both generalized and customized climate data and information will only continue to grow and become more acute. Take the necessary time to develop the appropriate leadership structure that can incorporate the extensive expertise and service capabilities of other federal agencies and make full use of expertise and flexibility of state and university partners. Together, we can accomplish much.

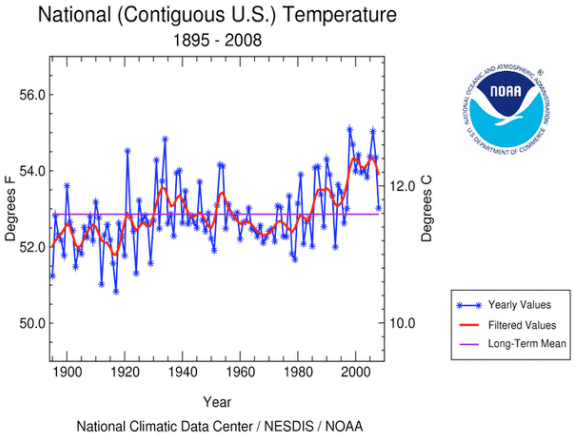
Thank you very much for this opportunity to share my views and those of many of my colleagues.

# 2008 SUMMARY OF THE UNITED STATES CLIMATE

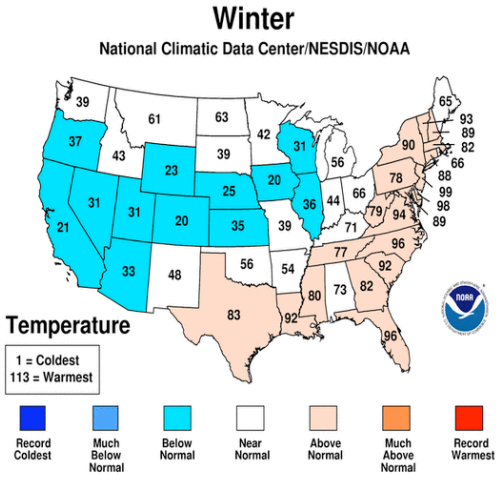
*Compiled from reports by the National Climatic Data Center*

**National Temperatures**

Based on data through the end of 2008, the contiguous U.S. experienced a nationally averaged temperature that was the coolest in more than ten years. The average temperature of 53.0°F (11.7°C) was 0.2°F (0.1°C) above the 20th century (1901-2000) mean.

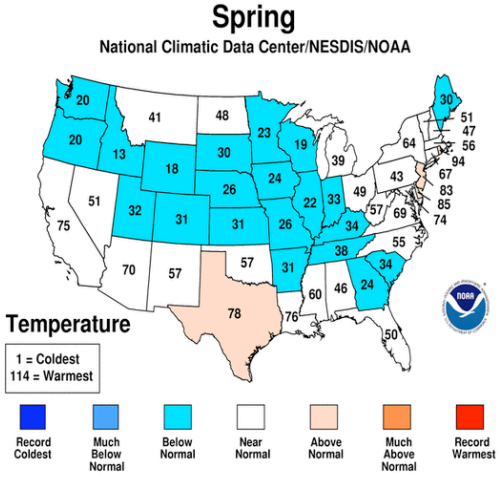


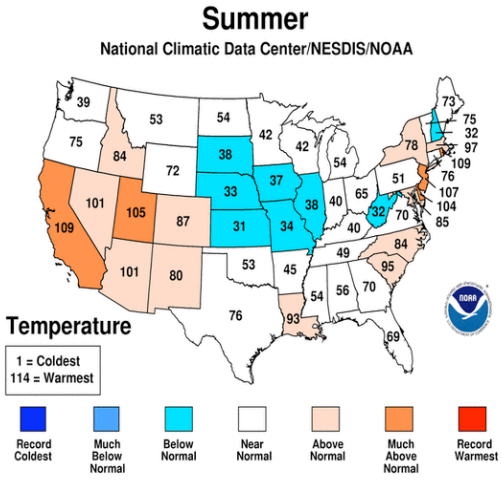

The average temperature for the U.S. has not been this close to the 20th century mean since 1997. The January - December statewide temperature ranking map for 1997 display a close resemblance to the 2008 map. The anomalous warmth that the contiguous U.S. has seen the past 10 years was generally isolated within the West, Southwest, and Northeast Regions during 2008. In contrast, the Central and East North Central regions of the U.S. were below the 20th century mean. This resulted in a near normal nationally averaged temperature of 53.0°F (11.7°C).



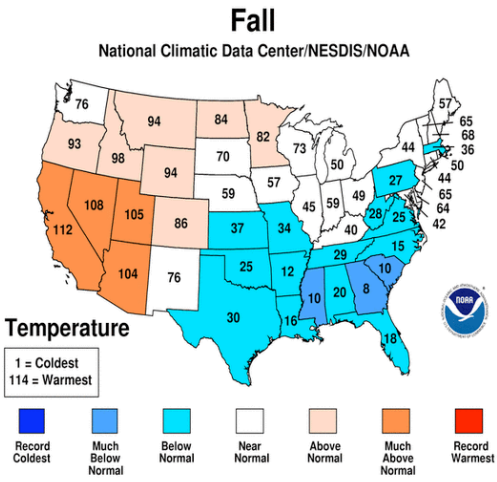

The 2007-2008 winter season (December-February) was the 53rd warmest such period on record (1896-2008), with warmer-than-average temperatures along the South, Southeast and Northeast. Winter temperatures were below normal in the East North Central, Southwest, and West regions.

Spring 2008 (March-May) was the 45th coolest for the nation, with below average temperatures across the central Plains and westward. Rhode Island was 11th warmest on record during this period.

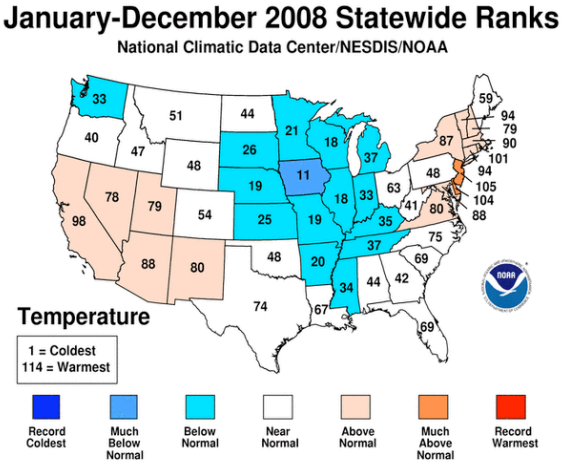




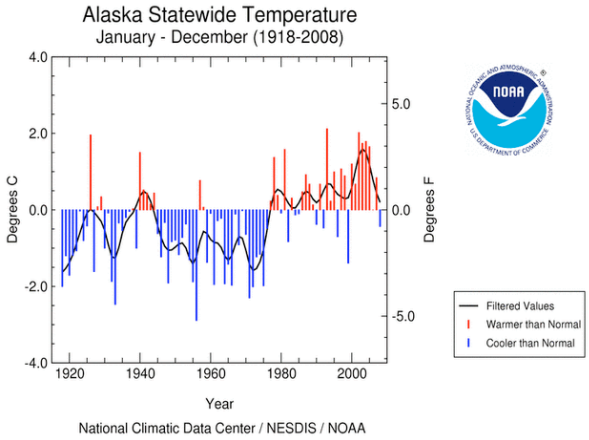

The contiguous U.S. experienced a warmer-than-normal summer (June-August), as the nation ranked 30th warmest in the last 114 years. Much above average temperatures were limited to the west, where California experienced their 6th warmest summer on record, and in the Northeast, where New Jersey experienced their 8th warmest summer and Rhode Island experienced their 6th warmest summer on record.




Temperature averages during the fall (September-November) for the western U.S. were above normal, while the eastern U.S. had below normal averages. California experienced the 3rd warmest fall on record. Arizona, Nevada, and Utah were much above normal during the period as well. This contrasted greatly with the South and Southeast where Georgia saw their 8th coolest fall period on record and both South Carolina and Mississippi experienced their 10th coolest fall. The resulting 2008 fall season (September-November) ranked 32nd warmest nationally.



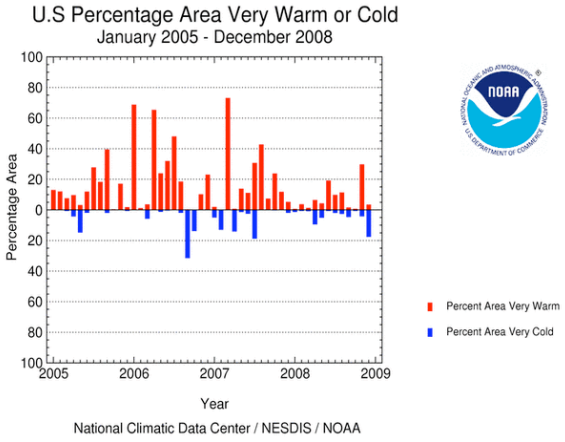

For the January-December 2008 period, cooler-than-average temperatures affected much of the Central, East North Central, and parts of the South regions, while warmer than average temperatures affected the Southwest, West, and portions of the Northeast regions. This resulted in the 39th warmest January-December in the 114-year record nationally. New Jersey experienced their 10th warmest and Delaware had their 11th warmest annual period. Conversely, Iowa had their 11th coolest annual period.



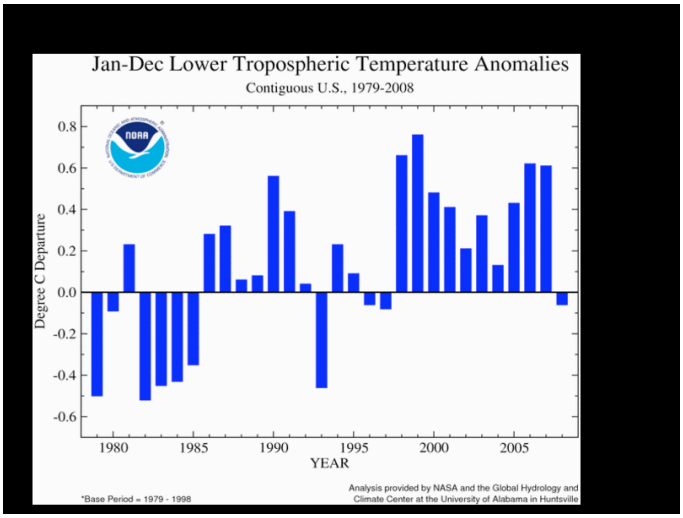

Annual temperatures across the state of Alaska during 2008 averaged approximately 0.7°F (0.4°C) below normal. Winter temperatures in 2007-2008 were near average. Spring was the 29th warmest on record with with a temperature 1.0°F (0.6°C) above average, Summer was 1.0 °F (0.6°C) cooler than average, and Fall was more than 2.0°F (1.1°) cooler than the 1971-2000 average.

More details of individual monthly and seasonal reports for 2008 can be found in NCDC's monthly and seasonal reports.

The percent area of the contiguous United States very warm and very cold during each of the past 48 months is listed in the figure to the left. These percentages are computed based on the climate division data set. Those climate divisions having the monthly average temperature in the top ten percent (> 90th percentile) of their historical distribution are very warm and those in the bottom ten percent (< 10th percentile) are very cold.




The U.S. did not see any massive warm or cold outbreaks during 2008 and only once in 2008 (November) did 20% or more of the U.S. experienced very warm monthly average temperatures.

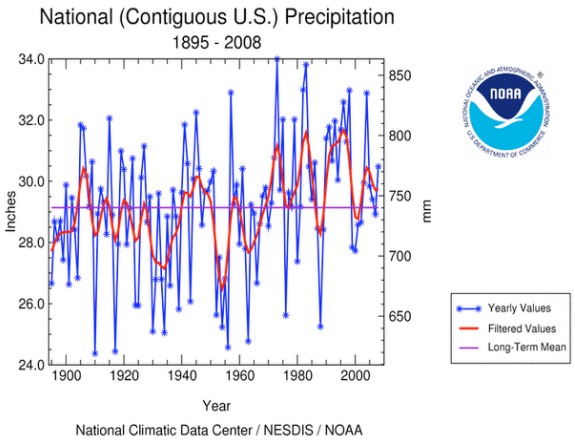


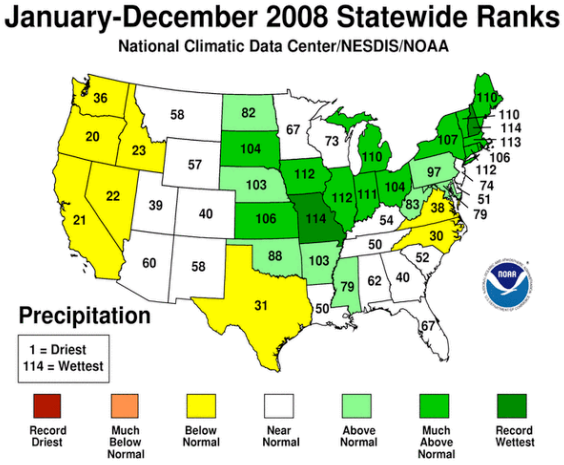

Below average temperatures were measured in the lower troposphere for the first time in more than 10 years. Data collected by NOAA's TIROS-N polar-orbiting satellites and adjusted for time-dependent biases by NASA and the Global Hydrology and Climate Center at the University of Alabama in Huntsville indicate that temperatures in the lower half of

the troposphere (lowest 8 km of the atmosphere) over the U.S. were slightly cooler than the 20-year (1979-1998) average.

**National Precipitation**

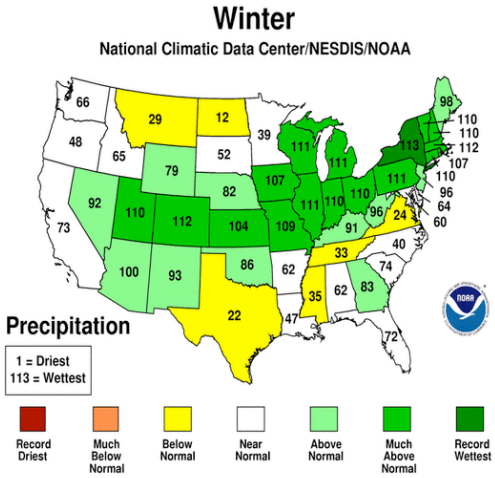
Precipitation in the United States during 2008 was variable throughout much of the country with periods of excessive rainfall, especially across the central third of the country. The western U.S. remained parched, while the drought conditions lessened in the Southeast. The Northeast region averaged 50.04 inches (1,274 mm) of precipitation in 2008, which was 9.06 inches (230 mm) above the 20th century (1901-2000) average. New Hampshire experienced their 5th consecutive year with above average precipitation with 19.84 inches (504mm). It was their wettest on record, breaking the previous record set just four years prior. Missouri also experienced their wettest year on record with 57.28 inches (1455 mm) of precipitation, which was 16.52 inches (420 mm) above average.



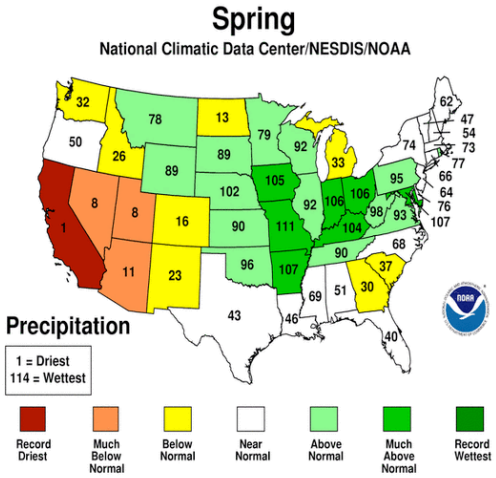

Precipitation during the December 2007 - February 2008 period was above normal for much of the contiguous U.S. as it was the 16th wettest winter on record. In the spring an average of 8.0 (203 mm) inches of precipitation fell across the U.S., making the season the 42nd wettest on record. California had the driest spring on record, while Nevada and Utah had their 10th and 11th driest springs on record; respectively, Missouri had their fourth wettest spring and Arkansas, Indiana and Iowa all experienced a wet period that ranked in the top 10 on record. The summer brought an average of 8.0 inches (203 mm) of precipitation across the U.S., however much of the precipitation occurred in the eastern two-thirds of the country. It was the 53rd driest fall on record for the nation. The precipitation pattern for much of the contiguous United States was comprised of both wet and dry extremes, which resulted in a near normal average for the period.

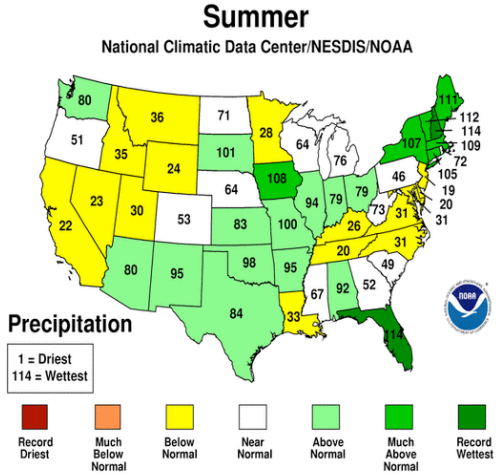
For the contiguous U.S. every month, with the exceptions of October and November, was near to above average in 2008. The increased precipitation during 2008 helped ease some of the drought stricken areas across the U.S. According to the U.S. Drought Monitor, the percent area of severe to extreme drought decreased by approximately 25% in the West. The severe to extreme conditions in the Southeast decreased by more than 50%. The average annual precipitation for 2008 was 30.48 inches (774 mm), which is 1.34 inches (34 mm) above the 20th century (1901-2000) average.




Nationally, this was the 18th wettest winter (December-February) in the 1895-2008 record. The state of New York recorded its wettest winter on record, and the states of Colorado, Connecticut, Pennsylvania, and Vermont experienced their second wettest winter on record. The South region received below normal levels of precipitation, mostly due to a dry winter in Texas.

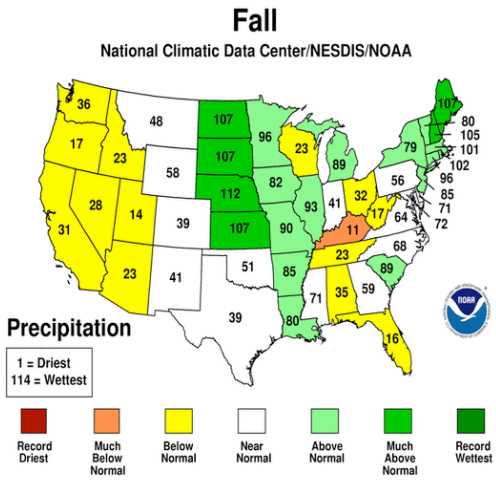
California had their driest spring (March-May) on record, while Nevada and Utah had their 10th and 11th driest springs on record, respectively. Conversely, parts of the central Mississippi valley received much above normal precipitation during the spring. Missouri experienced the fourth wettest spring, Arkansas the sixth, Indiana and Iowa the eighth wettest, and Illinois the tenth wettest spring in the 1895-2008 record.

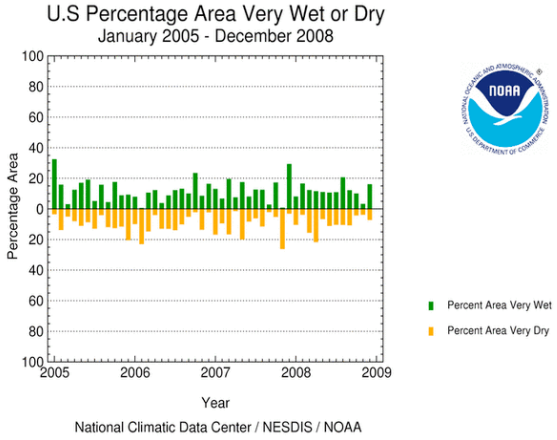



Both Florida and New Hampshire experienced their wettest summer (June-August) on record in 2008. The Northeast as a whole experienced their ninth wettest summer on record as Maine, Vermont, New York, Massachusetts, and Connecticut were much above normal. Iowa had their seventh wettest summer on record. Below normal precipitation was confined to areas in the West and East. Tennessee, New Jersey, Delaware, and California all experienced a below normal summer which ranked in the bottom 25.

This was the 53rd driest fall (September-November) in the 1895-2008 record nationally. An average of 6.7 inches (169.1 mm) of precipitation fell across the contiguous U.S., which is 0.1 inch (1.2 cm) below average. Nebraska experienced its third wettest fall on record and the state of Kentucky experienced its 11th driest fall on record. On the regional level, the West North Central received much above normal precipitation, while the Southwest and East North Central regions received below normal precipitation.



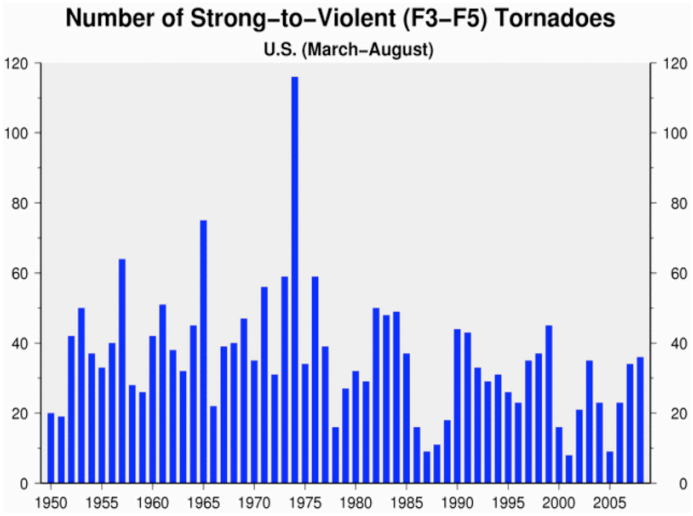




The percent area of the contiguous United States very wet and very dry during each of the last 48 months is listed in the adjacent figure. These percentages are computed based on the climate division data set. Those divisions having the monthly total precipitation in the top ten percent are very wet and those in the bottom ten percent are very dry. In 2008, a tenth or more of the country was very dry during March, April, and September.

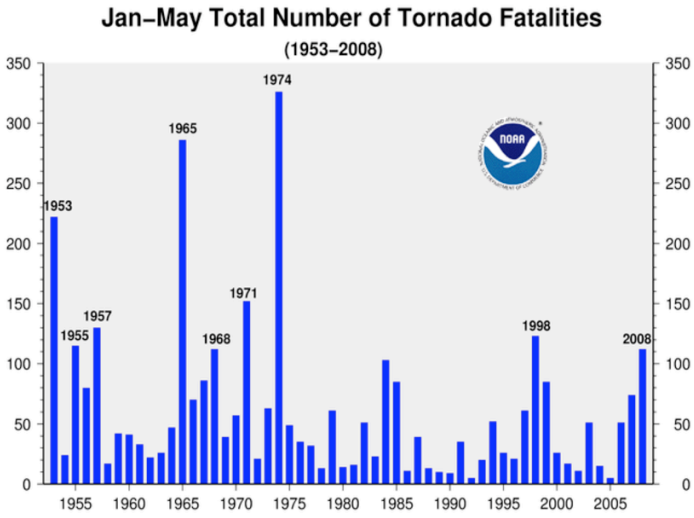
During February-September of 2008, a tenth or more of the country was very wet. The highest monthly percentage seen during 2008 was in August when 19% of the U.S. was very wet.

**Severe Storms**

According to NOAA's Storm Prediction Center, preliminary estimates indicate that there were 2,192 reported tornadoes from January-December 2008, which is well above the ten-year average of 1,270. Of these tornadoes, 36 were rated EF3-EF5, which is equivalent to the average number of strong to violent tornadoes, which have been reported over the period 1950-2008. Note that these numbers represent



preliminary tornado reports and not the final number of total tornadoes.

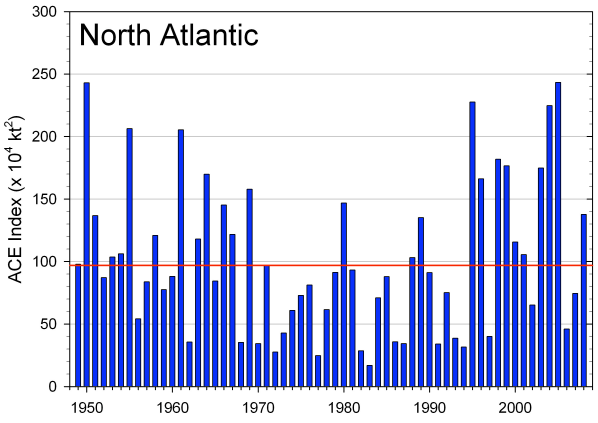



The beginning of 2008 was an active severe weather period. There were 54 confirmed reports of tornadoes and five deaths across the Midwest between January 7th and 8th, making it the second largest January tornado outbreak on record. On February 5th, while 24 states held primary elections, 87 tornadoes occurred. This deadly event, nicknamed the "Super Tuesday Outbreak", caused 57 deaths in the southeastern U.S. for a total of 58 nationally in the month of February. The number of tornado related fatalities reported in February was the second highest on record for the month.

May was also an active month with 460 confirmed tornadoes, making it the third most active May on record. For the period January through May, a total of 112 tornado fatalities were reported. This year shares the record with 1968 as the eighth deadliest January through May period since reliable records began in 1953. Severe weather continued into June when two outbreaks spawned 289 confirmed tornadoes.

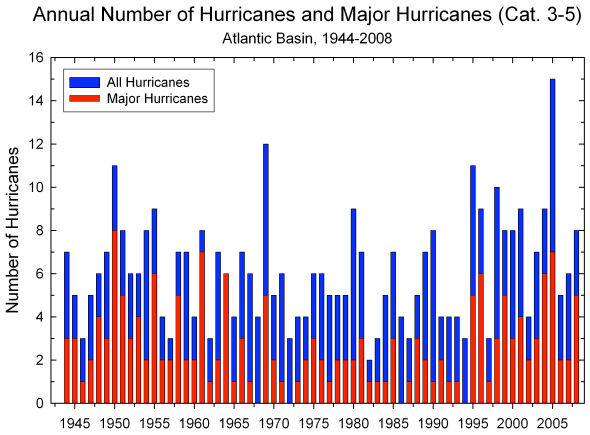
**Atlantic Hurricanes**

The 2008 Atlantic basin hurricane season was above the 1950-2000 average with 16 named storms, of which eight were hurricanes, including five major hurricanes. The ACE index of hurricane activity indicated an above-average season, with a preliminary value of approximately $142 \times 10^4$ knots$^2$. In terms of accumulated cyclone energy (based on integrated wind power of all tropical cyclones during the season, both landfalling and those remaining out at sea), 2008 ranked as the 16th most energetic season out of the last 59.

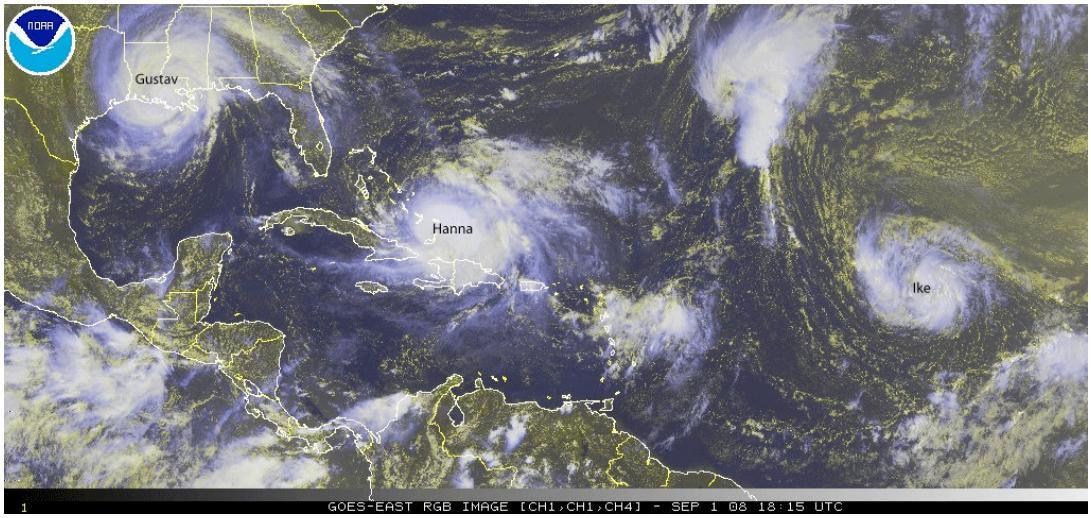



The first 2008 Atlantic storm to make landfall in the U.S. was Hurricane Dolly. The storm made landfall in South Padre Island, Texas on July 23rd. While there were no direct deaths from the hurricane, it caused an estimated $1.2 billion of damage. Tropical

Storm Fay was the first storm in recorded history to make landfall four times in a single state. Fay first made landfall in southern Florida on August 18th and continued to batter Florida through the 21st. Thirty-six deaths were blamed on the tropical storm and damages are estimated to exceed $180 million.




On August 25th, Hurricane Gustav formed in the South Caribbean as the season's second major hurricane. Hurricane Bertha on July 3rd was the season's first. Hurricane Gustav first made landfall in Haiti and again in western Cuba. On September 1st, Gustav made U.S. landfall in Louisiana as a category 2 hurricane. Gustav was blamed for a total of 138 deaths in the U.S. and the Caribbean and resulted in an estimated $4.3 billion of damage



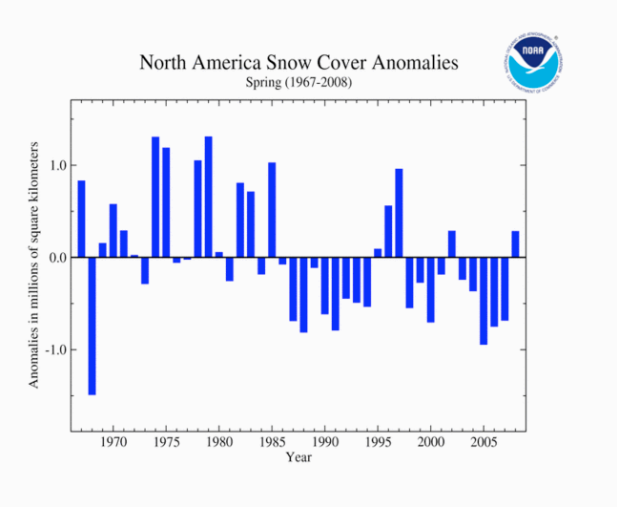

As Gustav made landfall, Hurricane Ike began to form in the eastern Atlantic. Facilitated by favorable atmospheric conditions, Ike was able to quickly intensify into a category 4 hurricane on September 4th. On the 7th, while trying to recover from three earlier storms (Fay, Gustav, and Hanna), Cuba was hit again with winds estimated at 127-132 mph (203-213 km/h or 110-115 knots). Ike made U.S. landfall at Galveston, Texas, on September 13th as a category 2 hurricane. One-hundred-sixty-four deaths were blamed on Ike and damage estimates totaled more than $30 billion in the U.S., Cuba, and Bahamas, making Ike the third costliest hurricane of all time behind Andrew and Katrina.

Hurricane Paloma was the last major hurricane in the 2008 Atlantic Basin season. It was also the third major hurricane to hit Cuba (Gustav and Ike). This marks the first time on record that Cuba was struck by three major hurricanes in one season. Paloma made

landfall in Santa Cruz del Sur, Cuba on November 8th and caused an estimated $1.4 billion of damage.

This year was the only year on record in which a major hurricane existed in every month from July through November in the North Atlantic (Bertha, Gustav, Ike, Omar, and Paloma). On July 20th, there were three active storms: Hurricane Bertha, and Tropical Storms Cristobal and Dolly. This was the earliest known date for three storms to be active on the same day. It is also noteworthy that none of the five major hurricanes (category 3 and above) were of major status at the time of U.S. landfall. This information is based on preliminary data and is subject to change.

**Snow Season**

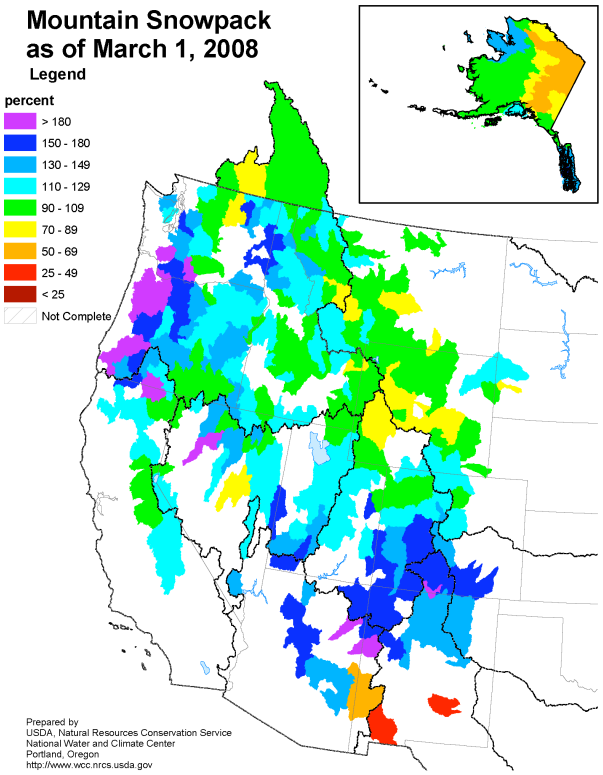



The 2007-2008 snow season began with above average snowfall across parts of th e Southwest and well-below-normal amounts in the Sierra Nevada, Cascades, and the Bear (ID, UT) and Salt River Ranges. A major ice storm struck parts of the south-central U.S. in the second week of December 2007, leaving over 600,000 residents in Oklahoma without power and causing over 20 fatalities across five states, prompting the governor to declare the ice storm the worst in Oklahoma history.

The same system later brought heavy amounts of snow to the Northeast, slamming Boston with up to ten inches (25.4 cm) on December 13th. As many residents began to clear out from the last storm, another strong upper-level system moved across the central U.S. through New England between December 15th-17th, bringing ice, sleet, damaging winds, and as much as 18 inches (45.7 cm) of snow in some areas. Detroit, MI, received 9.0 inches (22.9 cm) of snow, tying it as the 9th biggest December snowstorm on record. By the 17th, the total snowfall (19.6 inches/49.8 cm) in Boston, MA was more than the total snowfall of 2006-2007 (17.1 inches/43.4 cm).

February brought a series of large winter storms across much of the northern two-thirds of the U.S. By the end of the month, Boston's Logan International Airport broke a new February record for total precipitation, and parts of Wisconsin also set new seasonal snowfall records. In March, several additional cities broke seasonal snowfall records. Madison, WI set a new record for seasonal snow total of 100.1 inches (254.2 cm) on March 24, breaking the previous record of 76.1 inches (193.3 cm) from the 1978-79 season. Milwaukee, WI had its second snowiest winter on record as of March 24th. The seasonal snowfall total in Caribou, ME on March 21nd reached a new all-time record when the 2007-2008 total of 184.5 inches (468.6 cm) surpassed the previous record of 181.1 inches (460.0 cm) set during the 1954-55 snowfall season. By the end of the

month, the snowfall total at Caribou was 190.7 inches (484.4 cm). Snowfall records at Caribou began in 1939. By the end of March, the winter of 2007-2008 in Concord, NH ranked as the second snowiest on record, only six inches (15 cm) shy of the all-time seasonal record of 122 inches (310 cm) set in the winter of 1873-74.




During the winter of 2007/2008, the snowpack levels were above-average in much of the Rockies, Cascades, and Sierra Nevada in the western U.S. At times, some areas in Oregon, Washington, Arizona, New Mexico, Nevada and southern Colorado had levels above 180% of normal. Conversely, parts of Wyoming, Montana, Nevada and north-central Washington had levels below normal, as did much of eastern Alaska and southern New Mexico. Above-average snowfall during the 2007-2008 season brought relief to many areas of the western U.S. that were plagued by drought in previous years.

**Natural Resources Conservation Service**
National Water and Climate Center
1201 NE Lloyd Blvd, Suite 802
Portland, OR 97232
http://www.wcc.nrcs.usda.gov

***National Water and Climate Center Overview***

The National Water and Climate Center (NWCC) is part of the Natural Resources Conservation Service within the United States Department of Agriculture. The Center's mission is to "*lead the development and transfer of water and climate information and technology that support natural resource conservation*." The primary goal of the NWCC is to be "*a globally recognized source for a quality snow, water, and climate information and technology*."

***Staffing***

The NWCC consists of three branches under the Center's new Director, Mike Strobel; Water and Climate Services (WCS), Water and Climate Monitoring (WCM) and Information Systems Branch (ISB). Water and Climate Services has two main functions: produce water supply forecasts for the western U.S. and provide climate services for the NRCS and other cooperating USDA agencies nationwide. The key staff members of this Center are:

- Jim Marron, Resource Conservationist, jim.marron@por.usda.gov, 503-414-3047
- Jan Curtis, Applied Climatologist, jan.curtis@por.usda.gov, 503-414-3017

***Hydro-Meteorological Networks***

- SNOTEL: About - http://www.wcc.nrcs.usda.gov/snow/about.html, Sensors, Data, and Products - http://www.wcc.nrcs.usda.gov/snow/
- Snow Course: http://www.wcc.nrcs.usda.gov/snowcourse/
- SCAN: http://www.wcc.nrcs.usda.gov/scan/

***Climate Products***

- Soil Narratives and Tables: http://www.wcc.nrcs.usda.gov/cgibin/soil-nar.pl, http://www.wcc.nrcs.usda.gov/climate/climate-map.html
- Wind Rose Graphs: ftp://ftp.wcc.nrcs.usda.gov/downloads/climate/windrose
- Adjusted Daily Wind Database: ftp://ftp.wcc.nrcs.usda.gov/downloads/climate/windrose
- GEM (Generation of Weather Elements for Multiple applications) model: ftp://ftp.wcc.nrcs.usda.gov/downloads/climate/gem
- PRISM: http://www.wcc.nrcs.usda.gov/climate/prism.html

***Western Water Supply Forecasts***

Monthly, between January and May, this Center produces reports, maps, and graphs, with explanations on how to interpret these products at: http://www.wcc.nrcs.usda.gov/wsf/wsf.html. Experimental daily water supply products

have been developed for water resources managers: http://www.wcc.nrcs.usda.gov/wsf/daily_forecasts.html.

***Other Projects***

*QC of SNOTEL Data Continues*

These datasets can be access via the SNOTEL QC data server:
http://gisdev.nacse.org/prism/snotelqc/

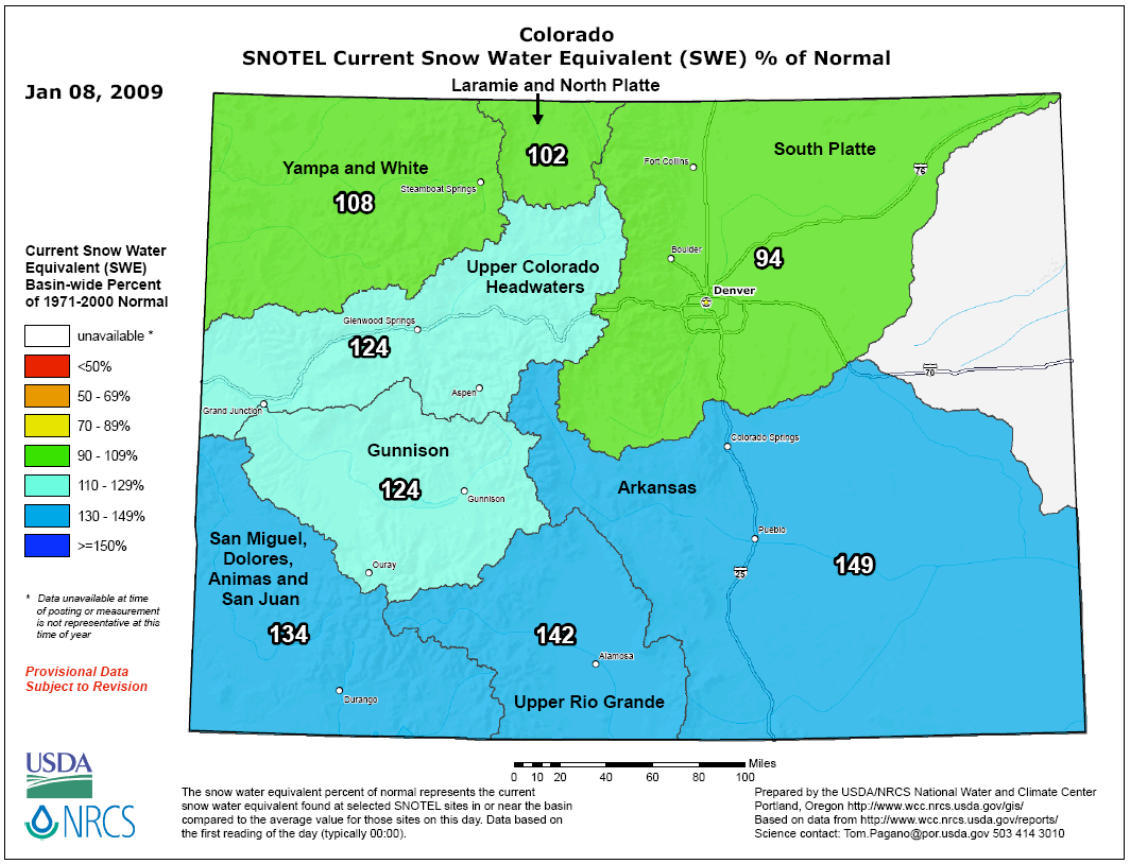
*Seamless Daily PRISM Maps*

The final set of daily US climate maps at a 4 km x 4km resolution for Tmax, Tmin, and Precip from 1960-2001 have been completed and can be acquired by contacting Jan Curtis above. These data will be available in GIS format. The related seamless COOP dataset by state is available at:
http://avenger.wrds.uwyo.edu/Seamless-Coop/

*New Maps of SNOTEL Data*

NWCC continues to add to its GIS-based products. The maps are available from - http://www.wcc.nrcs.usda.gov/gis/index.html.

Here is an example of a basin-filled map showing SWE:
ftp://ftp.wcc.nrcs.usda.gov/data/water/wcs/gis/maps/west_swepctnormal_update.pdf



# Midwestern Regional Climate Center

Illinois State Water Survey
2204 Griffith Drive
Champaign, IL 61820
mrcc@sws.uiuc.edu
http://mrcc.sws.uiuc.edu


***Steve Hilberg, Director***

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**Administration**

A major institutional change this past year was the moving of the Illinois State Water Survey, the MRCC's home institution, and three sister agencies from the Illinois Department of Natural Resources to a new Institute for Natural Resources Sustainability at the University of Illinois. The move was effective on July 1, 2008. Until this point the Illinois Scientific Surveys were "allied agencies" with the University, but under the administrative control of the IDNR.

There were a number of staff changes in the MRCC. Ken Kunkel resigned from the MRCC and the Illinois State Water Survey in July to accept a position as Executive Director of the
Division of Atmospheric Sciences at the Desert Research Institute.

Karen Andsager retired from the MRCC and Illinois Water Survey in June. Karen was the P.I. on the CDMP "Forts" project since its inception. Nancy Westcott has taken over her role directing the CDMP Forts project.

Alan Black was hired in June to fill the Service Climatologist vacancy created when Sam Shea left for a position in the National Weather Service.

Michael Timlin became the new Regional Climatologist at the MRCC at the end of February 2009, replacing Mike Palecki who left to take a position as Science Project Manager for the U.S. Climate Reference Network at NCDC.

**Data, Data Systems, and Data Management**

The MRCC staff continued to make steady progress on the MRCC Applied Climate System (MACS), an ACIS-based client to replace the aging Midwestern Climate Information System (MICIS). A number of products have been completed and are operating on the MRCC web site. The goal is to have MACS fully operational by Fall 2009, at which time MICIS will be decommissioned.

The MRCC made significant improvements to some of the map-based products produced on a routine basis. Modifications have been made to the MRCC gridded temperature departure maps so that they are now all visually consistent with regard to the color representation of temperature departures. We are now using one color bar to for the range from -25°F to +25°F, ranging from purples to greens on the negative half and oranges to

pinks on the positive half. Prior to this change, the grads program scaled each map and assigned colors to that scale. This meant that maps could not be visually compared, as one color could mean one temperature value on one map and a totally different temperature value on a second map.

This year the CDMP Forts Project largely passed through the software development stage and is in the production stage. Data from the CDMP Forts Database are being incorporated into two historical data sets, the Surface Pressure Databank (ISPD) version 2.2 for input into the Version 2 Reanalysis Data, and the Global Historical Climatology Network (GHCN) Daily Data. For more information on the MRCC's efforts with CDMP, see the web page at http://mrcc.isws.illinois.edu/research/cdmp/cdmp.html

**Climate Services and Collaborations**

The heavy rain and flooding in much of the Midwest last summer and heavy rain associated with the passage of the remnants of Hurricanes Gustav and Ike prompted many media inquiries at the MRCC last summer and fall. The MRCC issued a press release putting the 2008 flooding in the context of the Great Flood of 1993. We also produced several precipitation maps that merged precipitation from U.S. Cooperative network with observations from the Community Collaborative Rain, Hail, and Snow (CoCoRaHS) using GIS. The inclusion of the CoCoRaHS data more than tripled the number of available observations for analyses. A map of the rainfall from Ike's passage through the southern Midwest combined with heavy rain associated with a stalled front ended up being shown on The Weather Channel's Evening Edition segments. The MRCC also supplied data about the rain and flooding in Iowa to an author who is writing a book about the flooding and its impacts in Cedar Falls, IA.

The MRCC continues to cooperate with the NWS on a variety of issues,

MRCC Director Steve Hilberg is participating on the Design Team for the NOAA National Climate Portal. He is also serving as RCC representative to the NOAA Great Lakes Regional Collaboration Team.

**Applied Research**

Major research initiatives continued this year despite the departure of some key staff. Ken Kunkel continues to participate in the project that he began while at the ISWS to study mechanisms causing trends in heavy precipitation events. Nancy Westcott continued her work on high resolution precipitation gauge networks, evaluation of radar/rain gauge blend products and their use in river forecasting, and dense fog development. Management of the project to foster the development of a "drought ready communities" program, started under Mike Palecki, has been assumed by Illinois State Climatologist Jim Angel.

# Southeast Regional Climate Center

University of North Carolina at Chapel Hill
Department of Geography
Saunders Hall
Campus Box 3220
Chapel Hill, NC 27599-3220
Phone: (803) 843-9721


***Peter J. Robinson, Director***

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2008 was the first fully operational year for the NOAA Southeast Regional Climate Center located at UNC-Chapel Hill, with the technology branch at North Carolina State University. The SERCC Web site was modernized during the year, and functioned as a source of ACIS-based data and associated information. Use of this information system increased slowly though the year, as did the number of individual requests answered by the Center. Most requests came from the Carolinas, although in December Florida topped the list. Throughout the year SERCC responded to requests from the State Climatologists in the region, and continued to send requests to individual SCOs whenever they were in a better position to respond Deputy Director Chip Konrad represented SERCC at the 2008 AASC Annual Meeting.

The Center organized and supported a meeting with all the State Climatologists in the region in Atlanta, GA, April 14-15, 2008. A major topic was the development of strategies for advancement of coordinated climate services throughout the region. Specific actions are to be developed, with regular interactions scheduled. Thanks to the participation of NCDC, a regular monthly teleconference is now scheduled. A feature of the teleconference is commonly a review of the weather and climate of the past month, the Center using the local information as part of its required monthly climate monitoring report ,which is transmitted to NCDC and eventually to the Department of Commerce.

The Climate Prediction Applications Science Workshop 2008 was sponsored by the Regional Center and held in Chapel Hill March 4 – 7, 2008. Approximately 90 people attended. In addition to the opportunity to raise the visibility of climate services, Regional and State, throughout the climate prediction community, there was a lively interchange of information and ideas.

The Center has been charged by NOAA to serve as a focal point for activities linking climate, climate change and public health. The Center is in the process of refining its ideas concerning a climate information clearinghouse to emphasize the climate-health links, concentrating on the southeast United States, but amenable to pertinent information from anywhere on the globe. Center personnel attended several meetings, conferences and workshops in connection with the links, and is currently working with various groups to establish an agenda for the creation and provision of pertinent information.

During the year the Center also participated in meetings with the RISA's in the region and with representatives of NIDIS, all involving the development of improved climate services. In addition Center personnel attended functions with representatives of user groups in tourism, insurance, transport and horticulture. The level of participation varied, but in all cases there was an opportunity to indicate the types of services offered by the Regional center and by the State Climate Offices in the region.

# Western Regional Climate Center

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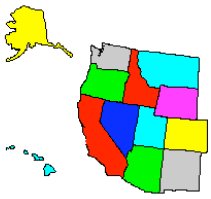

Western Regional Climate Center

***Dr. Timothy Brown, Director***

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The Western Regional Climate Center (WRCC) is housed at Desert Research Institute (DRI) in Reno, NV. DRI is a member of the Nevada System of Higher Education, which also includes University of Nevada-Reno, University of Nevada-Las Vegas, and several community colleges. Established in 1986, WRCC's geographical region is large in area and diverse climatologically, including 11 western states, Hawaii, Alaska, and the Pacific Islands. The region served by WRCC in the continental US includes Washington, Oregon, California, Idaho, Montana, Utah, Arizona, New Mexico and Colorado/Wyoming (the latter shared with the High Plains Regional Climate Center).

Early in 2008, Dr. Tim Brown was named director of the WRCC, and Dr. Kelly Redmond resumed his role as Deputy Director and Regional Climatologist.

**Data**

The WRCC contributed to further development of the Applied Climate Information System (ACIS), as a collaborative effort among the Regional Climate Centers. Grant Kelly and Greg McCurdy are WRCC's programmers who are working on ACIS. The National Park Service and others are already utilizing new capabilities to access data through ACIS.

Data acquisition at WRCC was augmented with new stations and networks in 2008, joining the ongoing archivalof many US and western US-specific weather and climate data sets. Currently we acquire and make accessible national data sets within the region. Archived data sets include: NWS Cooperative Observer Network, airport hourly (SAO/METAR), Remote Automated Weather Station (RAWS), and NRCS Snowpack Telemetry (SNOTEL), and regional data sets such as the California Irrigation Management Information System (CIMIS), California Snow Survey, Community Environment Monitoring Program (CEMP), and many other smaller networks such as NOAA buoys, coastal sites, Washoe Evapotranspiration Project, and individual sites of interest. The WRCC has now installed and maintains almost 70 climate stations, primarily in the California/Nevada region, with a recent focus on high altitude and coastal climate monitoring. Most of the WRCC-maintained stations are reporting at 5-minute intervals online. This year, WRCC completed an Enhanced California Climate Monitoring project, and took responsibility for a network on Catalina Island and a unique very dense network in the Owens River Valley.

Jim Ashby continues to work with the Reno National Weather Service (NWS) Forecast Office and the Nevada State Climatologist to digitize non-official cooperative observations.

WeatherCoder III, a joint project among NWS, NCDC and the RCCs (currently, through WRCC), operated well in 2008, and at year's end was on track to initiate a "paperless" cooperative network starting in early 2009. Grant Kelly remains the primary programmer and point of contact for technical issues. Greg McCurdy and Kelly Redmond are also involved.

**Climate Services**

WRCC web visitors now log approximately 1.7 million page views per month, about the same as 2007. The months from October to January log the highest use, with fewer page views occurring in summer. There were over a million unique visitors to the WRCC website this year.

Jim Ashby, Michelle Breckner and Dorothy Miller act as primary points of contact for information queries received via telephone, email and other means. Kelly Redmond remains the key staff person responsible for media interviews, but these tasks are also spread among others in his absence. The Center noted a steady increase in requests for climate change information.

**Applied Research**

Dave Simeral has been very active this year in Historical Climatology Network-Modernization (HCN-M) activities. Dave and Greg McCurdy have been performing site surveys for possible locations of HCN-M stations, with an average of 2 weeks per month on travel. The first region of interest includes the Four Corners states of CO, UT, AZ, and NM. Suitable sites have been found by WRCC and HPRCC at about half the 141 eventual locations.

Laura Edwards began work as a United States Drought Monitor author in 2008. A travel exchange with Brian Fuchs at the National Drought Mitigation Center provided the necessary training. Other new projects that were funded this year include the development of a WestWide Drought Tracker and National Science Foundation support for workshops geared towards early career women in atmospheric and related sciences. Both of these are three-year efforts.

Dr. Kelly Redmond is working with the National Integrated Drought Information System and its Program Implementation Team. A gap analysis is under way for the first NIDIS pilot project on the Upper Colorado River. Kelly and John Abatzoglou are involved in a NOAA project to develop a freezing level tracker for North America. Kelly was also very active in meetings, panels, and discussions related to the development of a National Climate Service.

In 2008, Dr. John Abatzoglou moved to a faculty position at San Jose State University, but he retains many connections to WRCC projects and activities. Together with Kelly

Redmond and Laura Edwards, a climate regionalization paper was submitted and accepted to Journal of Applied Meteorology and Climatology.

**Other Activities of Interest**

During 2008 Kelly gave about 40 presentations on a wide variety of topics, and accepted the Applied Climate Award from AMS at its Applied Climatology conference in Whistler, BC, Canda, in August. Laura served as the program co-chair for this meeting. Laura also worked with faculty at University of Nevada-Reno to develop an introductory global climate change course that has been accepted into the curriculum. The WRCC increased its involvement with wind energy initiatives, following initial efforts by recently retired WRCC director Dick Reinhardt.

Climatically, and notably, the year 2008 showed a significant cooling in the western states from the very warm temperatures of the previous decade, for reasons yet unknown.

# Alabama Office of the State Climatologist (AOSC)

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***John Christy, Alabama State Climatologist***
Bob Clymer, Assistant State Climatologist

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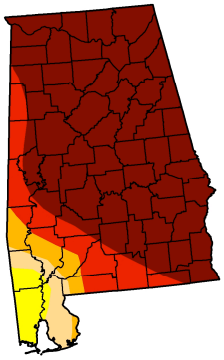
It is the role of the Office of State Climatology to provide weather and climate information to public and private interests to improve decision-making activities that affect environmental quality and the economic efficiency of the State. Activities include providing specific weather data for the state and for the world, developing plans to mitigate the economic impacts of weather and climate variability and providing consultation on the use, interpretation and availability of weather and climate information. The Alabama Office of the State Climatologist also directly engages in important societal debates such as global warming through workshops, congressional testimony and educational activities.

**2008 conditions improve after 2007**

The drought of record for several locations in north and central Alabama in 2007 (reddish-brown, see below for 21 August 2007 Drought Monitor) saw considerable improvement as near, but still below, normal winter rains returned in 2008 as the La Niña had an effect.



Of major impact was that of tropical storm Fay in late August, causing August 2008 to become the 2nd wettest statewide since 1895. December 2008 was also extremely wet in many northern Alabama locations.

**Major Freezes**

The typical see-saw in temperatures developed in late 2008, characteristic of a neutral phase of the ENSO cycle before the weak La Niña appeared at year's end. Early freezes

in late-October and mid-November set several daily records. The coldest reading of 2008 was 6°F in January, the highest 104°F in July. The AOSC spoke to growers about the probabilities of such events and helped interpret long-range forecasts.

**Historical Climate Network upgrades**

The AOSC continued to work with the NWS and NCDC to establish a robust climate monitoring network in Alabama. Nearly all of the 15 original HCN stations have been re-sited and upgraded with the highest quality equipment. In 2008, the following stations were added: Brewton 0N, Highland Home 0N, Talladega Municipal Airport 0N, Thomasville 0N, and Troy 0N. Adding the three Climate Reference Stations, Alabama now has 19 NCDC-commissioned HCN stations at present (http://www.ncdc.noaa.gov/crn/hourly). The time-consuming site surveys performed by personnel of the WFOs in Mobile, Birmingham and Huntsville, in close cooperation with the modernization team, made this possible. In addition, the expertise of NCDC and NWS SR and HQ scientists in several conference calls kept the communication lines open.

**CoCoRaHS**

On 1 November 2007, Alabama became an official member of the CoCoRaHS network. As of 12 Mar 2009 there were 670 stations registered. The AOSC is the state coordinator with each NWS WFO serving as Regional Coordinators for their appropriate counties. Again, the cooperation with the NWS WFO's and Southern Region HQ has been superb in promoting this very public service activity. Numerous media stories appeared on this topic.

**Economic Development**

The AOSC was again contacted by several industries wanting climate information necessary to make decisions about locating in Alabama and what their facilities might expect from various weather events. The AOSC continues heavily involved in the agricultural community by assessing water resources and the potential for irrigation expansion. The AOSC is involved at the state and federal level on water policy formulation.

Various economic interests contacted the AOSC in 2008 for information and speaking engagements related to climate change legislation. Because Alabama is a manufacturing and industrial state, the prospect of paying higher prices for energy (fuel, electricity, etc.) has caused considerable concern among those who have established our economic base. Alabama is one of the few states, which produces more electricity than it consumes, so this "product" is in jeopardy if rates are forced to rise. As a result of research on climate-change issues and impacts of legislation, the AOSC was able to provide hard metrics for business and congressional leaders for the development of policy.

# Alaska Climate Research Center

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***Gerd Wendler, Director and Professor Emeritus***
Martha Shulski, Research and Service Climatologist
Blake Moore, Systems Analyst
Nick Toye, Student Assistant

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The Alaska Climate Research Center is a service and research organization at the Geophysical Institute of the University of Alaska Fairbanks. Its primary mission is to respond to inquiries regarding the meteorology and climatology of Alaska at the request of public, private, and government organizations as well as researchers within Alaska and across the globe. Recently, the number of requests from the media has increased with greater coverage on recent temperature trends in Alaska. We are ideally located, with access to resources from the Geophysical Institute, the International Arctic Research Center, and the National Weather Service.

The Center maintains and operates a web site, which receives an average hit rate greater than 20,000 per day. The site features climate summary statistics, information regarding the observing network in Alaska, regional climate summaries updated monthly, links to weather and climate resources, information regarding past and present research, and a section for the many tourists that visit our state. Also online, users can see a display of current weather conditions updated every 5 minutes from a station maintained and operated by the center. In addition to a basic weather station, center maintains and operates a suite of radiation instrumentation and observations include incoming shortwave, longwave, and ultraviolet radiation.

The center maintains an active climate summary page featured on the website that gives summary statistics updated monthly for the different climate regions of Alaska. Summary graphics and narratives are also printed in newspapers around the state. In cooperation with the National Weather Service Fairbanks Forecast Office, the center writes a statewide summary that appears in Weatherwise magazine. In addition to regular summaries, the center also develops features on specialized topics relating to recent significant weather events around the state as needed. The center also collaborates with the NOAA RISA for Alaska – the Alaska Center for Climate Assessment and Policy – in developing a website to post monthly weather and climate highlights (http://www.uaf.edu/accap/awch/index.htm).

Along with service responsibilities, the center also conducts research on a number of high latitude meteorological and climatological topics. Several articles were in press for 2008 and one was published - *Alaska's Weather and Climate* by M. Shulski and H. M. Mogil in Weatherwise magazine. This represents the second in a series of 50 articles to be published in Weatherwise on the weather of all states.

A student assistant (UAF Geography major) employed by the center is working on the development of a metadatabase for all historical and current meteorological observations in the state of Alaska. This will greatly assist in data requests and various other tasks required by the center. This project incorporates the use of Google Earth and Geoserver software tools to design a user-friendly method to display weather observing stations and associated metadata (Figure 1). Due to the nature of the work, it has proven to be quite an investigative process due to the number of stations, differences between networks, and station inhomogeneity over time. A poster of the work was presented at the Association of Pacific Coast Geographers Conference held in Fairbanks in October of 2008 titled "An Interactive Inventory of Alaska Weather Stations: A web-based tool to aid in climate queries".

*Figure 1: Example of online station display option using GeoServer.*

Several speaking engagements were done in 2008 in connection with the book, The Climate of Alaska (2007) at venues such as the Alaska Book Festival, the Alaska Public Lands Information Center, the University of Alaska Museum of the North, and the University of Alaska Anchorage. Other invited talks on specific research topics were given at the International Arctic Research Center Seminar Series (Fairbanks, AK), the Arctic Miners Conference (Fairbanks, AK), the Advanced Technology Environmental and Energy Center (Fairbanks, AK), the USFWS Wildlife

Response to Environmental Arctic Change Workshop (Fairbanks, AK), and the First International Symposium on Arctic Research (Tokyo, Japan). Climate change and variability in Alaska remains a topic of high interest among our various stakeholder groups.

Though the center is in part funded by the state of Alaska, additional grant funds have been obtained through various sources and include: the Joint Fire Sciences Program, British Petroleum Corporation, Conoco Phillips, the Minerals and Management Service (MMS), the University of Alaska Foundation, and the UAF Center for Global Change. Phase I of an MMS funded project was completed in late 2008 titled: Beaufort Sea Mesoscale Meteorology Model Study in which Shulski served as Co-I.

# Office of the Arizona State Climatologist

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***Nancy J. Selover, State Climatologist***

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The Arizona State Climate Office (ASC) is located within the Office of Climatology of the School of Geographical Sciences at Arizona State University (ASU) in Tempe, AZ. Through 2008, the office included only the State Climatologist, Dr. Nancy J. Selover, although funding had been allocated for a part-time assistant. The purpose of the program is to: (1) manage and disseminate climatological information about the State of Arizona, (2) monitor the climate of Arizona and the region, (3) collaborate with state agencies in need of climate data and advisement, and (4) conduct research aimed at an improved understanding of the spatial and temporal variability of the climate of Arizona.

In addition to serving as a link to established climate data resources, the office receives and archives data from the Phoenix Real-time Instrumentation for Meteorological Studies (PRISMS) station network (17 stations across the Phoenix metropolitan area maintained by a local utility company). Also archived by the office are data from the Automated Surface Observing System (ASOS) of the National Weather Service Office in Phoenix; the Arizona Meteorological Network (AZMet) operated by the University of Arizona Agricultural Extension; and NWS Coop data, including our own site, Tempe ASU (028499), where we operate a Class A evaporation pan, and train students in climate observation and data issues. Daily weather data are also archived from three Weather Watchers who have been continuously observing the weather for over 20 years around the state. The office is still working on a database to archive as many of the local automated networks in Arizona as possible.

The Arizona State Climatologist performs several service roles within the state. The State Climatologist was appointed to the Governor's Arizona Drought Monitoring Technical Committee in 2004 and continues to generate monthly drought status reports (www.water.az.gov/dwr/drought/DroughtStatus.html) based on SPI and streamflow, using the Georgia model of Steinemann and Cavalcanti (2006). The State Climatologist serves on the Arizona Flood Warning System task force, a multi-agency group of flood control district and emergency managers established in 1994 (http://data.afws.org/sui/). Currently in our second decade of drought, we are occasionally subject to extreme flooding events and abnormally wet La Niña years. This year the State Climatologist position is supported full-time by the College of Liberal Arts and Sciences to provide applied, stakeholder research and outreach, making numerous presentations to

community and educational groups. The State Climate Office also maintains the field equipment for meteorology/climatology in the School of Geographical Sciences.

Research activities focus on hydroclimatology (North American monsoon, winter precipitation variability, drought monitoring) and study of surface-atmosphere interactions (urban heat island and microclimates). The office continues to work with Decision Center for a Desert City (an NSF research center studying water issues in arid urban locations) on impacts of urban and global warming on water resources, and with the Power System Engineering Research Center, on impacts of climate change on power demand, generation, and transmission.

With regard to the ARSCO for Arizona, the Arizona State Climate Office is committed to supporting the objectives of the AASC. Below is a brief description of the activities of the Office over the past year that addresses each of the ARSCO qualifications:

**Communication Capabilities**

- Updated our ASC web page (http://geography.asu.edu/azclimate) to make navigation easier, and add more products, and more format changes are ongoing. The website includes general climate and real-time weather information, statewide monthly temperature and precipitation maps used in the drought status report, a new monthly climate summary for Arizona, educational information, daily North American Monsoon updates (in summer), and links to other resources.
- Archived more than 200 GB of national and Arizona data annually, through an LDM server. The local database is being implemented this year (2009) as funding finally became available for an assistant and computer back-up services. The database will increase the amount of archived data.
- Maintain a voicemail system to take data and information requests when the office is not physically staffed. All calls are answered or returned within 24 hours. Specific data requests are evenly split between voice and e-mail, and data are served back through the phone, fax, e-mail, postal service, or the Internet.

**Information Services**

- In 2008(relative to 2007), we filled 149 (-48%) e-mail requests for data or information, 143 (-21%) voicemail requests for data, and had over 8000 (+60%) hits on our website. Users of the climate data (other than the web hits) include university researchers (7%), government agencies (11%), the public (33%), and the commercial and legal communities (24%). The new website, which will be operational in April 2009, will have statistics on users. We did 14 media interviews, including 4 television, 2 radio, and 8 newspaper, on drought, monsoon, urban heat island, and climate change; and were involved in 3 legal cases as consultants or expert witnesses. The trend is generally an increase in web hits and a decrease in voice mail and e-mail requests for data or information.
- Our monthly "Arizona Climate Summary", has been expanded to include cumulative precipitation graphs for Phoenix, Flagstaff and Tucson, and percent of normal precipitation maps for the state. Other products will be added as they are completed. (http://geography.asu.edu/azclimate/)

**Research**

- During 2008, we began a sensitivity analysis of our current drought status methodology to determine which precipitation stations in each watershed are the most important to calculating monthly SPI, and which SPI periods are most important for both short and long term drought status. The project is ongoing, and will include a shift from point data to gridded data to provide better spatial resolution of drought across Arizona. The project is funded by the Arizona Water Institute (www.azwaterinstitute.org/).
- Are continuing to work with the Power System Engineering Research Center at Arizona State University (ASU) to evaluate the impacts of climate change on power generation and transmission.
- Continuing to work with the National Weather Service Phoenix Forecast Office, ASU National Center for Excellence - Sustainable Materials And Renewable Technologies (SMART) group, Decision Center for a Desert City (DCDC - an NSF funded center to research water resources in urban deserts), and the Phoenix Urban Heat Island Task Force to identify and mitigate the effects of urban development on heat stress.

**Outreach**

- Presentations to eight First Lego League (FLL) teams on climate processes and climate issues of Arizona and Phoenix for this year's Lego League research topic "Climate Connections". Teams included public, charter, and home schoolers. Recruited judges for the research judging of the regional and state FLL competition. Provided advice and instruments for monitoring wind power for an Engineers Without Borders energy project and a local charter school water pumping effort. Climate change presentation for the annual Focus the Nation event at one of the local community colleges. Did 11 presentations on basic weather and water resources at local elementary schools. Interviews for feature stories in local newspaper, radio, and television on drought, monsoon, extreme heat and snow events, climate change, urban heat island, and the seasonal and annual outlooks for temperature and precipitation. Conducted a K-12 teacher workshop on basic climate and climate change.
- Monthly calculation of the SPI for Arizona's 15 watersheds, which is used to determine drought status, and presentations to the local county drought impacts groups on the drought assessment methods.
- Service on the Arizona Flood Warning System and Drought Task Force.

**Monitoring and Impact Assessments**

- Presented a proposal to the NOAA Climate Database Modernization Program (CDMP) to digitize data from the Navajo Nation's 23 automated weather stations, several of which have 13 year records of hourly data.
- Are working with WRCC and NWS to identify and prioritize sites for surface weather stations to fill in gaps in the current networks for both drought monitoring and HCN-M and NIDIS.
- Monthly statewide temperature and precipitation updates and calculation of watershed SPI for drought monitoring for the Governor's Drought Task Force.

- Web-publish monthly newsletter summary of Arizona climate, and contribute monthly temperature and precipitation summaries to the Arizona-New Mexico – CLIMAS publication "Southwest Climate Outlook".
- Archive data from the PRISMS network for Phoenix and the Phoenix first-order weather station, and the AZMet network for Arizona.

Plans for 2009 include becoming a CoCoRAHS state, implementing the database, and making our new website interactive, updating Sellers' "Climate of Arizona", and updating Schmidli's "Climate of Phoenix".

# Office of the California State Climatologist and CalClim (California Climate Data Archive)

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http://www.calclim.dri.edu

***Michael Anderson, State Climatologist***
Laura Edwards, Western Regional Climate Center, Desert Research Institute

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The California Office of the State Climatologist (OSC) is housed in the California Department of Water Resources (DWR) Division of Flood Management. Interacting with other divisions within DWR which makes up the state climate office (SCO) and the California Climate Data Archive (CalClim) group at the Western Regional Climate Center (WRCC), the OSC provides a growing range of climate services for California.

The past year proved to be a busy and event-filled year for California and the OSC. The year included a storm bringing winds over 100 mph on some mountain peaks, the driest spring on record for many sites in Northern California, a dry convective event that spawned over 1000 forest fires in June, and saw the start of a third consecutive dry water year.

Work continued on many fronts over the past year. The updating of the state's rainfall intensity duration frequency design curves continued with the completion of an internal draft document. Release of the updated document on the web is expected in 2009. Concurrently NOAA is working to produce an update to its rainfall frequency product for California; which should be complete sometime in 2010. Both of these products will be used in an effort to produce hydrologic information for floodplain mapping and other hydrologic and hydraulic studies associated with California's FloodSAFE program.

In another flood management project, collaboration with NOAA began on the development of an extreme precipitation monitoring network that will include GPS-Met stations to monitor atmospheric water vapor, soil moisture sensors, and vertically pointing radar to detect freezing level in the atmosphere. The project, born out of NOAA's Hydrometeorological Testbed work in the American River watershed, is a five-year effort to lay out the initial components to a statewide monitoring network to improve precipitation forecasts and increase lead time for flood mitigation actions.

On October 1, 2008, California joined the CoCoRaHS nation. In the first three months of the program, over 300 volunteers have signed up. CoCoRaHS offers another opportunity

for collaboration between NOAA personnel and the State Climatologist with NWS Weather Forecast Offices taking the lead as regional coordinators.

Drought response activities increased in 2008 as the second dry year in a row unfolded. The OSC participated in the DWR drought team providing data and material for decision support and outreach activities. Interactions with the U.S. Drought Monitor continued with increased coordination between the OSC and the NWS California-Nevada River Forecast Center, the Sacramento Weather Forecast Office and the WRCC. Efforts are expected to continue in 2009 as dry conditions persist.

The state climatologist website saw a makeover in 2008 to conform to new DWR standards for web sites. Additional changes are in the works for the coming year to expand content and facilitate data serving. As dry conditions continued in California during 2008, an increase in data requests handled through the office via email and phone was observed. As for the data portals, CDEC recorded over 124 million page views in 2008 while CIMIS recorded 345,271 data reports generated. The State Climatologist website saw over 93,000 page views.

Travel and presentations were prominent in 2008. Presentations and/or session moderating duties included meetings for the California Water and Environment Modeling Forum, California Cooperative Snow Surveys Annual Meeting, the Western Snow Conference, the Western States Water Council, the California Energy Commission's Annual Climate Change Conference, the ASCE 2008 Water and Environmental Congress, the annual Yosemite Hydroclimate Meeting, the California Floodplain Management Association annual meeting and the Fall Meeting of the American Geophysical Union. The annual WERA-102 Committee meeting was hosted by the OSC and the University of California, Davis this year.

The CalClim (California Climate Data Archive) project contributions include a redesign of the website this year. With just a few key parts yet to be implemented, it appears to have been well received. Similar to the OSC, CalClim has received more data requests this year than in previous years through its online data request and feedback form. Early 2009 will bring further improvements, including an upgraded climate station data access interface. Large data requests this year included the California Air Resources Board and the South Coast Air Quality District, as well as collaborating on acquiring data for a heat wave study by OSHA. While there are several "repeat customers", in 2008 there were many more new or one-time data requests.

The CalClim group continues to grow its data archive through the addition of networks, both existing and new installations. 2008 saw the implementation of a small network on Santa Catalina Island that is included in the updated data interface, as well as the inclusion of a US Navy weather network and other smaller networks that have been funded at WRCC.

One key presentation was made this year at the California Energy Commission's annual Climate Change Conference. This year's poster addressed challenges in drought

assessment in California, and was a direct outgrowth of the relationship between OSC and NWS partners working together, and the ongoing drought in the state. Many California drought activities filtered into other related projects at WRCC (See WRCC report for details).

Looking ahead to the coming year, the California OSC plans to continue coordination of activities with the CalClim Group and the WRCC including the start of a collaborative, capacity-building project for the OSC. The State Climatologist will continue efforts to engage climate researchers active in the state and continue collaborative efforts with NOAA personnel.

# Colorado Climate Center

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***Nolan J. Doesken, State Climatologist***
Wendy Ryan, Research Associate

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The Colorado Climate Center (CCC) was established by the state in 1974, through the Colorado State University Agricultural Experiment Station, to provide information and expertise on Colorado's complex climate. Through its threefold program of Climate Monitoring (data acquisition, analysis, and archiving), Climate Services and Climate Research, the Center responds to many climate-related questions and challenges. The Center monitors climatic conditions on both broad, regional scales and very local scales. By documenting climate variations in time and space, the relationships between climate, water supplies, other natural resources, agriculture and societal responses can be better understood and applied to support appropriate planning and decision making.

Priorities of the Colorado Climate Center in 2008 were: 1) Conduct and coordinate climate monitoring and research specific to practical local needs and applications. A component of this work was the testing and evaluation of weather instrumentation, and the preservation of the historic Fort Collins weather station (completed 120 years of uninterrupted continuous climate monitoring, 2) Assess the observed trends and variations in key climatic elements such as temperature, precipitation, snow accumulation and evapotranspiration and provide this information to the citizens of Colorado to help address concerns over climate change and public response, 3) Support and coordinate the Colorado Agricultural Meteorological Network (COAGMET), expand the network where appropriate, and promote the use of these data in decision making, 4) Engage the citizens of Colorado in backyard climate monitoring through the Community Collaborative Rain, Hail and Snow network (CoCoRaHS) and related activities and 5) Broadly disseminate climatic information, expertise and applications, and assist others in applied climate research.

Recent publications are available from the CCC's web site at (http://ccc.atmos.colostate.edu)

Ryan, W.A., N.J. Doesken, and S.R. Fassnacht, 2008. Preliminary results of ultrasonic snow depth sensor testing for National Weather Service (NWS) snow measurements in the US. *Hydrological Processes*, 22(15):2748-2757.

Ryan, W.A., Doesken, N.J. and Fassnacht, S.R. 2008. Evaluation of Ultrasonic Snow Depth Sensors for U.S. Snow Measurements. *Journal of Atmospheric and Oceanic Technology*, 25(5):667-684.

N. Doesken et al., 2008: Citizen's Guide to Colorado Climate Change. Prepared by Colorado Foundation for Water Education. 45pp.

N. Doesken et al. 2008: Climate Change in Colorado, A Synthesis to Support Water Resources Management and Adaptation. A report for the Colorado Water Conservation Board. 52pp.

***ARSCO Qualifications:***

The Colorado Climate Center is designated by the AASC as the official state climate office for Colorado. The following describes ways in which CCC addressed each of the ARSCO qualifications in 2008:

***Communication Capabilities:***

Communication and outreach are high priorities for the Colorado Climate Center. Through a partnership with the Colorado State University Public Relations Department, CCC has direct access to both print and broadcast media in Colorado. This year, we also began working with a local educational TV studio to produce the "Water Report" a monthly cable TV show and streaming video where local K-12 students help track climatic conditions in northern Colorado and the impact on water supplies.
http://www.psdschools.org/services/channel10/wtwy.aspx

The CCC benefits from good relations and strong communications with NOAA's National Weather Service, National Climatic Data Center, and also other state and federal agencies that are providers and/or users of climate information. CCC participates in the Governor's Water Availability Task Force and State Flood Task Force providing year-round updates on water supplies and flood potential. The monthly climate maps and drought presentations are at the following urls:
http://ccc.atmos.colostate.edu/coloradoprecipitation.php
http://ccc.atmos.colostate.edu/droughtpresentations.php

***Information Services:***

The Colorado Climate Center staff routinely responds to requests for climatic data and expertise. The number of individualized phone and e-mail requests continues to be lower now than in the past. This is more than made up for by continued increase in demand through the Climate Center website. Phone and e-mail requests now tend to be complex, interdisciplinary, and rarely routine – often requiring specialized or integrated data sets. The CCC maintains a website http://ccc.atmos.colostate.edu with many climate information resources and links. Products based on standard climatic elements such as, temperature and precipitation from NWS cooperative weather stations and the USDA Natural Resources Conservation Service remain a mainstay for water supply monitoring. Water year precipitation summaries and drought index information are two examples. CCC also features access to the CoAgMet automated weather network near real time and

historic data. We completed and promoted new evapotranspiration products and services and we continue to see growing demand for better information on this important component of the hydrologic cycle. A new and very popular service in 2008

The Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) is now nearly a nationwide network developed and maintained at the Colorado Climate Center. Precipitation data, including rain, hail and snow is available for viewing and for exporting. The largest users of this information source are National Weather Service forecast offices and River Forecast Centers.

***Research:***

***Snow sensors***

The Colorado Climate Center completed work evaluating the potential use of ultrasonic sensors for measuring and reporting snowfall and snow depth. A final report was submitted to the National Weather Service. We continued rain gauge comparison studies and began comparing measurements of evaportranspiration from atmometers and comparing results with pan evaporation as well as model-estimated ET from automated weather stations. We are nearing completion on a multiyear evaluation of trends in evapotranspiration and the quality of data required to track this element of climate. We continued work with the Western Water Assessment (RISA) investigating long term trends of basic climate parameters such as temperature, precipitation and snow. Two significant publications were co-authored on climate trends and change in Colorado. We began active participation with the National Integrated Drought Information System (NIDIS) in their initial pilot project == developing a drought early warning system for the Upper Colorado River Basin. High resolution (spatial) rain and hail data from the CoCoRaHS network were used in an assessment of the possible impact from the use of hail canons in the San Luis Valley of Colorado.

***Outreach:***

During the past year, climate information was presented to the public via news media, traditional publications, field trips, cable TV and the CCC web site. Also, Climate Center staff gave dozens of invited talks and seminars to diverse audiences and led several field trips to the Fort Collins historic Weather Station. The "Walking Through the Water Year" water education initiative funded through a cooperative agreement with the U.S. Bureau of Reclamation began gaining momentum. This educational program is designed to show the public and K-12 students that the weather is our water supply and that by paying closer to attention to our changeable weather that we can better understand our complex system of water collection, storage and delivery in Colorado.

The largest outreach effort during 2008 was the Community Collaborative Rain, Hail and Snow network (CoCoRaHS) http://www.cocorahs.org. 40 states and approximately 15,000 volunteers were involved by early 2009. CoCoRaHS has been very effective at not only reaching the general public but also building partnerships with other State Climate Offices, National Weather Service forecast offices and regional headquarters, and other local, state and federal organizations that need and benefit from detailed and timely precipitation information.

***Farewell to Odie:***

Odie Bliss, project coordinator at the Colorado Climate Center and an expert in the credible and personal delivery of climate services, died suddenly in August 2008 shortly after having been diagnosed with cancer. Her 30 years of dedicated work at the Colorado Climate Center left a mark on people all across the state of Colorado and nationwide. She is sorely missed, but taught us all a lesson about climate services and life in general -- she always listened first to the needs of others and then helped them accordingly.

# Connecticut State Climate Center

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***Xiusheng (Harrison) Yang, State Climatologist***

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## 1. Past and current activities

During the past year, Connecticut State Climate Center (CSCC) has provided over a hundred of services to the research, education and outreach communities at University of Connecticut (UConn), state and local government agencies, and the general public in the State of Connecticut. Provided below are the highlights of the accomplishments:

1.1 Research

a. As a valuable asset of the research community, CSCC has acquired, processed, and provided NCDC quality-assured climatic data for 3 research projects in the fields of climate change, environmental engineering, and plant science. Two letters were sent by PIs to the State Climatologist to express their gratitude for the data support.
b. CSCC has been continuously working on the study to characterize the climate and climate change in Connecticut. The results are to be used to update the book entitled "Climate in Connecticut" which was published in late 1960's.
c. Recently, CSCC has been actively working with the UConn Atmospheric Group to successfully make the university become a member of UCAR (University Corporation for Atmospheric Research).

1.2 Teaching

a. Several courses are developed and taught at the University of Connecticut using the climatic data provided by CSCC. In particular, NRME 3145 has been using live images of weather in teaching large scale storms (mid-latitude cycles and hurricanes). An online course has been taught in summer which has attracted many non-traditional off-campus students. A new course on climate and climate change also is under development to introduce the current issues on global climate change.
b. CSCC is working with other faculty members to develop more structured educational and training programs at University of Connecticut. A proposal was submitted to NASA global climate change program for establishing an integrated training program, in which CSCC is an important contributor at various levels of education, from K12 through Ph.D. students.

1.3 Outreach

a. An online data distribution system was established and used for public to access climatic data for the State of Connecticut. The system is hosted by University of Connecticut CANR server (http://www.canr.uconn.edu/nrme/cscc), providing processed climatic data for 17 stations across the State. Many residents,

government agencies, schools, and businesses in the State have used the system in the past year for various purposes.

b. In addition to the website, CSCC also delivers climate information via the joint web page with Connecticut IWR http://www.ctiwr.uconn.edu, feature articles in various local media, traditional ways through our cooperative extension system, posters and demonstrations at university and college organized events (such as Cornucopia), and peer-reviewed publications.
c. CSCC has delivered over one hundred of services per semester to university research community, governmental agencies and general public by providing processed and certified climatic data sets in various formats through email, telephone, fax, and mail.
d. As the Director of CSCC, Dr. Yang has provided many impact analyses to various media (newspapers, magazines, and radio talks), local governments and schools, and state government agencies on climate change, El Niño, drought, and abnormal wintry weather. He also has been invited by out-of-state users to provide specific microclimate assessment.
e. Dr. Yang has been recently added to a state committee on climate change formed at the request of the governor.

**2. Future planning**

CSCC is planning to work on the following projects in the next year:

a. Re-develop and update the CSCC website to include the most comprehensive data and graphs from the results of the study. The new database will include statistics and derived climatic variables for more than 100 stations with a period longer than 100 years. To our knowledge, this will make CSCC the most authentic source of climatic data in the state.
b. Integrate our website into national and regional systems.
c. Draft the new edition of the source book "The Climate of Connecticut".
d. Apply for NCDC fellowship and send a graduate student to the national climatic data center for training. Such training is anticipated to greatly improve the effectiveness of services provided by CSCC.
e. Develop teaching modules of climate analysis for classroom and online instruction. Such modules will enable students to study the fundamental theories of meteorology and climatology using information from the very current weather and climate events.
f. Actively participate in the AASC organized activities of research, education, and outreach, and take full advantages of the climate initiatives of the federal, state, and local governments.

# Office of the Delaware State Climatologist

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http://www.deos.udel.edu/osc

***David R. Legates, State Climatologist***
Daniel J. Leathers, Associate State Climatologist
Kevin R. Brinson, Assistant State Climatologist

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The Office of the Delaware State Climatologist is located in Newark, Delaware at the University of Delaware and is co-operated and co-located with the Delaware Environmental Observing System (DEOS). In July of 2009, both DEOS and the Office of the State Climatologist will move to a new College of Earth, Oceans, and Environment and join a new University-wide environmental institute. Both the Office and the State Climatologist continue to provide climate support services to the State of Delaware, albeit without state or federal funding.

The Office of the Delaware State Climatologist is an AASC Recognized State Climate Office (ARSCO) and partners with the National Climatic Data Center, the Northeast Regional Climate Center, and the National Weather Service in Mt. Holly NJ to provide data and climate services to the citizens of the State of Delaware. As with most State Climate Offices, we provide climate data and expertise to the public and private sector as well as conduct newspaper, radio, and television interviews, give public lectures, and provide legal expertise and court testimony. The Delaware State Climatologist also serves in the Technical Assistance Center of the Delaware Emergency Management Agency during critical weather events. A bill pending in the State legislature will formally appoint the State Climatologist to the State's Water Supply Coordinating Council. The Office currently has two main projects:

**The Delaware Environmental Observing System (DEOS)**
Our main funding effort has been the establishment of a real-time system dedicated to monitoring environmental conditions across the Delmarva Peninsula. The Delaware Environmental Observing System (DEOS) is designed as a tool for decision makers involved with emergency management, natural resource monitoring, transportation, and other activities throughout the State of Delaware. DEOS also provides both State agencies and the citizens of Delaware with immediate information as to environmental conditions in and around the State. Being that it is supported by the Office of the Delaware State Climatologist, DEOS also provides a climate archive of the data to support the developing needs of high-resolution (in time and space) requests for environmental data. (http://www.deos.udel.edu)

Being a peninsula, isolated by the Delaware Bay, the Delaware River, and the Chesapeake Bay, the Delmarva Peninsula is very much affected by coastal storms and processes. To make appropriate decisions that depend upon these environmental

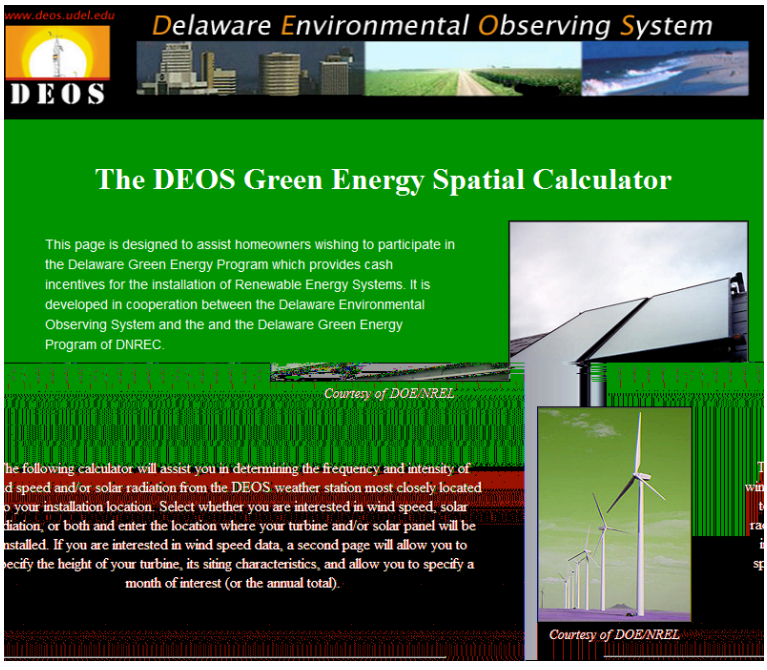
conditions, decision makers must have environmental data with the highest spatial and temporal resolution possible. Data needs include weather information, observations of streamflow, bay and ocean conditions, and water and air quality. But more importantly, these data must be of the highest quality, readily available, and easily applied. DEOS integrates existing observations from federal, state, and local sources and augments these existing observations with approximately twenty additional observing sites (primarily weather stations, but installed sensors also have included water temperature, wave period, and water quality for the Delaware Bay) around Delaware, Maryland, and Pennsylvania. These observations are connected to a central data collection facility through existing telecommunications capabilities. DEOS currently provides timely data dissemination to State agencies, the National Weather Service, and the public and also is in the process of developing reliable data quality control and quality assurance procedures.

DEOS consists of three main components: (1) the DEOS Environmental Monitoring and Observing Network (DEMON), a network of thirty-one new meteorological observation sites coupled with existing weather and other environmental observation sites in and around Delmarva, (2) the DEOS Integrated Visualization and Analysis System (DIVAS), a GIS-based integration of surface weather observations with National Weather Service WSR-88D radar estimates of precipitation, thereby providing estimates of meteorological and environmental variables over a high spatial resolution grid, and (3) a number of DEOS Analysis Systems (DAS), designed to provide decision support in a variety of environmentally-sensitive areas. One such system will provide transportation and emergency management officials with real-time assessments of coastal and stream flood risk potentials.

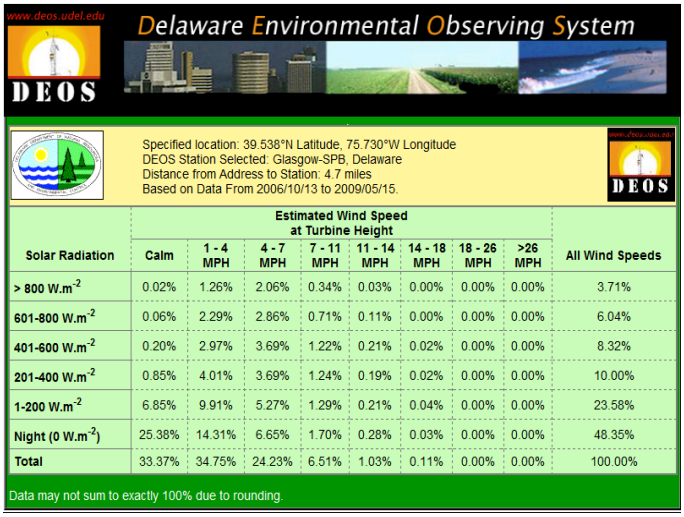
Our network has now grown to a total of forty-one stations located in the three counties of Delaware, Chester County in Pennsylvania (in cooperation with Chester County Emergency Management), and Cecil County in Maryland. With new projects focusing on coastal flood monitoring and enhancing agricultural weather information, we expect that several more stations – including the development of a portable DEOS system – will be available in the coming years.

*The Delaware Green Energy Spatial Calculator*

The Delaware Energy Office coordinates the Delaware Green Energy Program. This program operates in cooperation with the local energy provider and makes available cash incentives for homeowners and businesses to install renewable energy systems, including solar power and wind turbines (up to 50% of the cost of the system). One of the requirements to obtain a



grant, however, is that the homeowner or business must demonstrate the ability to generate a significant amount of energy via wind and/or solar power at the proposed location.




| Solar Radiation | Estimated Wind Speed at Turbine Height | | | | | | | | All Wind Speeds |
|---|---|---|---|---|---|---|---|---|---|
| | Calm | 1 - 4 MPH | 4 - 7 MPH | 7 - 11 MPH | 11 - 14 MPH | 14 - 18 MPH | 18 - 26 MPH | >26 MPH | |
| > 800 W.m$^{-2}$ | 0.02% | 1.26% | 2.06% | 0.34% | 0.03% | 0.00% | 0.00% | 0.00% | 3.71% |
| 601-800 W.m$^{-2}$ | 0.06% | 2.29% | 2.86% | 0.71% | 0.11% | 0.00% | 0.00% | 0.00% | 6.04% |
| 401-600 W.m$^{-2}$ | 0.20% | 2.97% | 3.69% | 1.22% | 0.21% | 0.02% | 0.00% | 0.00% | 8.32% |
| 201-400 W.m$^{-2}$ | 0.85% | 4.01% | 3.69% | 1.24% | 0.19% | 0.02% | 0.00% | 0.00% | 10.00% |
| 1-200 W.m$^{-2}$ | 6.85% | 9.91% | 5.27% | 1.29% | 0.21% | 0.04% | 0.00% | 0.00% | 23.58% |
| Night (0 W.m$^{-2}$) | 25.38% | 14.31% | 6.65% | 1.70% | 0.28% | 0.03% | 0.00% | 0.00% | 48.35% |
| Total | 33.37% | 34.75% | 24.23% | 6.51% | 1.03% | 0.11% | 0.00% | 0.00% | 100.00% |

Data may not sum to exactly 100% due to rounding.

To assist in this project, DEOS has developed the Delaware Green Energy Spatial Calculator. It allows the user to determine the frequency and intensity of wind speed and/or solar radiation from the nearest DEOS weather station to their proposed location (interpolation is unnecessary owing to the relatively dense DEOS network). The user specifies the location (street address or latitude/longitude) and whether wind speed or solar radiation data, or both, are desired. If wind speed is selected, the height of the turbine is entered along with general siting characteristics (*i.e.*, ground cover and relative nearby obstructions) and the logarithmic wind speed profile is used to estimate wind speed at turbine height; roughness length is estimated from the siting characteristics. Output from the Spatial Calculator provides information on annual patterns and stratified by month, with data in tabular form showing the percentage of time wind speed or solar radiation fell within a given range for the entire period of record. For users who specify both wind speed and solar radiation, a contingency table is displayed to show what percentage of the time they can expect to receive significant effects from solar power, wind power, both, and neither. Row and column sums provide the marginal probabilities. Data are updated monthly and stored on the computer so each table is not regenerated each time a request is made (see http://www.deos.udel.edu/dgep).

**The DEOS Environmental Monitors Program (DEMs)**

We also continue to operate the DEOS Environmental Monitors Program (DEMs). DEMs is a statewide spotter network of more than thirty volunteers that make daily measurements of rainfall, snowfall, and (for some) air temperature. DEM volunteers also serve as local spotters to inform State Weather Officials of breaking severe weather as well as provide local conditions during emergency weather events.

DEMs volunteers enter their data directly into the DEOS database through webpage access (a few, however, still prefer to use mail-in cards). This program is a way to identify those people that are truly interested in taking long-term climate measurements and make them official cooperative observers by providing them with more accurate (and more expensive) equipment. We also have been investigating the possibility of folding the DEMs system into CoCoRaHs.

In summary, the Office of the Delaware State Climatologist is growing. In the past three years, we have obtained support for three undergraduate and three graduate students

working on specific projects with DEOS and State Climate personnel. We also have obtained permanent support for a technician and a programmer to continue our development of DEOS. We hope to expand to include support for an administrative position in the coming year.

# Florida Climate Center

Center for Ocean-Atmospheric Prediction Studies
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***David Zierden, State Climatologist***
James J. O'Brien, Emeritus State Climatologist
Melissa Griffin, Assistant State Climatologist
Preston Leftwich, Climate Research Assistant

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**About the Florida Climate Center**

The Florida Climate Center is housed at the Center for Ocean-Atmospheric Prediction Studies (COAPS) in the Fuqua Research Complex at Innovation Park. Though physically located off-campus, COAPS and the Florida Climate Center are part of the Department of Meteorology at the Florida State University. The Florida Climate Center is public service center sponsored by the Institute of Science and Public Affairs. The office space, facilities, and equipment are provided by COAPS, but the Climate Center receives ongoing state financial support that covers the salaries of 1.5 full-time employees. The Florida Climate Center staff currently consists of David F. Zierden, current State Climatologist, Melissa Griffin, assistant state climatologist, Preston Leftwich, a part-time research associate and instructor of an introductory meteorology course to undergraduates in the main department on campus, and Marcus Williams, graduate student assistant. Also contributing is Dr. Mort Winsberg, author of *Florida's Weather* and professor emeritus of geography at FSU. Dr. James. J. O'Brien, former State Climatologist and Professor Emeritus, remains actively involved and provides welcome leadership to the Florida Climate Center.

The Florida Climate Center is an American Association of State Climatologists (AASC) Recognized State Climate Office (ARSCO) and works in partnership with the National Climatic Data Center, Southeast Regional Climate Center, and National Weather Service to provide data and climate services to the citizens of the State of Florida. We have a standing memorandum of understanding with NCDC and letters of support from the National Weather Service Forecast Offices.

**Florida Climate Center's Approach to Climate Services**

One of the primary missions of the office is to provide routine climate data and services. In addition to the inquiries that come straight to the office, they are also referred to us from NCDC, the regional climate centers, and the National Weather Service Forecast Offices. The Florida Climate Center receives dozens of phone calls, emails and faxes each day requesting everything from answers to simple climate and weather questions to detailed data requests and analyses. We have developed a unique philosophy on climate services that allows us to best serve the needs of our "customers". The keys to our philosophy are as follows:

- Archive and access to historical data
- Climate "service" begins with personal contact, listening to needs
- Look beyond traditions weather variables; use derived quantities and other products
- Charge for services, where applicable
- Certifying data, legal services
- Education and outreach
- Community involvement

**Research and Involvement with the Southeast Climate Consortium**

The Florida Climate Center is a leading authority on climate variability in Florida, particularly as related to ENSO. The Florida Climate Center has long been an active partner with the Southeast Climate Consortium, one of the Regional Integrated Science and Assessment (RISA) teams funded by NOAA's Office of Global Programs. Through this involvement, we conduct research into downscaled and localized climate forecasts and their application to the sectors of agriculture, forestry, and water resources. Recent expansion of the consortium now includes the State Climate Offices of Georgia and Alabama, as well as agriculturist, hydrologists, and social scientists from the University of Florida, University of Miami, University of Georgia, University of Alabama Huntsville, and Auburn University. The Southeast Climate Consortium now receives additional funding through USDA and USDA Risk Management Agency.

The primary mechanism for disseminating climate forecast information for the Southeast Climate Consortium is AgClimate, a web-based decision support system for climate and agriculture in the Southeast U.S. The Climate Center has been a key participant in the development of *AgroClimate* (www.agroclimate.org), a web-based decision support system facilitating the effective use of climate forecast information in agriculture and forestry in the Southeast U.S. *AgroClimate* displays information on ENSO climate variability based on historical weather data from over 200 cooperative observer stations in the Southeast. In addition, *AgroClimate* provides probabilistic information how climate variability effects yields of such crops as peanuts, tomatoes, and potatoes. *AgClimate* also provides background information on ENSO and climate as well as management options of crops and forests during the various ENSO phases.

**Community involvement and CoCoRaHS**

In October 2007 Florida became the 23rd state to join the CoCoRaHS program and now boasts over 450 active observers across the State of Florida. The CoCoRaHS program started in Colorado in 1998 and has expanded to 27 states where more than 7,500 observers take daily measurements of rain, hail and snow. Melissa Griffin, Florida's assistant state climatologist, is the State Coordinator for CoCoRaHS in Florida and provided the momentum to initiate the program in this state. The non-profit organization stresses training and education and welcomes volunteers from all walks of life to take part in monitoring precipitation. Florida CoCoRaHS has recently received a grant from Florida 4-H for K through 12 participation in the CoCoRaHS program. Just recently Melissa Griffin was named chair of the national CoCoRaHS training and education committee.

**Climate Change Education**
The State Climatologist has become active in education and community outreach on the subject of climate change in the State of Florida. David Zierden is now and adjunct member of the University of Florida Extension Service's climate variability and change focus group, a grassroots group of extension agents and faculty that are initiating programs on coping with climate change in agriculture, community planning, and sustainable living. Through this focus group, David Zierden has presented material on the science of climate change and its impacts on Florida in the last year at the UF Extension virtual symposium and a climate change in-service training program. We have videotaped the presentation and made it available via webcast. The Florida Climate Center is also teamed with other scientist at COAPS and educators at University of South Florida in a NASA proposal on climate change education for public school teachers.

**Regional Climate Issues**
The Florida Climate Center is actively involved in the National Integrated Drought Information System (NIDIS) pilot project in the Southeast U.S. The NIDIS pilot project is concentrating on drought issues in the ACT and ACF basins and hosted an initial stakeholder workshop last April in Peachtree City. David Zierden has also recently presented information on climate variability and its impacts on natural resources at the Tampa Bay Water Resource Summit and at a meeting of the Tampa Bay Regional Planning Council. The state climatologist routinely provides input to the weekly U.S. Drought Monitor.

The Florida Climate Center has begun to produce monthly state climate reports with an emphasis on impacts to agriculture and water resources under the AASC State Climate Exchange Program. These climate summaries detail the recent weather and climate in each state and put it into historical context. The state climate summaries are released on the third working day of each month and contain the following information:

- An accounting of average temperature and precipitation over the state, including departures from normal, historical ranks, and a more local breakdown if necessary. The same breakdown may be given for longer time periods (3 months, 6 months, etc) if pertinent.
- A summary of extreme weather, severe events, and storm reports over the past month.
- An overview of how recent climatic conditions are affecting ongoing or developing drought, if applicable.
- With input from Extension specialists, a summary of how the past months weather and climate affected agricultural production and practices for key commodities.
- A review of how the past months temperature and precipitation patterns followed the seasonal climate forecasts or known ENSO patterns.
- Any appropriate maps, graphs, or tables of climate information needed to support the above elements.

- Allow supplemental information or observations from non-standard sources such as state mesonets

These monthly climate reports or summaries are used to supplement the monthly reports from the Southeast Regional Climate Center (SERCC) and NCDC and in conjunction with periodic climate outlooks produced by the Southeast Climate Consortium and disseminated through AgroClimate.org.

Finally, the State Climatologist and staff are always available to the media for facts and opinions on current climate issues. We have a working relationship with such newspapers as the *USA today, Tampa Tribune, St. Petersburg Times, Tallahassee Democrat, Gainesville Sun, News-Press, Florida Today* to name a few, and television outlets such as the *Florida News Channel.* The State Climatologist and staff comment on such issues as global climate change, drought, El Niño, hurricanes, and damaging freezes.

# Georgia State Climatology Office

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***David Stooksbury, State Climatologist***
Pam Knox, Assistant State Climatologist

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The Georgia State Climatology Office is located in Athens, GA, on the campus of The University of Georgia in the Biological and Agricultural Engineering Department. The office houses two full-time climatologists: Dr. David Stooksbury, the State Climatologist and Associate Professor, and Pam Knox, the Assistant State Climatologist. We also have a postdoctoral scientist, Dr. Pierre Gerard-Marchant, working on hydrologic projects.

The Georgia State Climatology Office continues to be involved in a variety of research and public outreach activities. We maintain a web site and actively interact with users from around the state. These contacts include university scientists, educators, lawyers, construction and insurance companies, government agencies, reporters, and private citizens. Many of these data requests come by way of email, but we also receive phone calls, walk-ins and the occasional letter.

The State Climatology Office has been heavily involved this year with the Southeast Climate Consortium on a variety of research projects. We have participated with other states in training activities for Extension agents on the use of the AgClimate.org website, a web site which relates climate statistics for the Southeastern US to El Niño phase and crop management issues. We are now developing a similar site for water managers (called se-water-climate.org). This site will provide assistance in planning for drought and wet conditions using ENSO phase information and Climate Prediction Center projections of current and upcoming precipitation amounts. Interviews with a variety of water managers and stakeholders have helped us hone the content of the site and our understanding of how water managers use climate information. We also contribute to the National Drought Monitor and write a monthly climate summary for use by the Southeast Regional Climate Center and our web visitors.

In addition to research activities, we provide guidance to a number of state agencies on weather and climate conditions and severe weather, including the State Drought Monitoring Committee (which Dr. Stooksbury co-chairs with the Director of the Georgia Environmental Protection Division) and the Georgia Emergency Management Agency (GEMA). The State Climatologist regularly monitors water conditions across the state and issues drought statements and other special climate statements when conditions warrant it.

Dr. Stooksbury is on the National Integrated Drought Information System (NIDIS) implementation team. The office co-hosted in May NIDIS' southeastern pilot project which is focusing on developing an early warning drought system for Alabama, Florida and Georgia.

In May of 2008 Georgia joined the CoCoRaHS network, founded in Colorado by Nolan Doesken and collaborators. Pam Knox assisted in setting up the network and continues as a regional coordinator for Regions 1 and 3 in northeast Georgia. As of January 20, 2009, there were almost 500 active stations in the network. On a typical day we expect close to 200 observations to come in from observers all over the state.

# Hawaii State Climate Office (HSCO)

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***Pao-Shin Chu, State Climatologist***
Ying Ruan, Graduate Research Assistant
Sara Thomas, Student Assistant

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The Hawaii State Climate Office (HSCO) is located on the campus of the University of Hawaii, in Honolulu. The HSCO is a part of the School of Ocean and Earth Science and Technology at UH Manoa, in the department of Meteorology. The office was established in 2000. Dr. Pao-Shin Chu is the State Climatologist.

The Hawaii State Climate Office is the AASC Recognized State Climate Office and is also partnered with NCDC and also maintains a website in order to provide accurate climate data for Hawaii residents and researchers.

The Hawaii State Climate Office (HSCO) has been dedicated to complete several projects and handling a variety of requests.

One of the projects that the HSCO has been involved with was NPS climate monitoring protocol for the National Park Service in Hawaii and other major Pacific islands. This part involves data analysis, display, and interpretation, including providing a summary of all the available data around National Parks in the area of interest, suggesting several traditional methods of data analysis, then giving some examples of using these methods to display climate data set.

The continuation of updating the annual average rainfall maps for two counties (Maui and Honolulu) of the state is another big project for the HSCO this year. The currently available climatological rainfall maps for Hawaii are only for period from 1960 to 1990, and the last comprehensive rainfall report was published in 1973 by the State Department of Land and Natural Resources. Given that the climate is changing and the Hawaiian rainfall has shown a long-term downward trend over the last century (Chu and Chen, 2005), it is desirable to have more recent maps based on current rainfall records. In this regard, the maps compiled by the HSCO, which cover the period from 1975 to 2004, will be the newest reference for all in the state. The index for Maui County was completed and the final report was submitted in December 2008. The last part of this project, the report for Honolulu City and County, is in progress and will be finished by June.

During the past year, the HSCO tried very hard to maintain connection with various interested organizations. With a SCEP award from NOAA, starting from November 2008, monthly reports on Hawaii's climate have been sent to the Western Regional

Climate Center (WRCC) on a regular basis. This project is expected to improve the communication between the WRCC and the HSCO. Moreover, the WRCC will include part of our report in their regional monthly assessment to the NCDC, and this in turn, will bring the WRCC closer to the needs of NCDC. From time to time, rainfall information had been sent to people monitoring the Iao area, Lahaina, and West Hawaii aquifer status.

The most outstanding feature of requests during the past year is that not only people who asked requests were from various fields but also that the data they asked for were diverse. Lawyers needed rainfall data for traffic accident cases, a Girl Scout leader asked for weather conditions for better understanding of their camp site, a production supervisor of LOST wanted weather forecast information to ensure shooting progression, and the construction of University of Hawaii at Manoa's new gym required historical wind data for construction design, etc.. Besides, people were interested in lightning data, barometric pressure data, statewide precipitation data, solar radiation and heavy rainfall events summary and so on.

The HSCO is also keen on doing research concerning Hawaii climate; for example, one paper about extreme rainfall events in Hawaii was published in the recent issue of Journal of Applied Meteorology and Climatology (Chu et al., 2009).

References

Chu, P.-S., and H. Chen, 2005: Interannual and interdecadal rainfall variations in the Hawaiian Islands. Journal of Climate, 18, 4796-4813.

Chu, P.-S., X. Zhao, Y. Ruan, and M. Grubbs, 2009: Extreme rainfall events in the Hawaiian Islands. Journal of Applied Meteorology and Climatology, 48, 502-516.

# Idaho State Climate Services

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***Russell J. Qualls, Idaho State Climatologist***
Wenguang Zhao, Research Scientist
Ayodeji Arogundade, Graduate Student
Yohannes G/Eyesus Getahun, Graduate Student

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Climatic information is essential to every citizen of Idaho. To help people obtain the climatic and water data and information necessary to planning and every day work, the State Climatologist Program strives to acquire, archive, process and disseminate, in the most cost effect manner possible, all climate and weather information which is or could be of value to policy and decision makers in the state and to provide climatic services which are important to the people of Idaho.

The functions of the State Climatologist and State Climate Services are to:

- Act as liaison between Idaho weather information users and the National Climatic Data Center
- Maintain a data bank of climatological and hydrological data and information
- Supply data in a form useful to users
- Perform requested climate analyses or refer requests to other appropriate persons, agencies or consulting firms
- Maintain contact with users of climatic and hydrological data in order to ascertain their needs for data and analyses
- Maintain a bibliography of publication pertinent to Idaho and Pacific Northwest climate

In May, 1978, an agreement was concluded among the National Climatic Data Center, the National Weather Service and the University of Idaho to provide climate services which had been provided by a former National Weather Service program. ISCS became the AASC Recognized State Climate Office (ARSCO) for the State of Idaho in 2001.

Idaho State Climate Services is housed in the Department of Biological and Agricultural Engineering and is directed by the Idaho State Climatologist. It is supported by the Idaho Agricultural Experiment Station and the Idaho Cooperative Extension System in cooperation with the Idaho Water Resources Research Institute.

***ARSCO Qualifications:***
ISCS is designated by the AASC as the official state climate office for Idaho. The following describes the ways in which ISCS addresses each of the ARSCO qualifications:

***Communication Capabilities:***

- ISCS maintains internet, email, telephone, and fax communication links.

***Information Services:***

- Idaho joined CoCoRaHS in January 2009; the Idaho SC serves as the statewide coordinator of the precipitation network, which now has 92 observers.
- Maintain an online archive of the complete period of record for all Idaho Cooperative Observer data sets in cooperation with the University of Idaho Library, which may be downloaded by user-selected station. http://inside.uidaho.edu/asp/liststations.asp
- Responded to more than 400 e-mail requests for climate data/information/services.
- Answered more than 200 telephone requests
- Interviewed by more than ten Idaho newspapers.
- Maintain an automated weather station, a Cooperative Observer Station with over 110 years of data, and a recording precipitation gage, and partially fund a Sno-Tel site.
- Established three Idaho Transportation Department Road Weather Information System Weather Stations.

***Research:***

- Use remote sensing to simulate snowmelt runoff from the Upper Snake River.
- Examine the effect of climate change scenarios on snowpack and runoff volumes and timing for the eastern Snake River Plain, the principal water supply for southern Idaho.
- Evaluate the impact of current water rights on distribution of irrigation water under changing supplies associated with various climate change scenarios.
- Evaluate the impact of climate-induced changes to evapotranspiration on irrigation water demand.
- Analyzing historical temperature trends at climate stations across Idaho
- Analyze socio-economic impacts of various climate change scenarios
- Developing algorithms and models to assimilate remotely sensed data for use in spatially distributed land surface-atmosphere exchange models
- Conducting studies for the Idaho Transportation Department on the interaction of inclement weather and road slope and curvature on the frequency of accident occurrences.

***Outreach:*** Participation and collaboration of the following outreach activities:

- Climate Presentations to local elementary schools
- Provide news interviews
- Serve as a climate expert on Idaho Public Television talk shows.
- Work with Boy Scouts of America as a merit badge counselor for environmental science

# Illinois State Water Survey
## IL Dept. of Natural Resources
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***Jim Angel, State Climatologist***


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The Illinois State Climatologist Office (SCO) is located at the Illinois State Water Survey (ISWS) in Champaign, Illinois on the campus of the University of Illinois. Since 1973, ISWS has supplied the salary for the state climatologist, as well as computer and communication support and office space. The office also operates the NWS coop site for Champaign-Urbana.

**ARSCO Qualifications**
The AASC has designated the Illinois SCO as the state climate office for Illinois. The following describes the ways in which the office addresses each of the ARSCO qualifications:

**Communication Capabilities**
The Illinois SCO has phone, fax, and email services with high-speed Internet service for the rapid transfer of data. The state climatologist maintains a web site devoted to climate data and information on a wide variety of climate topics.

**Information Services**
The Illinois SCO receives numerous requests for climate data and information. In a last year, the SC handled about 500 phone calls and email requests. The web site contains maps, plots, and tables of current climate conditions, historical data, and climate summaries as well as information on important climate topics in Illinois such as El Niño, drought, winter storms, and heat waves. In the last year, the web site received 1.5 million hits with 150,000 unique visitors and 34,000 repeat visitors.

**Research**

- For the ISWS Water Supply Planning (WSP) Initiative Year 2, we produced future Great Lake water level scenarios from GCM simulations used in the 2007 IPCC reports. A paper on this subject is under review in the *J. of Great Lakes Research*.
- We are in Year 2 of a NOAA grant using the Forts daily climate observation data set to analyze 19$^{th}$ century extreme climate events.
- We received funding from NOAA Climate Program Office (CPO) Sector Applications Research Program (SARP) through the National Drought Mitigation Center to develop a "Drought Ready Community" in Decatur Illinois.

- We received funding from AASC for a comparison of CRN sites in Illinois, and for development of new CRN products.

**Outreach**

- Wrote contributions to the monthly ISWS Water and Climate Summary.
- Provided data and guidance to agencies in Illinois, including the Illinois Drought Response Task Force, the Illinois Department of Transportation, the Illinois Attorney General's office, and the Illinois Emergency Management Agency.
- Gave 98 media interview and produced monthly press releases.
- Gave 18 public and three professional (scientific) talks.
- Worked with local NWS offices and the Midwestern Regional Climate Center on issues related to climate, including visits to NWS offices, the sharing of data and climate information, and coordinating efforts on CoCoRaHS.

**Monitoring and Impact Assessment**

- Provided input into the U.S. Drought Monitor.
- Monitored climate/meteorological events in Illinois as they unfolded, including the wet spring, severe flooding in June, and more heavy rains in September.

# Indiana State Climate Office

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***Dev Niyogi, Indiana State Climatologist***
Ken Scheeringa, Associate State Climatologist
Joseph Mays, Data Specialist

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The Indiana State Climate Office (*IClimate*) was established in 1956 in the Agronomy Department of Purdue University where it continues today. In addition to permanent staff the office provides work opportunities to graduate and undergraduate students in research projects and customer service interactions.

**ARSCO Qualifications**
*IClimate* is an American Association of State Climatologists (AASC) Recognized State Climate Office (ARSCO). This office fulfills the ARSCO requirements in the following ways:

**Communications Capabilities**
*IClimate* has full access to Internet, email, telephone, and fax capabilities. We maintain a website with daily and hourly Indiana observations from multiple climate networks.

**Information Services**
A priority of *IClimate* is to collect and archive historical and current climate data for Indiana and to make these publicly available on the *IClimate* web site www.iclimate.org. Databases are maintained for observation networks including NWS cooperative stations, ASOS stations, and a statewide automated network of Purdue agricultural weather stations. Clients can query these databases or email data questions to us via web forms. We also assist clients to interpret these data as needed to solve their climate related problems.

**Research**
*Iclimate* is involved in two new research projects with NASA and NSF support. One is related to the assessment of the role of land use and land cover including urbanization on the regional hydroclimatology. The second is on the development of a regional drought information portal and an environmental cyberinfrastructure prototype for heterogeneous data access and processing. Details regarding these projects and resulting publications can be found at http://landsurface.org

**Outreach**
Media interviews were given in 2008 especially during times of significant weather events and as new seasonal outlooks were released. Invited guest speaker talks were given to extension groups such as a 5-day tour of Indiana cities as part of the annual Crop Management Workshops. Climate talks were also given to the Crop Improvement Association, the Indiana Professional Lawn and Landscape Association, at Beck Hybrid Days, among others. In total several hundred people received information about weather and climate from us through these various extension meetings and conferences.

**Monitoring and Impact assessment**
The 2007 drought in Indiana underscored our need for water loss data as a component of the water balance cycle. Partial funding by the Purdue Ag Experiment Station to our proposal enabled the measurement of hourly ET at two locations last summer. A follow up proposal to integrate ET measurements into our statewide automated network starting in 2009 was recently fully funded. The results of ET data collected in 2009 and 2010 will be compared to ET models available in the RefET software along with other analyses. A visiting student from China last summer did some preliminary comparisons of our 2008 measurements to modeled ET with good results.

Of course precipitation is on the supply side of the water balance cycle. *IClimate* in partnership with NWS Indianapolis founded and continues to manage CoCoRaHS Indiana. *IClimate* and NWS staff again conducted numerous CoCoRaHS training sessions for new observers in 2008 with a free rain gauge as a training incentive. Several local coordinators were recruited to host additional local training sessions. At the end of our third year in 2008 nearly 1000 volunteers had joined CoCoRaHS Indiana. We write occasional CoCoRaHS state newsletters as a tool to keep volunteers informed and involved.

*IClimate* participates in environmental quality monitoring. Ken continues as the local observer for the National Atmospheric Deposition Program, which monitors precipitation chemistry, by providing weekly precipitation samples to the national program lab. *IClimate* supports other Purdue staff active in the EPA National Air Emission Monitoring Study by providing a data feed as an independent source of quality assurance data for their field measurements nationwide.

In 2008 *IClimate* received a grant from AASC to enhance our monthly state climate summaries to include impact reports. Each week *IClimate* provides a weekly summary of weather impacts to the Midwestern Regional Climate Center (MRCC) for inclusion in their online Midwest Climate Watch. A monthly summary is also provided to MRCC as they compile their monthly Midwest summary for NCDC. A version of our monthly summary is also posted to the AASC website www.stateclimate.org.

During the growing season *IClimate* participates in the biweekly Purdue Crop Weather Roundtable. The discussion topic is the impact of current and forecast weather on diseases, weeds, insects, farm economics, and other concerns on growing field crops. On

campus meeting participants are Purdue crop specialists. Extension educators in Indiana counties join the meeting remotely using Adobe Connect.

# Iowa State Climatologist Office

## Iowa Dept. of Agriculture & Land Stewardship

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***Harry J. Hillaker, State Climatologist***

The State Climatologist Office (Iowa SC) is a bureau of the Iowa Dept. of Agriculture & Land Stewardship. The State Climatologist is appointed by the Iowa Secretary of Agriculture (an elected state official). The Iowa SC office was founded in Iowa City at the University of Iowa on October 1, 1875 and was initially known as the Iowa Weather Service. In 1890 the Iowa Weather Service operations were moved to Des Moines and came under the supervision of the Iowa Weather & Crop Service. The Iowa SC was co-located with the National Weather Service from 1890 until 2003 and has worked very closely with that agency since its inception. Finally, the Iowa SC was made a division of the newly created Iowa Department of Agriculture in 1923.

Information Services:

The Iowa SC office maintains archives of NWS co-op and first order station data back to the beginning of records. This would include the regular NCDC reports such as *Storm Data, Iowa Climatological Data* and *Local Climatological Data*, as well as the original observations. Access to a multitude of federal and state weather and climate data archives are also maintained. With 133 years of continuous operation the Iowa SC Office has an unusually large archive of original federal and state books, reports and manuscripts from the 19th and early 20th Century.

Research:

The Iowa SC office primarily is involved with the acquisition, processing, dissemination and archiving of weather and climate data. However, research activities are performed as funding permits and have been conducted in cooperation with agencies such as the National Climatic Data Center (NWS co-op network metadata), the Midwestern Regional Climate Center (pre-1948 data keying project), the National Science Foundation (crop-hail climatology), U. S. Army Corps of Engineers (evaporation, snow, short-duration precipitation studies) and the Iowa Dept. of Natural Resources (development of more timely temperature data resources).

In the past year the Iowa SC office has been working with the Midwestern Regional Climate Center (MRCC) to document the quality control methods utilized in creating a serially complete set of daily Iowa temperature, precipitation, snowfall and snow depth data dating to January 1991. These records have been converted by MRCC into the

common TD-3200 format for use by other interested researchers. It is hoped that this data set will be useful in evaluating the effectiveness of data QC techniques used by other agencies, as well as in documenting any trends in data completeness and accuracy over the 17 year period of record. Further, the data set should be of great utility in applications requiring complete time-series of data (i.e., no missing or cumulative data). This report is scheduled for publication in the *Journal of Service Climatology*.

Work also has continued in developing a monthly data base of historical Iowa precipitation records with about 19,500 station-years compiled. Preliminary work in developing statewide averages of various weather statistics beyond average monthly temperature, precipitation and snowfall was also begun. These new averages include the number of days per year reaching or exceeding maximum temperatures of 90ºF or 100º and minimum temperatures at or below 0ºF, dates of last spring and first fall freeze, as well as extreme annual maximum and minimum temperature and maximum daily precipitation amount.

Outreach:

The office maintains very open communication with the news media with a total of 478 news media contacts this past calendar year. This, combined with preparation of Public Information Statements issued in cooperation with the National Weather Service, and weekly and monthly crop-weather summaries prepared for the USDA provides very wide dissemination of climate products and information. A total of 2,365 inquiries were answered during the past year. Most inquiries were received from government agencies (39%), the news media (20%), attorneys (11%), education (5%) and insurance (5%). Virtually every major branch of State government utilizes the Iowa SC Office data on a regular basis.

The office also prepares regular monthly climate reports, the *Preliminary Iowa Monthly Weather Summary* and the *Iowa Climate Review*. The Preliminary Monthly Weather Summary is issued within the first few work days of each month and provides a brief summary of Iowa's weather conditions for the previous month. This report is available on-line and is also sent free of charge via regular mail. The Iowa Climate Review is a monthly report containing daily data for all official Iowa weather stations and is available by subscription. The Climate Review report is not currently on-line; however, the raw data are provided to Iowa State University's Iowa Environmental Mesonet web page and made available at that site. As part of the AASC/NCDC exchange program work began in providing monthly weather summaries to the Midwestern Regional Climate Center (MRCC), via the AASC web page, beginning with the November 2008 summary. Occasional special storm event summaries have also been prepared for the MRCC as part of this grant.

The Iowa State Climate Office works closely with the National Weather Service in monitoring the co-op and ASOS data networks so as to improve the quantity, quality and timeliness of Iowa climate observations. The State Climatologist has served on several

NWS regional and national committees involved with climate and data issues. Finally, the Iowa SC attended the AASC annual meeting in Burlington, VT in July 2008.

Monitoring and Impact Assessments:

The Iowa State Climate Office is a member of the Governor's Drought Task Force and Flood Task Force. The office provides regular updates of monthly temperature and precipitation data to the USDA Farm Service Agency for their use in evaluating county-by-county eligibility for disaster relief programs. The office also assists the Iowa Homeland Security and Emergency Management Division in their operations and occasionally provides guidance for county and regional emergency response offices. The office also provides near real-time rain event maps for the Iowa DOT for their use in evaluating where roadways may be in need of detailed examination for possible flood damage. The past calendar year has been particularly busy with record flooding in eastern Iowa and the greatest number of tornado-related fatalities (13) since 1968. The year 2008 went into the books as the fourth wettest, 11$^{th}$ coolest (among 136 years of precipitation and temperature records) and fourth snowiest year (among 121 years of records) in Iowa.

# Kentucky Climate Center

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***Stuart A. Foster, State Climatologist and Director***
Rezaul Mahmood, Associate Director

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The Kentucky Climate Center (KCC) observed its 31st year of operation in 2009. As a member of Western Kentucky University's Applied Research and Technology Program (ARTP), the KCC received funding to support both undergraduate and graduate students and provide opportunities for them to participate in a variety of research and service activities, including presentations at statewide, regional, and national meetings. The KCC currently supports students from programs in geography, meteorology, computer science, and mathematics. The KCC is recognized by the AASC as the State Climate Office for Kentucky.

**Information Services**

The KCC provides climate data and information through a variety of channels. These include communication via telephone, fax, and e-mail. Our primary source of service delivery is via our website, which includes a variety of narratives, tables, maps, and graphs summarizing Kentucky's historical climate. The website emphasizes interactive graphics to help users find the data and information they need. Recent website enhancements include interactive graphics to explore climate change and relationships between drought and teleconnections in Kentucky.

The Kentucky Climate Center received a grant through the National Climatic Data Center and Midwestern Regional Climate Center to develop monthly climate summaries for Kentucky. These reports are disseminated through the AASC website, as well as the KCC website.

**Research**

Faculty and students associated with the Kentucky Climate Center are involved in a variety of applied research projects. They published results of USDA-funded research on air pollution sampling associated with livestock operations in the *Transactions of the ASABE*, and published results of a modeling study examining the effects of anomalous soil moisture on atmospheric boundary layer variables in *Physical Geography*. In addition, an affiliate of the KCC published a monograph addressing historical temperature observations for NCDC's Climate Database Modernization Program.

Faculty, staff, and students affiliated with the Kentucky Climate Center presented research papers at the Annual Meetings of the American Meteorological Society, the Association of American Geographers, the Kentucky Academy of Sciences, and the Southeast Division Association of American Geographers. Presentations were also made at the AMS Conference on Applied Climatology.

**Outreach**

The KCC provided outreach via the media, including interviews through the television, radio, and newspaper media on topics including drought, tornadoes, the January 2009 ice storm, and the Kentucky Mesonet.

Representatives of the KCC were invited speakers on drought at the Interstate Environmental Health Seminar held in New Bern, NC and on climate monitoring at the Workshop on Corn and Climate hosted by Iowa State University in Ames, IA.

The state climatologist played an active role on the Drought Mitigation and Response Advisory Council formed by the Kentucky Division of Water to draft a new drought plan for the state. The plan was submitted to the Kentucky Senate at the end of 2008.

In conjunction with ongoing development of the Kentucky Mesonet, the KCC hosted the Kentucky Mesonet Workshop. This two-day event held in October 2008 included a variety of invited presentations and breakout sessions addressing the use of weather and climate data in agriculture, education, emergency management, energy, transportation, and water supply management. The workshop concluded with compilation of a set of recommendations for applications of Mesonet data. Participants represented local, state, and federal agencies, as well as the private sector.

**Monitoring and Impact Assessments**

Development of the Kentucky Mesonet continued. Twenty-four automated environmental monitoring stations have been installed throughout the state as of May 2009, and an ambitious installation schedule is in place for the remainder of the year. The information technology division is developing and testing automated quality assurance procedures and has initiated GIS-based product development efforts. Mesonet staff continues to enhance relationships with NWS forecast offices serving Kentucky. Data from the Kentucky Mesonet is freely available to the public at http://www.kymesonet.org/.

A large portion of Kentucky was affected by a severe ice storm in January 2009. A preliminary impact assessment was compiled and submitted to MRCC. The ice storm left more than 700,000 customers in Kentucky, a record number, without electric power. As of May 2009, cleanup efforts from the storm are ongoing.

# Louisiana Office of the State Climatologist

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Kyle Brehe, User Services Coordinator
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Ricardo Noguiera, Graduate Assistant
Hal Needham, Graduate Assistant
Michael Roberts, Graduate Assistant

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The LOSC is located on the campus of Louisiana State University (LSU) and is housed within the Department of Geography and Anthropology.

**Mission**
The mission of the Louisiana Office of State Climatology (LOSC) and the LA State Climatologist is to serve as the State focal point for activities pertaining to the climate of Louisiana. Responsibilities include:

- To collect, archive, and make available climate data for the state of Louisiana
- To provide climate education and information to the citizens of the region through various outreach programs including the media
- To maintain an active research program pertaining to the climate of Louisiana and the region.

To achieve these goals, the LOSC cooperates with LSU, the National Weather Service (NWS), Southern Regional Headquarter of the NWS, the Southern Regional Climate Center (SRCC), and the National Climatic Data Center (NCDC). LSU provides the infrastructure for the LOSC, and the National Weather Service Offices maintain the quality of weather observations in the region, with climate data exchanged between the LOSC, NWS, SRCC, and the NCDC.

**ARSCO Qualifications**
LOSC is designated by the AASC as the official state climate office for Louisiana.

**Communication Capabilities:**
LOSC has full access to internet, email, multiple phone lines, facsimile machines, and regular mail. We maintain a website with updates of daily, weekly, and monthly summaries for the State.

**Information Services:**
A primary role of the LOSC is to collect and archive high quality climate data for Louisiana and then make these data available to the general public, often with some

interpretation or forensic application. Users of these data include researchers, attorneys, construction companies, federal and state planning agencies, private consultants, power companies, insurance companies, teachers and students, among others. The number of requests continue to decline, though hundreds are still handled annually. We also collaborate with the Louisiana Office of USDA's National Agricultural Statistics Service, where data are shared.

**Research**
The LOSC maintains an active research agenda involving the State and region, and sometimes beyond. Over the past year, this research primarily focused on hurricane climatologies, applied climatology. We also began a joint venture with the University of Oklahoma to operate a NOAA-Regional Integrated Sciences and Assessments called SCIPP – the Southern Climate Impacts Planning Program.

**Outreach**
The LOSC conducts frequent interviews with radio, newspaper, and magazine media. Several hundred media contacts were logged in 2008. We cooperate and coordinate efforts closely with the NWS Offices in the region. We also remain primed and ready to work with Louisiana Office of Emergency Preparedness when needed.

**Monitoring and Impact Assessments:**
The LOSC has taken on the responsibility of producing a weekly summary of the State's weather and climate in the form of the *Louisiana Weekly Climate Review* available on the LOSC website at the following URL: <www.losc.lsu.edu>. This report is also e-mailed to over 100 recipients across Louisiana, including most television weather-casters in the State, concerned State Office Officials, as well as the National Weather Service Offices that serve Louisiana. The Office also provides a weekly summary of Louisiana Climate Data to the National Agricultural Statistics Service (NASS) that is published weekly in the *Louisiana Crop Weather Summary*. In addition to these weekly products, the LOSC also produces monthly summaries of the State's Climate data, which is also available on the LOSC website. The office also produces event-based summaries for significant weather events that impact Louisiana. The LOSC is also active on the ad hoc committee of the *U.S. Drought Monitor*.

# Office of the Maine State Climatologist

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***George L. Jacobson, State Climatologist***

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The past year has been busy, with routine activities interspersed with preparation of a major report, and organization of a new structure for the Maine office.

A great proportion of time this year was devoted to research for and preparation of a report requested by Governor John Baldacci in late 2007. The broad goal of the analysis was to assess probable climate changes of the 21st Century, and then to evaluate likely changes in the state's natural ecosystems (terrestrial, freshwater, marine) in the context of the projected climate shifts. In addition, the Governor asked that we evaluate the implication of those altered natural systems for Maine's various economic sectors, many of which are tightly coupled with natural resources. In essence, the request dealt with the need for climate-related adaptation planning by the state, which had earlier developed a mitigation strategy (Maine's Climate Action Plan of 2004).

During most of 2008, a group of 75 scientists from the University of Maine and around the state worked in teams to prepare the various sections of the report. Despite the fact that the work was not supported with specific funding, the contributors gave generously of their time and expertise to provide this service to the state. Those efforts have been greatly appreciated by the Governor and many other Maine citizens.

The report, ***Maine's Climate Future: An Initial Assessment***, was completed and printed in early 2009, and was formally delivered to Governor Baldacci on 25 February. At that event, the Maine State Climatologist was asked to brief the Governor's entire Cabinet, and the Governor encouraged all state agencies to work with the research teams to incorporate climate-related planning in future policy. The report is available in pdf form at the University of Maine's Climate Change Institute website:

Jacobson, G.L., I.J. Fernandez, P.A. Mayewski, and C.V. Schmitt (eds). 2009. Maine's Climate Future: An initial assessment. Orono, ME: University of Maine. http://www.climatechange.umaine.edu/mainesclimatefuture/

Legislation directing the Maine Department of Environmental Protection to undertake stakeholder-driven adaptation planning was passed by the Maine Legislature in April, and the process was initiated with the first major meeting on 1 May 2009. The Maine State Climatologist provided an opening background briefing for the group, and the process was underway.

In addition to the preparation of the report, the Maine State Climatologist has been busy throughout the year giving several dozen public presentations around the state, at scientific conferences, and in meetings with the media. All of these interactions are part of an active initiative to provide climate-related information and perspective to Maine citizens, policy makers, educators, and decision makers throughout the state.

Finally, the Maine State Climatologist is working to develop a new web site designed specifically for easy access by the public. The site ***(Maine Climate News)*** will be operated cooperatively by the Maine State Climatologist, University of Maine Sea Grant (NOAA), University of Maine Cooperative Extension, and the two National Weather Service offices from Maine (Caribou and Gray). The site will include information about recent weather patterns, reports on climate-related research activities by University of Maine faculty and students, connections to reports, and a means for Maine citizens to request information and to have questions answered.

The early part of 2009 was unusually cold throughout the Northeast. On January 16th, an instrument at the Big Black River USGS remote station in northwestern Maine recorded a temperature of – **50 F**, immediately a candidate for the coldest reading ever in the state (during the period of modern instrumental measurements). This reading triggered the convening of the Records Verification Committee for Maine, and the committee met twice (by phone) to discuss the relevant issues. The Committee consisted of representatives of the NWS Caribou office, the USGS office in Augusta, the Maine State Climatologist, the NOAA Northeast Regional Climate Center in Ithaca, and the NCDC in North Carolina. After appropriate challenges, including testing of several pieces of equipment, the group voted unanimously to approve the record as official. That reading now stands as the coldest for Maine, replacing the previous record of
- 48 F from nearby Van Buren in 1925. The -50 F record for Maine also equals the all-time record cold temperature for any New England state (Vermont having that same value).

Unusually warm temperatures for Maine occurred for several days in late April 2009. Many stations recorded temperatures that were 8-11 F warmer than the previous record high for the date at those locations. In fact, readings at the Portland Jetport on April 28th were 92F, the first time that temperatures had ever exceeded 90F in April and 11 degrees more than the record for the date. Daily records for several stations were also set on April 26th. Temperatures for April in Portland were 3.0 degrees above the 30-yr mean.

# Maryland State Climatologist Office

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***Konstantin Vinnikov, Acting State Climatologist***
Lisa Wojdan, Assistant State Climatologist

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**Past-Year Synopsis**

- Department of Atmospheric and Oceanic Science (Prof. Jim Carton, Chair) continue to host and support Maryland State Climatologist Office. An additional support to the office is currently provided by College of Computer, Mathematical, and Physical Sciences University of Maryland (Prof. Steve Halperin, Dean) and by the State of Maryland Department of Environment.
- Dr. Konstantin Vinnikov, Senior Research Scientist at this department is appointed as Acting State Climatologist for Maryland. Graduate Student Lisa Wojdan is appointed as the Assistant State Climatologist.
- The State Climatologist Office has been recently moved into the Helmut Landsberg Memorial Library, located at the 3rd floor of the Computer and Space Science Building, room 3400.

**Current Activities**

- Provide weather and climate data from NOAA (NCDC and other sources) to the public
- Maintain data archive of Maryland climate information
- Collect and study long-term historical climatic records for Maryland from the very beginning of meteorological, hydrological, and other environmental observations
- Keep citizens of Maryland informed about climate change related problems using media and the Internet
- Provide climatological information to the AOSC Department to be used at Maryland Day and other educational events
- Study Past, Present and Future Climate of Maryland and its vicinity using observed data and climatic models.
- Reconstructing official website of the State Climatologist Office for Maryland. New version should be posted by the middle of June 2009.

**Data Requests**

We receive several data requests a week at the Maryland State Climatologist Office. A majority of the requests involve temperature and precipitation data for all areas in Maryland. We have approximately 40 stations reporting weather data throughout Maryland. Data can be requested by going to our website, www.aosc.umd.edu/~climate/ and clicking on the 'Data Request Form' link.

# Michigan State Climatologist's Office

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***Jeff Andresen, Michigan State Climatologist***

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**Background**

The original State Climatology Program in Michigan was established by law on June 1, 1895, under Public Act No. 246 as a part of the Michigan Weather Service (MWS). A Type I transfer made it a part of the Michigan Department of Agriculture (MDA) in 1965. In 1980, Public Act No. 314 placed the program under the the Environmental Bureau of MDA. Through a departmental reorganization, the name MWS was changed to Michigan Climatology Program in January 1982. As part of yet another reorganization in 1997, the program was transferred to Michigan State University, where it operates today as the Michigan Climatological Resources Program (MCRP).

Leadership of MCRP is the responsibility of the State Climatologist (Jeff Andresen), who supervises operational and research activities under the direction of the Chair of the Geography Department. Operational and research support in the program are provided by Peter Kurtz and Aaron Pollyea, while technical and clerical support is provided by Cathy Sernick. Kurtz serves the program as system administrator, with responsibilities including software development and operation, data collection, processing, and archival, and processing some large or unusual data requests. The research support position (Pollyea) is responsible for assisting with the operation and analysis of the program's various research projects. An additional position, a professional Geographic Information Systems specialist, was filled by Tracy Aichele in 2002 in association with an externally-funded research project. Finally, graduate students and undergraduate students are occasionally hired as hourly workers in the Climate Office for assistance in research, data processing, and other operational duties as allowed by external funding.

MCRP serves as an archival and service center for climatological data and information for the State of Michigan. Major objectives of the MCRP are consistent with the American Association of State Climatologist-defined role of a state partner in provision of climate services, including: 1) Collection of observations for the purpose of climate monitoring, summarization and dissemination of weather and climate information to the user community; 2) Demonstration of the utility of climate information in the decision making process and assessment of climate impacts; 3) Development of an active research program addressing climate-related issues in the state and region; and 4) Development of an educational element of the program which allows and encourages students to

participate in climatological research, gain operational job experience on internships, and provide training in applied use of climatological information.

MRCP applied for AASC ARSCO status in spring 2009.

**Current and Recent Program Activities**

*Information Services and Outreach*

The total number of public requests for climate-related data and information in 2007/2008 was just under 1000, most of which were received via phone or email. The majority of these requests were from law firms, the insurance industry, and other researchers. The number of formal billable user requests filled in FY 2007/2008 was 135. The numbers of formal user requests and amount of request income have decreased significantly during the past 10 years, which mirrors trends observed at other climatological service organizations in the US. These decreases are most widely thought to be attributed to the growing access and availability of weather and climate data on the internet. This is also consistent with the numbers of users on the associated Climate Information (climate.geo.msu.edu), MAWN (www.agweather.geo.msu.edu/mawn) and Enviro-weather (www.enviro-weather.msu.edu) web sites, which have collectively grown from less than 25 per day in 1997 to more than 4300 per day in 2008.

The MCRP in conjunction with MSUE (through the SC's formal appointment) also maintains an active outreach program through traditional venues, providing climate-related information in formats ranging from public speaking engagements to regular columns in the popular press. During 2007/2008, the MCRP staff provided 10 interviews to print, radio, and television media and 12 talks or seminars to the public. The SC and some MCRP staff also write weather- and climate-related columns on a daily (MSUE Crop Advisory Team, see www.ipm.msu.edu/aboutcat.htm) and bimonthly (Michigan Farm Bureau) basis. During FY2007/2008, 92 columns were written. The MCRP also actively supports a number of local and state government functions. During FY2007/2008, the SC served as a member of the State of Michigan's Climate Action Council. The Climate Action Council was tasked (by Governor Jennifer Granholm) with developing an inventory and statewide strategy for reduction of greenhouse gases as a part of future legislation related to climate change mitigation.

*Research*

MCRP maintains an active research program addressing climate-related issues in the state and region. Current projects involve agricultural water use research within the state (including operational irrigation scheduling), investigation of past and projected future climate changes in the region, and the impacts of weather and climate on regional agriculture. We also continued work on the Enviro-Weather project, the primary objective of which is the development and implementation of www-based techniques and tools that address weather- and climate-related processes in agricultural and natural resource management in Michigan. During FY 2007/2008, staff at MCRP published 1 refereed journal article and 5 non-refereed articles and technical reports. MCRP was awarded 1 new external grant during FY 2007/2008, had 5 grants in force from previous years, and 6 new grant proposals were submitted for review.

# Minnesota State Climatology Office

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***Jim Zandlo, State Climatologist***

The Minnesota State Climatology Office (MN_SCO) exists to manage, analyze, and disseminate climate information in service to the citizens of Minnesota. The MN_SCO is funded by the State of Minnesota Department of Natural Resources - Division of Waters, and housed at the University of Minnesota - Department of Soil, Water, and Climate. This partnership was formed in 1973.

The MN_SCO assists its customers in their investigations of the climate's impact on various components of the natural environment, and on socioeconomic activities. The MN_SCO uses its climate monitoring resources to quantify weather conditions and to place these conditions within historical and geographical context. The MN_SCO also provides quantitative summaries of historical climate conditions, allowing users to make informed decisions about future activities.

In order to provide its services, the MN_SCO requires an extensive historical climate data set. The climate database managed by the MN_SCO consists of over 100 million numbers. The database features data collected by Minnesota's high spatial density precipitation monitoring program, formed in the early 1970's. This "network of networks" utilizes the efforts of water-oriented state and local agencies to assemble precipitation data from approximately 1500 observers each year. Additionally, the National Weather Service (formerly the U.S. Weather Bureau) has maintained a large scale, volunteer-based climate monitoring network in Minnesota since 1890. Other, smaller scale climate monitoring efforts extend the historical record earlier into the 19th century. The MN_SCO also archives multi-element hourly weather data gathered at Minnesota's airports.

The MN_SCO provides customers with free access to a comprehensive electronic climate database. The MN_SCO also serves its customers by offering a variety of value-added analyses of climate data in the form of narratives, maps, graphs, and tables. Customers access MN_SCO products and services via a Web site, e-mail, telephone, and office visits.

The customers of the MN_SCO are many and varied. Customers can be grouped in the following categories:

- Minnesota Department of Natural Resources (sponsoring agency)
- State, Federal, and Local Governmental Agencies
- Private Sector Professionals

- Academic Community
- General Public

**ARSCO Qualifications:** the MN_SCO is designated by the AASC as the official state climate office for Minnesota. The following describes the ways in which the MN_SCO addresses each of the ARSCO qualifications:

***Communication Capabilities:***

- full-featured web site
- fully staffed information line
- near-immediate response to e-mail inquiries

***Information Services:***

- Web site – the MN_SCO Web site receives visits from approximately 2800 users per day. The Web site offers users free access to nearly all of Minnesota's digitized climate data, as well as a host of value-added products such as narratives, maps, and tabular summaries.
- The Web site offers on-line daily data entry and data maintenance capability to volunteer precipitation observers. These near real-time data are automatically transferred to the National Weather Service North Central River Forecast Center.
- Phone and e-mail – the MN_SCO answers dozens of phone calls and e-mails per week from customers with climate questions.

***Research:***

- In 2008, the MN_SCO began a project that compares hourly precipitation data (TD-3240) with daily precipitation data (TD-3200 and Minnesota's high spatial density precipitation monitoring program) in an effort to 1) refine or create time-of-observation metadata and 2) provide a quantitative evaluation of observer behavior. A primary use of the project concerns the preparation of data sets for NOAA's Hydrometeorological Design Studies Center work on the NOAA Atlas 14 - Midwest Volume.
- In 2008, the MN_SCO prepared a report titled "Observing the Climate". The report examines both recent and long-term observed climate trends in Minnesota. A preface to the results section describes non-climatic influences on the climate observing system. Future enhancements and revisions to this document are likely.

***Outreach:***

- Staff are commonly requested to attend multi-agency, multi-displinary meetings where a climatological perspective is required.
- Staff give frequent interviews to the state's electronic and print media.

***Monitoring and Impact Assessments:***

- Web site offers a variety of routinely prepared summaries of weekly and monthly temperature, degree day, precipitation, and snow depth data.
- Web site offers a chronological journal of significant weather events, providing a description of the event, impacts, and historical context.

- The MN_SCO utilizes a list server to deliver a monthly electronic newsletter summarizing climate conditions observed during the previous month and the resulting impact on water resources (approximately 500 subscribers).
- The MN_SCO is in frequent communication with authors of the U.S. Drought Monitor.

# Office of the Mississippi State Climatologist

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***Charles Wax, State Climatologist***
Michael Brown, Assistant State Climatologist

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Dr. Charles L. Wax was appointed Mississippi State Climatologist upon nomination by Governor William Winter and the execution of a Memorandum of Agreement between NCDC, NWS Southern Region, and Mississippi State University dated April 21, 1983. The MOA was signed by University President James McComas and the SC Office was vested in the Department of Geosciences at Mississippi State University, where the office remains today. The SC is not funded beyond one-quarter time release from teaching in the department. The SC is involved in teaching, research, and service through the university, and has been granted ARSCO status. A new Memorandum of Agreement between NCDC and Mississippi State University dated October 17, 2008 recognizes the Mississippi State Climate Office as the ARSCO State Climate Office for the State of Mississippi with Dr. Charles L. Wax as State Climatologist. The 2008 MOA was signed by Dr. Vance Watson, University President, and Dr. Tom Karl, NCDC Director.

Service activities of the SC this past year include the routine handling of daily requests for data or information, and provision of data analyses for more complex requests. The same sort of climate data consumers are found in Mississippi as elsewhere—lawyers, engineers, professors, researchers of all types, businessmen, housewives, farmers, teachers, students with science fair projects, and every other imaginable user. Much time is spent providing weather summaries to other government agencies upon request, but no routine publication of this sort is attempted. The number of data requests has diminished in the last few years with the introduction of so much climate data on websites free to the public. This is a welcome change!

Outreach activities this past year have continued to be heavily focused on the perceptions and possible effects of climate change. The SC office has been overwhelmed with requests for information and for presentations about potentially changing weather characteristics to groups throughout the state and region. The SC has been cast in the unwelcome role of "expert" on climate change! The Mississippi public is also manifesting a heightened awareness of the effects of weather and climate on all types of activities, due most likely to increased media coverage of weather and climate.

Research activities this past year included the climatological suitability for growing bio-fuels in Mississippi, the physical and cultural impacts on groundwater resources from the shallow alluvial aquifer of the Mississippi Delta region, and climatic influences on duck migration patterns. An article on climatically controlled disposal of large hog farm

wastewater in Mississippi was submitted to the new AASC Journal of Service Climatology!

Several international companies (Nissan, Toyota) have built plants in Mississippi. Their corporate offices have requested special information on hurricanes, insurance complications and availability, and other severe weather events, in addition to mundane things like humidity and maximum temperatures.

**The following specific outreach activities and educational presentations on weather and climate were conducted this year:**

- Entered Mississippi into the CoCoRAHS network. Over 200 observers are enlisted across the state at present, and the State Climate Office has used a little over $2000 of grant money to buy rain gauges to distribute to the observers.
- Served as a member of Mississippi Mesonet Steering Committee attempting to establish a mesonet in the state
- Two taped interviews for TV news shows
- Mentored Tupelo High School senior Leland Chaney on his senior project on weather instruments—attended the school projects exhibit in Tupelo
- Presented a guest lecture to the Broadcast Meteorology Program Summer Workshop
- Presented a guest lecture to Wildlife and Fisheries undergraduate seminar class
- Presented a seminar on climate change to University of Mississippi Chemical Engineering Department graduate students and faculty in Oxford
- Presented a guest lecture to the Geoscience Club Brown Bag Luncheon
- Presented a guest lecture on research for the Geology Research Methods class
- Presented a guest lecture on Climate Change to the Geography 1001 First Year Seminar Class
- Forestry prescribed burning shortcourses on weather and stability conducted for Mississippi Forestry Commission at MSU in April and in Hattiesburg in October
- Hosted a visit and presented a lecture on climatology and climate change to a home school group from Jackson, MS working on a project in the national First Lego League Challenge Competition
- "Global Warming." Guest lecture to the Environmental Science class at Jackson Preparatory School, Jackson, MS
- Presentation on wind patterns in Noxubee County to Noxubee County School Board in public hearings on the effects of locating a chicken farm next to Noxubee County High School
- "Introduction to Weather and Climate." Presented to the Mississippi Master Naturalists course, Mississippi Cooperative Extensive Service, Coastal Research and Extension Center, Biloxi, MS
- "Severe Weather, Storms, and Climate Change." Presented to Café' Scientifique, Starkville, MS
- "Arctic Climate and Landscape of the Yukon Klondike Region." Presentation to Starkville Reads Association, Starkville, MS

- "Climate and Climate Change." Presentation to Oktibbeha County Audubon Society, Starkville, MS

**Invited Conference presentations:**

2008. C.L. Wax. "Modelling Groundwater Use from the Mississippi Delta Shallow Alluvial Aquifer." Southeastern Section, Groundwater Managers Development Association, Tallahassee, FL.

2008. C.L. Wax. "Changing Climate Trends and Cycles." National Association of Conservation Districts, Inc., Annual Meeting, Biloxi, MS.

2008. C.L. Wax. "Climate Change and Water Availability." Mississippi Water Resources Conference, Jackson, MS.

2008. C.L. Wax. "Climate Change." Mississippi Manufacturers Association Annual Meeting, Philadelphia, MS.

2008. C.L. Wax, Tia Merrell, and J.W. Pote. "Development of a Model for Managing Groundwater Use from the Delta Alluvial Aquifer. Mississippi Water Resources Conference, Jackson, MS.

2008. Schummer, M.L., R. Kaminski, C. Zimmerman, M. Brown, and C. Wax. "Weather-related Indices of Autumn-Winter Dabling Duck (Anas spp.) Migration Through Middle North America. Wildlife Society Annual Meeting, Jackson, MS.

**Publications:**

2008. Brown, M.E. and C.L. Wax. "Temperature as an Indicator of the Influence of Landforms on Atmospheric Processes." Physical Geography, 28(2), pp 148-157.

2008. C.L. Wax. "Late Freeze Impacts in Mississippi." In, The Easter Freeze of April 2007: A Climatological Perspective and Assessment of Impacts and Services. NOAA/USDA Technical Report 2008-01. http://www1.ncdc.noaa.gov/pub/data/techrpts/tr200801/tech-report-200801.pdf

2008. Wax, C.L., J. Pote and T. Merrell. "Climatological and Cultural Influences on Annual Groundwater Decline in the Mississippi Delta Shallow Alluvial Aquifer: Identifying the Causes and Solutions." In Proceedings, Mississippi Water Resources Conference. Mississippi Water Resources Research Institute. http://www.wrri.msstate.edu/pdf/wax08.pdf

2008. Cooke, W.H., K. Grala and C.L. Wax. "A Method for Estimating Pan Evaporation for Inland and Coastal Regions of the Southeastern U.S." Southeastern Geographer, 48(2) pp 149-171.

In Press. Wax, C.L., J.W. Pote and M.E. Brown. "Integrating the Natural Climate Regime Into Management Plans for Swine Wastewater Lagoons." Journal of Service Climatology.

In Press. C.L. Wax. "Mississippi's Climate," In Mississippi Encyclopedia. Center for the study of Southern Culture, University of Mississippi Press, University, MS.

# Missouri Climate Center

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***Patrick Guinan, State Climatologist***

Charly Clendenning, undergraduate assistant

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Missouri Climate Center is designated by the AASC as the official state climate office for Missouri. As State Climatologist for Missouri and Director of the Missouri Climate Center, I serve as resource for weather and climate information. The State Climatologist collects and maintains an extensive historical climate database of Missouri weather records for monitoring and dissemination to the citizens of the state and beyond. This includes performing and assisting in the primary functions of the center whose mission is to advance the use of climate information for the economic and environmental benefit of Missouri and the public safety of its citizens through climate monitoring, research, education, and extension and information services. In 2008, alone, we fulfilled hundreds of climate data requests and gave educational presentations in dozens of venues around Missouri. The following information provides information over the past year of how the Missouri Climate Center addressed each of its ARSCO qualifications.

***Communication Capabilities:***

- The MCC web site provides easy access to weather and climate information including links to specialized web sites for real-time and historical weather in Missouri. In 2008, the Missouri Climate Center web site was assimilated into the American Association of State Climatologists web site. Also, the Missouri Climate Center web site incurred a 100% makeover. Today, a more informative, enhanced and visually pleasing web site is available.
- An agricultural weather forecast is developed every morning and e-mailed to all the county extension offices in Missouri;
- Over 4000 lines of data arrays are collected daily from a network of 29 automated weather stations. The daily and hourly arrays are posted on a server for free access.
- The Meteorological Assimilation Data Ingest System (MADIS) incorporates 5-minute weather conditions from 16 real-time weather stations in Missouri associated with the Commercial Agriculture Automated Weather Station network.
- Recruited more than 100 new volunteers for Missouri CoCoRaHS
- Continued development and recruitment for an e-mail delivery agricultural weather product called Horizon Point. Horizon Point is a custom weather analysis system for farmers and provides an opportunity to have specific weather reports sent directly to their e-mail address. Currently over 600 Missouri agricultural producers and agents are enrolled.

***Information Services:***

- Submitted numerous press releases and updates to the Extension news service related to weather, climate and the environment;
- Serve as an information source for the media including national, state, and local mediums;
- Provide impending or continuing drought status reports for Missouri to the National Drought Mitigation Center;
- Fulfilled hundreds of requests for climate information and provided climatological expertise to numerous individuals, groups and agencies;
- Submit weather and soil information published in a national bulletin **Weekly Weather and Crop Bulletin:** http://www.usda.gov/oce/weather/pubs/Weekly/Wwcb/
- Run the black cutworm forecasting program over the internet for public utility: http://agebb.missouri.edu/weather/reports/bcwforecast.htm;
- Run the rice model program to predict rice growth stages: http://agebb.missouri.edu/rice/ricemodel.htm;
- Provide a weekly climate summary table for the **Integrated Pest and Crop Management** Newsletter: http://ppp.missouri.edu/newsletters/ipcmindex.htm;
- Provide a 2-inch and 6-inch soil temperature table for the Agricultural Electronic Bulletin Board (AgEBB): http://agebb.missouri.edu/weather/reports/soilTemp2.asp http://agebb.missouri.edu/weather/reports/soysoil6.asp;
- Brought one weather station online real-time: http://agebb.missouri.edu/weather/stations/ ;
- Real-time weather data from automated network is made available to local NWS offices;
- Campus weather station linked to main MU web site: http://www.missouri.edu/ ;
- Campus weather station linked to College of Ag web site: http://cafnr.missouri.edu/
- The real-time stations are providing 5-minute weather conditions to the Meteorological Assimilation Data Ingest System (MADIS);
- Participate in a weekly radio show on KMZU, Carrollton, MO, featuring Ag Weather.

***Research:***

- Providing real-time weather status to 16 weather stations in the Commercial Agriculture Automated Weather Station Network for Integrated Pest Management;
- Provide climate data for graduate students and faculty research projects
- Co-authored a protocol for the research project titled "Paper birch decline in the Niobrara Valley: Interactions with weather and microclimate". Authors: Esther D. Stroh, Joel P. Miller and Patrick E. Guinan
- Co-authored a paper submitted to the Missouri Academy of Science titled “A Long-Term Study on Tropical Systems Impacting Missouri”. Dawson, N.W., Guinan, P.E. and A.R. Lupo.
- Co-authored a paper submitted to the Missouri Academy of Science titled “COCORAHS in Missouri: Three Years Later, The Importance of Observations”. Moon, III, J.T., P.E. Guinan, and A.R. Lupo.

***Outreach***: Education, Awareness, and Contact Activities

- Instructor for People, Plants, and Environment. Reid Smeda and Mary Ann Gowdy, Instructors. University of Missouri, Columbia. Topic: Climate Change and More
- Instructor for Allen Thompson's Ag Systems Management class. Topic:

Automated Weather Application for Agriculture;

- Instructor for Peter Motavalli's Soils and Environment class. Topic: Applicability of automated weather stations.
- Gave tour of Sanborn Field automated weather station for Dr. Keith Goyne's Environmental Science class.
- Agricultural Weather presentation at Crop Injury Diagnostic Clinic
- Climate Change presentation at Missouri Natural Resource Conference
- Climate Change presentation at Bowood Farms in St. Louis
- Climate Trends and Ag Weather Resources presentation to producers in Blue Springs, MO
- Weather Update presentation for Missouri Corn Growers Association in Columbia and Memphis, MO.
- Missouri Climate Patterns presentation to the Audubon Society, Jefferson City
- Weather presentation to numerous field days across the state;
- Agricultural weather presentation associated with MU's Winter Crop Conferences in Marshall, St. Joseph, Lamar, Wentzville and Wellington, MO;
- Ag Weather session at MU's Annual Crop Management Conference;
- Participated in a concurrent session on climate change at the Missouri Waste Control Coalition Conference. My presentation was titled "Historical Missouri Climate Patterns and Future Climate Scenarios."
- Presented at the 2008 Swine Institute: "How was 2008 Weather Different?"
- Presented and attended at the American Meteorological Society 17th Conference on Applied Climatology, Aug 11-14, 2008, Whistler, British Columbia. My paper and presentation was titled "Missouri's Transition to a Near Real-Time Mesonet".
- I attended a sub-regional Data Stewardship Workshop hosted by the National Weather Service-Central Region in Kansas City, MO on July 29-30, 2008. I gave a presentation titled "Missouri Climate Data: What's available, how it's used and why it's so important."
- Served as a panelist at a NDMC hosted workshop in Kansas City on the Status of Drought Early Warning Systems in the U.S.
- Weather updates for MU Exntension Quarterly Ag-Marketing Teleconferences;
- Weather updates for weekly for MU's Integrated Pest Management and Horticulture Teleconferences (April-August);
- State Co-Coordinator of the Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) in Missouri and conducted training sessions;
- Member of the Missouri Drought Assessment Committee;
- Member of the Plant Protection Programs steering committee;
- Member of the North Central 1018 Regional Climate Committee: Food, Feed, Fuel and Fiber: Security Under a Changing Climate ;
- Information resource for the following media outlets: Missouri Net, Brownfield Network, Cooperative Video Group, and numerous local television, radio, and newspaper outlets across the state.

# Nebraska Climate Office

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***Al Dutcher, Nebraska State Climatologist***

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During 2008, I handled 724 data requests for climate information by users from 31 states and the District of Columbia. Totals revenues generated were $3482.07. Of these requests, 252 were direct media inquiries for climatic data and/or explanations of climatic events and their impacts on diverse subjects including water supplies, agriculture, drought, flooding, and tornado outbreaks. During the May-July period, I handled the majority of data requests for the High Plains Regional Climate Center until the vacated Climate Service position was filled. The Nebraska Climate Office was hired by Adams Cattle Company, Broken Bow, to provide an analysis of the November 2006 central Nebraska blizzard that resulted in an 8 million dollar loss to their cattle herd. The result of this analysis allowed for an out of court settlement between litigating parties.

The Nebraska Climate Office gained official American Association of State Climatologists Recognized State Climate Office (ARSCO) status in June 2008. ARSCO status allows the Nebraska Climate Office to continue its relationship with the National Climatic Data Center and High Plains Regional Climate Center in terms of climate data acquisition and quality control. In order to maintain ARSCO status, the State Climate office provided the AASC with an annual report of climate office activities including a breakdown of climate services provided. The Nebraska State Climate Office was selected by the American Association of State Climatologists to provide a monthly update of climatic trends for Nebraska to the High Plains Regional Climate Center as part of their regional monitoring directive.

In addition, I attended the annual AASC meeting in Burlington, VT as a representative of the Nebraska State Climate Office and director of the High Plains Regional Climate Center. At the Burlington meetings, I was appointed to the membership committee, which is responsible for establishing nominating procedures and guidelines for membership. The committee has already had two teleconference calls (September and October) to propose and develop changes in the AASC constitution that specifically address criteria for members, associate members, and honorary members.

I gave no less than 25 talks during 2009 on a diverse range of topics including the climate of Nebraska, irrigation issues, spring flooding, spring planting delays, fall wheat planting establishment, freeze risk, and harvest weather. Attendance counts indicated that at least 2440 people attended one or more of these talks. Most of the spring talks focused on the high risk of spring flooding and planting delays due to high soil moisture content across the eastern 2/3 of the state. Probability risk analysis was provided on past growing

seasons that exhibited similar La Nina trends experienced during the 2007-08 winter. Summer talks focused on the impacts of planting delays with special emphasis on estimated time of pollination and the potential of freeze risk to late maturing crops. Fall talks focused on current soil moisture status, winter wheat establishment, reservoir recharge, harvest weather, and winter weather outlooks. It is difficult to estimate the financial impacts of my talks on participants, but in discussions immediately following my talks, many participants indicated a desire to adjust their crop insurance coverage, modify the quantity and types of hybrids they would plant, and reassess how they would market their grain.

The Nebraska State Climate office worked with the editor of CropWatch, a University of Nebraska agricultural production newsletter, to provide daily updates on site specific soil temperatures, growing degree day accumulations, and evapotranspiration (ET) estimates. These files are the most frequently downloaded information from the CropWatch web-site. During June 2008, 32,000 unique visitors accessed the CropWatch.web-site and if only 1000 of these visitors were able to reduce their center pivot application by one rotation at an estimated cost of $500, one half million dollars in cost savings would have been realized. In addition, I provided nine article submissions to CropWatch covering diverse topics including reservoir status and projections, spring flooding coverage, crop maturity projects, harvest weather forecasts, and seasonal outlooks.

In addition, a weekly U.S. weather forecast was provided to the World Wide Ag Network and Market Journal, as well as, a two-week weather outlook for Heartland Express's Farm and Ranch Magazine. Heartland Express reaches over 50,000 households each printing cycle, while Market Journal reaches over 10,000 households (2006 Nielsen rating). If only five percent of the viewers were able to reduce their irrigation by one application due an accurate weather forecast, a savings of 1.5 million dollars would have been realized. Minimum estimated irrigation savings based on weather forecasts provided to media entities are in excess of two million dollars.

I provided weekly updates of insect development estimates for corn flea beetles and alfalfa weevil using degree day from March through mid-May to Entomology Department personnel. This information was relayed through news releases to crop consultants and extension educators in order to facilitate accurate scouting . Without this information, numerous field trips might be required to track insect numbers and development. With this data scouting becomes more efficient, since thermal models can pinpoint when insect development has reached the stage where economic damage could occur. The estimated financial savings is unknown, since treatments are dependent on over-wintering capacity, insect density, and use of genetically modified crops.

A monthly analysis of the 220 Nebraska cooperative weather observer forms was preformed to identify outlier observations. Typical errors included incorrect observations in wrong entry columns, shifting of observations to prior days, incorrect maximum and/or minimum temperatures in relation to "at observation" temperatures, invalid summation of precipitation variables, and failure to record "at observation" temperatures. After manual inspection of data, observations were manually entered into digital archives for

analysis by summary programs. Ran summary programs on temperature and precipitation variables to identify outlier stations. Identified errors relayed to local National Weather Service offices so their personnel could contact and re-train weather observers.

The Nebraska State Climate Office provided the Nebraska Agricultural Statistics Service (NASS) daily updates through tabular and graphical files of precipitation trends for defined periods, soil temperature summaries, growing degree day accumulations, and temperature extremes. This information is critical for the department to track crop development, planting delays, and unusual weather events. Monthly summaries are used by NASS as inputs into their yield forecast models. In addition, I provided a year-in-review summary of temperatures and precipitation trends that were included in their annual wheat yield estimate publication.

I worked with the University of Nebraska's Center for Information Technology to produce five radio programs in 2008 addressing the weather outlook for each of the seasons, as well the subject of spring planting. Each 4 minute, 15 second radio taping would summarize current climate conditions and focus on relevant issues facing Nebraska such as reservoir status, snow pack, flooding potential, crop maturity delays, freeze risk, and potential harvest delays. CIT releases these radio spots to all media outlets servicing the state of Nebraska for follow-up interviews if media entities so desire.

The development of the Nebraska Climate Office web-site has been delayed due in part to my additional climate services work for the High Plains Climate Center during the May-July period and serving on two search committees for their Service Climatologist and Regional Climatologist positions. To date, nearly 22,000 graphical and tabular files have been developed that analyze monthly climate trends, freeze probabilities, climate normals, and period of record summaries for temperature and precipitation variables. The framework for the new web-site has been developed and I am currently working to bring the Nebraska Climate Office web-site on-line by the end of this summer.

I served as the chair of the Water Availability and Outlook Committee (WAOC) of the governors Climate Assessment and Response Committee. Worked with other WAOC members to summarize climate assessments for the state and present those findings to CARC during the spring meeting. Outlook scenarios of climate trends were presented to the committee so that appropriate recommendations could be made to the governor in terms of drought aid, water policy, and mitigation strategies. The findings/recommendations were compiled in a report that can be accessed through the CARC web-site.

Participated in the university Crops Teleconference phone bridge. The phone bridge meets monthly from September through March, then weekly from April through August. Provided the conference call participants updates on soil moisture, crop status, climatic risks to crops during the upcoming forecast period, unusual climate trends, expected precipitation and/or severe temperature events, and additional crop concerns from other regions of the country when necessary.

The Nebraska State Climate office provided the U.S. Drought Monitor group recommendations for drought classification with the boundaries of Nebraska. This included conducting an analysis of precipitation trends, soil moisture, crop water use, streamflow summaries, and reservoir levels to effectively portray drought categories within Nebraska.

I was one of two state climatologists that participated in a national teleconference call on the risk of spring flooding and planting delays that was hosted by the Environmental Working Group in Washington, D.C. Over 50 major media outlets participated in this teleconference call and the emphasis was on acreage impacted by flooding, short/long term weather outlooks, and crop vulnerability to below normal growing season temperatures.

I was involved in 8 of the 12 School of Natural Resources (SNR) faculty meetings during 2008. Of the four missed meetings, three were due to speaking engagement conflicts and one conflicted with annual leave. Worked with SNR Appplied Climate Systems (ACS) faculty to identify a wish list of potential faculty positions for SNR and developed the job description for an Air Dispersion Modeler. Participated in the 5-year SNR review listening sessions, with particular emphasis on the working group for Climate Change and Climate Variability.

I worked with several ACS graduate students to review their research proposals and thesis submissions. Met with the Omaha LEGO team (home school science competition group) to identify emerging climate issues as part of their national science competition. Completed a one-hour climate change oral survey by a Texas A&M graduate student as part of her doctorate research. Met with a Iowa State graduate student on potential options for graduate studies within the SNR ACS group. Finally, I assisted a Denver, Colorado high school student on her senior class project, which examined hydrological issues within the Platte river basin.

# Nevada State Climate Office

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Nevada State Climate Office

***Jeffrey Underwood, Nevada State Climatologist & Assistant Professor***

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The Nevada State Climate Office (NVSCO) was established under Nevada Revised Statute 396.595 with the mission of maintaining descriptions of information on the climate in the state including atmospheric conditions and levels of precipitation.

**Activities:** During 2008 the NVSCO was occupied with drought analysis and preparations for a disaster declaration for regions of the state. The 2007-2008 snow pack in both the Sierra Nevada and the Lower Colorado Basin was inadequate to alleviate the drought conditions that have persisted for the past three years in Nevada. All seventeen counties in Nevada reported severe drought impacts and the agricultural areas of the state were hard hit by the lack of water for forage crops and for livestock. Working with Director of the Nevada Department of Agriculture the NVSCO was the lead agent in drought analysis and provided the Governor's staff with a portfolio of observational data and climate analysis with which the state compiled a compelling case for federal disaster status for fourteen counties in the state. The Governor's request for federal disaster assistance was approved by the FDA in early 2009. (see:http://www.fsa.usda.gov/FSA/newsReleases?area=newsroom&subject=landing&topic=edn&newstype=ednewsrel&type=detail&item=ed_20090126_rel_1408.html).

NVSCO personnel were also active in the Nevada Hazard Mitigation Planning Subcommittee during 2008. The committee was busy with implementation activities throughout the year including the review of a number of proposals for projects to fulfill the mission of the Hazard Mitigation Subcommittee.

Personnel from the NVSCO also produced a number of referred research articles that were published during 2008-2009. This includes a pair of articles in the Journal of Hydrometeorology that investigate flooding in lee-side basins of the Sierra Nevada. Presentation of this research was also well received at numerous conferences over the past year.

**Changes:** The NVSCO has undergone substantial changes in organizational structure during 2008. The state climatologist who was previously funded at 50% to run the office has moved to a full-time faculty position in the Department of Geography at the University of Nevada. The Office is in the process of hiring an Assistant State Climatologist who will take over much of the day-to-day responsibilities for the Office.

Dr. Jeffrey Underwood will remain in the role of Nevada State Climatologist but will operate in a directory role and spend the majority of his time as a research and teaching professor in the Departments of Geography and Atmospheric Sciences at the University of Nevada.

The NVSCO webpage is undergoing a complete overhaul. The new and very much improved website will make its debut in late May 2009.

# New Hampshire State Climate Office

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***Mary Stampone, State Climatologist***

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The New Hampshire State Climate Office (NHSCO) resides within the Department of Geography at the University of New Hampshire – Durham, a land-, sea-, and space-grant institution. In concert with the mission of the University of New Hampshire, the goal of the NHSCO is to:

- Provide New Hampshire citizens and other constituents with climate information at the local, county, and state levels.
- Conduct research on climate-related issues relevant to the state of New Hampshire and its residents.
- Be a resource in climate science for educational and outreach purposes.

The office underwent some exciting changes during the summer of 2008, including a new campus location and a new State Climatologist. Shortly after Mary Stampone became the New Hampshire State Climatologist in August of 2008, the NHSCO moved into a newly renovated space in Huddleston Hall. This move spurred a reorganization of the NHSCO analog data inventory, leading to the recovery of original, hand-written weather records dating back to the late-nineteenth century. Many of these records are now being preserved and archived by the New Hampshire Historical Society.

**ARSCO Qualifications**

The following activities address the NHSCO's qualifications as an ARSCO.

*Communications capabilities*:

- Redesigned the NHSCO website (http://www.unh.edu/stateclimatologist/) to allow users, with various interests and skill levels, direct access to climate data from a variety of data repositories. Information on each dataset is also provided to allow users to identify the data source that is most appropriate for their purpose and level of expertise.
- Provide free data via the internet, email, telephone and regular mail.
- Advise and provide expertise in areas of climatology and climate science over the phone, in person, and in print.

*Information services:*

- Responded to over one hundred data requests from New Hampshire citizens, businesses, schools, and organizations.
- Granted over a dozen media interviews, including newspaper, radio, and television, on topics ranging from trends in New Hampshire climate to seasonal forecasts to explanations of recent weather events. 2008 was an interesting year that included record-breaking snowfall, summer flooding, a devastating tornado, and devastating ice storm.
- Consulted as an expert reference on ice storms for an upcoming episode of the MSNBC docudrama "*Extinction Earth*."
- Updated climate statistics for select New Hampshire stations.

*Research:*

- Began organizing and cataloging New Hampshire state data resources including analog data records maintained by the NHSCO and digital records provided by national organizations for upcoming research.

*Outreach:*

- Assisted four, and consulted with several other, teams in preparation for the Fall 2008, New Hampshire Lego League competition. New Hampshire climate and climate change was the theme for 2008. Team projects included the influence of climate change on New Hampshire greenhouse gas emissions, maple syrup and honey production, bear populations, and winter recreation to name just a few.
- Participated in the Newmarket, NH school job fair.
- Spoke to students about careers in weather and climate.

*Monitoring and impact assessment:*

- Performed basic maintenance and served as contact person for the two NOAA Climate Reference Network (CRN) stations located in southern New Hampshire.
- Began plans to implement a CoCoRaHS monitoring network in New Hampshire.

# Office of the New Jersey State Climatologist

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Founded in 1979, the Office of the New Jersey State Climatologist (ONJSC) resides within the Rutgers University Center for Environmental Prediction. Our mission is to monitor and understand the diverse weather and climate conditions experienced across the Garden State on various temporal and spatial scales. Included are efforts to inform and educate, thus making the 8.7 million residents of this most densely populated state weather and climate aware.

The ONJSC operates the New Jersey Weather and Climate Network, or NJWxNet. This unique network of over 150 weather stations <http://climate.rutgers.edu/njwxnet> serves as a one-stop Internet resource for New Jersey weather and climate data. The NJWxNet is a network of networks, including, among others, NJ Dept. Transportation RWIS, NWS ASOS, South Jersey Resource Conservation and Development Council RISE, NOAA IFLOWS, USGS stations and two networks operated by the ONJSC. Stations operated by ONJSC include 15 NJ Mesonet sites, monitoring a rich suite of atmospheric and surface variables, and 25 NJ SafetyNet stations, monitoring a subset of important variables primarily at public safety agencies. Hourly observations are collected and displayed in real time as colorful maps and tables on the NJWxNet web site. This past year marked a major upgrade of our servers, providing space and speed. Our new servers are now hosted in a secure and stable facility on campus. Mesonet upgrades continued and renewed support was received from the NJDEP, US Forest Service and NJ Office of Emergency Management.

New Jersey joined the ranks of Community Collaborative Rain, Hail and Snow Network states in early 2008. There are now over 225 observers enrolled. We have introduced color-filled state and regional maps of daily precipitation http://climate.rutgers.edu/stateclim/?section=menu&%20target=CoCoRaHS using software originally developed for the OK Mesonet and also used for the NJWxNet. In addition to the NJWxNet and NJ CoCoRaHS, the ONJSC maintains a comprehensive

archive of historical data, metadata and climatologies from National Weather Service primary and cooperative stations. This is supplemented with data submitted by ONJSC volunteer observers. This information is manually processed and displayed in event, weekly and monthly maps and tables.

Research endeavors within the ONJSC range from student projects on topics such as regional heat islands and snow climatologies to collaborative efforts with Rutgers colleagues and state and federal agencies. Examples of ONJSC outreach activities include participation in the Liberty Science Center teacher training program, the creation of online weather training materials for NJ public safety officials, and a wealth of interviews and presentations.

The ONJSC is partnering with the NJ Institute of Technology, through support from the NJ Department of Transportation to develop a roadway decision support system. This has included developing and maintaining a proto-type transportation weather portal.

Approximately 150 media interviews were given in the past 12 months. This is indicative of a rather tranquil year, devoid of a lengthy drought, much tropical activity or a major snow event. We are also quite certain that the number of interviews has fallen in the past year or two due to financial problems in the newspaper industry. So too are we aware of the media going directly to monthly narratives and data posted on the ONJSC website, rather than always calling or emailing us.

The ONJSC is grateful for the AASC SCEP grant that permits expansion of our monthly reports of NJ weather and climate highlights, including societal impacts. Reports are shared with the Northeast Regional Climate Center, posted on the AASC national website and on the ONJSC website, and published in the "Weather Shelter" newsletter of the North Jersey Weather Observers.

**ARSCO Qualifications**: The ONJSC is an American Association of State Climatologists (AASC) Recognized State Climate Office (ARSCO). As such, the office fulfills a number of qualifications outlined below.

**Communication capabilities**

- Ingest, process, archive and disseminate historic and real time climate data.
- Maintain numerous web sites related to the ONJSC mission <http://climate.rutgers.edu/stateclim>.

**Information Services**

- More than 500 specific requests for data and products each year.
- More than 500 unique visits to ONJSC web sites each day.
- Weekly and monthly climate summaries in map and tubular form.

**Research**

- Collaborate with Rutgers colleagues, as well as state and federal agencies on projects associated with issues such as forest fire management, pest management, agriculture, transportation, water resources, public safety, homeland security.
- Student research on topics such as urban heat islands, state snow cover variability, ocean influences on state weather and climate.

**Outreach**

- Up to several hundred media interviews each year.
- Presentations to schools, civic organizations, Liberty Science Center, etc.
- Conference presentations to the NJ Clean Water Council, the 4-H Climate Change Workshop, the NJ Homeland Security Research Symposium, the NJ Agribusiness Association, the NJ Weather and Environmental Hazards Symposium, the NJ After School Conference, and many others.
- The NJ State Climatologist is a member of the NOAA Climate Working Group, the NWS StormReady Community Program advisory board, the NOAA Integrated Surface Observing System ad hoc advisory committee, and the Liberty Science Center Education and Teaching Advisory Committee.

**Monitoring and impact assessment**

- Operation of the NJWxNet. <http://climate.rutgers.edu/njwxnet>
- State operation of NJ CoCoRaHS
- Web site updates for significant winter events.
- The NJ State Climatologist is a member of the NJ Drought advisory committee.
- Statewide climate variability and change is being assessed through the NJ Climate Report Card project.

http://climate.rutgers.edu/stateclim_v1/climreportcard/climate_report_card.html

# New Mexico Climate Center

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***Ted Sammis, State Climatologist***
Stanley Engle, Programmer/Analyst

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**General Information**

The New Mexico Climate Center (NMCC) resides within the Department of Plant and Environmental Sciences of the Agricultural Experiment Station at New Mexico State University (NMSU) in Las Cruces, New Mexico. The climate center is comprised of two faculty positions, a full-time staff position, and an undergraduate student assistant. The assistant state climatology position is currently open. By law, the duties of the NMCC are to (1) assess the effect of climate on the natural environment, agricultural production, land and natural resources and human health, (2) coordinate climate impact studies and programs, (3) consult and coordinate with the federal and state agencies government in climate related activities, and (4) disseminate climate data, information, advice and assessments to state and local agencies and the general public.

**Information Services**

The NMCC collects, archives, and disseminates climate data from official U.S. government and private observing stations throughout New Mexico. Additionally, the NMCC maintains a network of 16 automated weather stations throughout the state that are used primarily for agricultural purposes. In all, daily data from approximately 136 sites is collected, processed, and distributed via the NMCC website (http://weather.nmsu.edu/). In 2008, the NMCC website had again an estimated one million page hits for climate information and data. Requests were also answered by phone and email. In addition, the New Mexico Climate Center provides a variety of web-based tools for decision support in the areas of agriculture, hydrology, construction, health and economic development. . Drought information is posted by not only the New Mexico climate center which look a climate-based drought but by the New Mexico drought task force which posts information on all aspects of drought. CoCoRaHS expansion was funded by the Rio Grande project and the state coordinator is continuing to interact with new people that move to New Mexico to get them to participate in the program.

**Research**

Research activities in 2008 consisted primarily of applied research in which climatic information was used for studies involving crop improvement and irrigation/water management. NMCC staff members worked collaboratively with the NMSU Water Task Force, other university researchers, and local stakeholders on the Rio Grande Basin

Initiative, a joint Texas A & M University and NMSU effort aimed at improving water conservation through research and education of irrigation efficiency. A new project on irrigation management of Pecans was funded and the state climatology is not only supplying data for calculating reference evapotranspiration, but is work with the research to automate the calculation of Et by remote sensing. The state climatology program has new server that have the entire modes satellite data down load with new data downloaded automatically for automatic processing.

The Jose Fernandez Chair in Field Crop Production awarded to Dr. Sammis continued to provide undergraduate students with real world experience in agricultural meteorology with the student gaining information on climate data acquisition and management In addition research results were published on water use studies on Phreatophyte Control in Arid Environments (Wang and Sammis 2008) and Eddycovariance measurements of crop water uses: the energy closure problem and potential solutions ( Wang, et al 2008). Studies on measuring and simulating local dust dispersion from field agriculture operations using meteorological and LIDAR instrumentation were also published (Wang et al 2008).

**Outreach**

A meter burst communication system and climate state was install at a remote site to transmit climate data for calculation of Et on a watershed manipulate to increase water yield by the New Mexico Energy and Minerals Department. Three climate center new letters were published in 2008 with stories relating to climate in New Mexico.

**Goals for 2008**

Plans for 2009 include the continued development of our web resources including implementing a mapping protocol for displaying the entire climate data that is collect by the center. The NMCC will continue to work with the Climate Assessment of the Southwest (CLIMAS) program at the University of Arizona to continue developing and evaluating web resources, to maintain and build stakeholder relationships, and to improve drought monitoring and impact reporting capabilities. Documentation on how the data acquisition system work and the data processed has been implemented. Search for a new state climatologist is underway and the new state climatologist should start duties by July 2009.

**References**

Wang, J. and T.W. Sammis. 2008. Trend of Phreatophyte Control in Arid Environments and the Development of Control Monitoring and Evaluating. Arid Environment. Nova Science Publishers, Inc. 400 Oser Avenue, Suite 1600. Hauppauge, NY 11788. In press.

Juming Wang, Ted W. Sammis, and D. R. Miller 2008. Eddy covariance measurements of crop water uses: the energy closure problem and potential solutions. In. Agricultural Water Management Research Trends Nova Science Publishers In,c , NY. Pages 1-7

Wang, Junming, April L. Hiscox, David. R. Miller, and Ted W. Sammis. 2008. A Dynamic Lagrangian, Field-Scale Model of Dust Dispersion from Agriculture Tilling Operations. ASABE Transaction. Transactions of the ASABE 51(5):1763-1774

# State Climate Office of North Carolina

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John Mc Guire, Environmental Meteorologist
Bic Fort, Administrative Assistant

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**The State Climate Office of North Carolina** is a public service center for climate-environment interactions at NC State University. It serves the State of North Carolina as the American Association of State Climatologists Recognized State Climate Office (ARSCO) for North Carolina. Its public service mission includes extension, research, and educational components.

**Extension** efforts were focused on delivery of services through direct interaction and communication with clients, partnerships with state agencies, and collaboration with extension specialists and scientists at NC State University. Significant extension activities in 2008-2009 included the development of several new climate information tools, deployment of five new ECONet monitoring stations, initiation of new projects in collaboration with agricultural scientists, active monitoring and response to drought conditions in NC, development of climate database and information tools for the NOAA Southeastern Regional Climate Center, and membership in the Southeast Climate Consortium.

**Research** efforts in the past year focused on study of North Carolina's climate and its interaction with the environment, and investigations into the effects of climatic variations on agriculture and natural resources to assist in resource management. Highlights of our applied research efforts include evaluation of new models and precipitation estimation tools, winter and tropical storm climatologies, a new climatology for recreational activities in NC, and advancements in short-term and seasonal agricultural forecasts.

**Educational outreach** activities in the State Climate Office are designed so that climate scientists interact with K-12, community college teachers and students, and with other community organizations on different aspects of NC climate and environment. There continues to be overwhelming demand from the public for education on climate variability and climate change, as well as severe events. Activities in the past year include

dozens of invited presentations, development of severe weather training programs for Emergency Managers, participation in the FIRST Lego League Challenge and NC Science Olympiad, and a start of new climate education tools in partnership with the NCSU Science House.

**Highlights of Climate Services**

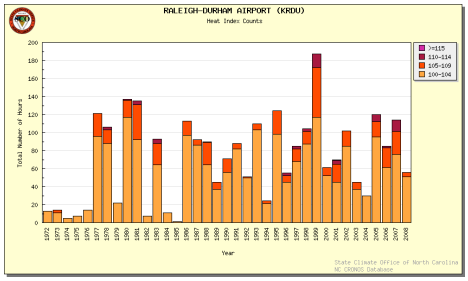
*Requests for Services*: 2% increase in time spent directly responding to requests for services from clients. Clients request services via email, phone, and through the Climate Office website.

*Monthly climate summaries*: Climate summary reports are prepared each month to highlight climate patterns and impact to agriculture and water resources in NC. These are distributed via a monthly online newsletter, reports to NOAA through the Southeast Regional Climate Center (SERCC), and reports to the American Association of State Climatologists (AASC). The SCO uses the newsletters to also inform users about new products and services. The AASC is providing $2500 to support these services.

*National Catalog of Climate Services*: SCO is the lead state working with the American Association of State Climatologists to develop a catalog of climate products and services provided by the state climatologists and NOAA regional climate centers. SCO is collecting data from AASC members to showcase the economic benefit of these local products and services and contribute to the NOAA Economics website. The Catalog will illustrate the value of state and regional expertise in the context of a National Climate Service and other NOAA initiatives. AASC is providing $5000 to support this effort.

*NCDA Monitoring*: NC Department of Agriculture now receives a feed of climate data from the SCO to develop their weekly weather and crop status reports.

*Holiday Climatology*: New tool to provide public and media with local climatologies for most holidays, including those that do not occur on the same calendar date each year (e.g. Thanksgiving, Easter, Labor Day). http://www.nc-climate.ncsu.edu/holiday_climatology.php




*Heat Index Climatology*: New page that provides a historical climatology of heat events as measured by heat index thresholds.

*Web Usage*: 19% increase in website activity as measured by the number of unique visitors. The SCO website averages nearly 14,000 unique visitors every month. Other measure of website activity such as bandwidth and hit counts are available but may be biased by the increase in the number of pages and content added to the site over the past year.

A sample of what some clients have said during the past year:

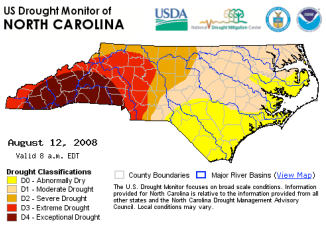
> *"Excellent service....very responsive and exactly the information I needed to do my job." – Landon D.*
>
> *"Thanks for your prompt response. The data you have provided will help me get part of my research done. I do appreciate your help so so much." – Naser A.*

*"Thanks very much for the rainfall info you sent to me. It has helped greatly in pinpointing the amounts of rain required to trigger the leak in the property." – Jason M.*

*"Thank you for the prompt response and information, it has been very helpful for my Viticulture report." – Renee S.*

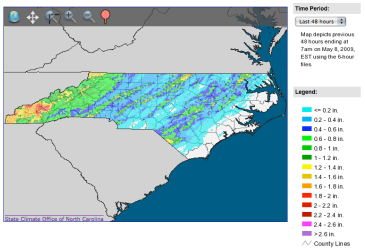
*"Thank you for making my job more productive and helping me provide accurate information to our clients." – Mary T.*

## Drought Monitoring and Response




SCO is a key member of the NC Drought Management Advisory Committee, participating in weekly drought monitoring conference calls and providing public presentations on drought in NC. In the past year, drought conditions were widespread and persistent. In response, SCO staff frequently provided public presentations and media interviews. Through CRONOS, SCO provides state agencies with climate and weather data for drought monitoring and management planning. Drought monitoring products have been developed and are used each week for discussions on depictions of drought severity as part of communicated recommendations to the US Drought Monitor.

## Water Data Support for DENR Division of Water Resources (DWR)




SCO contracted with DWR to provide ongoing climate and water data to support drought monitoring and water resource planning in North Carolina. As part of this effort, SCO developed new software to ingest, process, and integrate streamflow, groundwater, reservoir, and precipitation observations from several providers, including US Geological Survey, US Army Corps of Engineers, Duke Energy, National Weather Service, and DWR. As part of a separate contract with DWR, SCO developed a tool to provide multi-sensor precipitation estimates (MPE) via a simple URL and developed an interface that provides MPE-based comparisons with normal precipitation. *http://www.nc-climate.ncsu.edu/cronosh2o/*

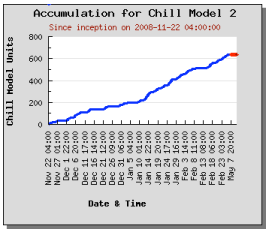
## Turfgrass Irrigation Management System (TIMS)

SCO collaborated with partners in NCSU Crop Science to develop irrigation guidance tools for urban lawn maintenance, called TIMS. Phase 3 of this project was funded by the Center for Turfgrass Environmental Research and Education through June 2009. Phase 3 will add CoCoRaHS data and NWS forecasts to the TIMS website tool. Also included in the phase 3 proposal is an evaluation of the next generation of precipitation estimates, called Q2. *http://www.turffiles.ncsu.edu/TIMS/*

### Peanut Disease Advisories

Working Dr. Barbara Shew (NCSU Plant Pathology), SCO provided daily guidance for fungicide spraying to peanut growers in NC from June-October 2008. These advisories take advantage of research into the relationships between climate and the development of two peanut fungal diseases.

### Berry Chill and Heat Models




Working with Dr. Gina Fernandez (NCSU Horticulture Science) and Dr. Bill Cline (NCSU Plant Pathology), SCO developed web-based climate monitoring tools to support blackberry and blueberry growers through heat and chill accumulation tools. SCO presented the blueberry tool at the annual Blueberry Open House.
*http://www.nc-climate.ncsu.edu/cronos/blackberry/*
*http://www.nc-climate.ncsu.edu/cronos/blueberry/chill_model*

### Southeast Climate Consortium

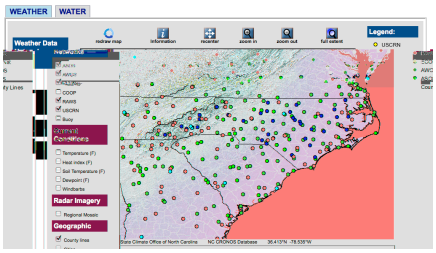
The Southeast Climate Consortium is a group of Universities in FL, AL, and GA working to develop climate risk research and decision support tools for agriculture in the southeastern US. NCSU was invited into this Consortium in 2008. This effort has research, education, and extension components. NC hosted two workshops for extension specialists and county extension agents to introduce them to AgroClimate.org and get their feedback. Workshops involved direct participation and presentations from collaborators in Georgia and Florida. Working with our SECC partners, tools for NC have been added to the SECC decision portal *http://agroclimate.org/*

### Climate Information Support for the NOAA Southeast Regional Climate Center

NCSU and UNC-Chapel Hill were awarded the NOAA Southeast Regional Climate Center (SERCC) in 2007. As part of that award, the SCO is responsible for supporting and maintaining the Applied Climate Information System (ACIS), which serves as the climate database for all six NOAA Regional Climate Centers. Additionally, SCO is responsible for developing and maintaining the SERCC web services and online climate tools.

Over the past year, SCO has provided operational support for ACIS and the SERCC website. Additionally, SCO has enhanced server reliability and developed a new Climate Perspectives tool that places recent climate observations in geographical and historical context. *http://www.sercc.com/perspectives/*

## CRONOS Database




CRONOS is the name given to the SCO's climate database, which includes data from surface observational networks, severe weather data, and every type of climate data that we can insert. The CRONOS database serves as the foundation for most SCO products and services.

*Usage*: Average of 4400 queries per month to CRONOS, the SCO online climate database.

*Soil Erosivity*: Collaboration with Dr. Manuel Reyes (NC A&T State University) to develop and launch database calculations of soil erosivity for monitoring stations that report data at 1-minute intervals.

*SCOUT Data availability tool*: A tool to visually explore database inventory. This tool will be helpful for both staff and the public, as they would be able to see if the data they want is available before submitting a data request.

## NC Environment and Climate Observing Network (ECONet )

The ECONet is a network of real-time research-grade monitoring stations that provide observational data on atmospheric and soil conditions.

*New Installations:* Five new stations were installed at Burnsville (Yancey County), Mount Mitchell (Yancey County), Taylorsville (Alexander County), Wallace (Duplin County), and Durham (Durham County).

Sensor Upgrades: Upgrades for the network are underway to provide new data loggers, solar radiation sensors, sonic wind sensors, and impact precipitation sensors. These upgrades also provide data recorded every minute.

# North Dakota State Climate Office

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***Adnan Akyüz, State Climatologist***

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**Mission Statement:** The mission of the North Dakota State Climate Office is to advance the use of climate information for the economic and environmental benefit of North Dakota and the public safety of its citizens, through climate monitoring, research, education, and extension and information services.

**ARSCO Qualifications:** NDSCO has been recognition by the AASC as the official state climate office for North Dakota since March 2007. NDSCO also enjoys the support from local National Weather Service Forecast office in Fargo-Grand Forks, High Plains Regional Climate Center and holds a Memorandum of Agreement between NCDC and the State Representative. In addition, the following describes the ways in which NDSCO addresses each of the ARSCO qualifications:

**State Climatologist Exchange Program Grants:** NDSCO has been granted a $2000 award for writing monthly state climate summaries. Starting from September 2008, NDSCO started sending the monthly state climate summaries by the 3rd day of each month to the High Plains Regional Climate Center. The summaries also published at the NDSCO web site: http://www.ndsu.edu/ndsu/ndsco/publication/index.html. Each time a new state climate summary was updated, a notice was published on the AASC web site as a news item: http://www.stateclimate.org/state.php?state_id=ND.

**Observation Capabilities:** The State Climate Office operates a state of the art Automated Environmental Weather Monitoring Network called The North Dakota Agricultural Weather Network (NDAWN) which consists of 70 stations distributed across North Dakota, the Red River Valley, and border regions of surrounding states.

Stations provide hourly averages or totals for all variables and hourly maximum wind speed plus daily summaries consisting of maximum and minimum air temperature, maximum wind speed, times of occurrence, and various totals or averages for all other variables in English or metric units. Measured and calculated variables and more complete descriptions of each may be found in the site description and archived data areas.

Data are retrieved via telephone modem shortly after midnight each day. A computer program identifies missing or erroneous values which are replaced by estimates calculated from data at surrounding stations. Following this initial quality control (QC) data are loaded into the NDAWN data base and made available to the general public via

the NDAWN web site free of charge. Every Monday thru Friday morning, except holidays, data from all stations are visually compared in order to identify suspicious or erroneous data that the computer program cannot detect. In addition, weekly and monthly average data are similarly compared to identify possible calibration or other problems.

**Communication Capabilities:** The North Dakota State Climate Office oversees the operation of the NDAWN Center. The access information to NDAWN Center and the services are listed below:

- North Dakota Agricultural Weather (NDAWN): http://ndawn.ndsu.nodak.edu/
- NDAWN Weather Data
    - Tables and Maps (Hourly, Daily, Weekly, Monthly, Annually, Normals, Departure from Normals) http://ndawn.ndsu.nodak.edu/hourly-table-form.html
- NDAWN Agricultural Applications
    - Barley, Canola, Corn, Potato, Sugar beet, Sunflower, Wheat, Small Grains, Crop Water Use, Insect Development, Degree day for the energy use. http://ndawn.ndsu.nodak.edu/applications.html
- Answers e-mails requesting climate information or asking climate related questions frequently.
- Regularly answers to telephone requests
- Frequent media contacts

**Publications:**

Akyuz, F. A., M. Ewens, B. Mullins, R. Carcoana, 2008: NWS Frost Depth Observation with Liquid-in Probes Performance: Two-year Review. Journal of Service Climatology. V2. No: 2 (1-10).

Akyuz, F. A., T. Scherer, D. Morlock, 2008: Automated Irrigation Scheduling Application of the North Dakota Agricultural Weather Network. International Conference on Soil Fertility, Land Management, and Agroclimatology. Preceedings, p 3. Kusadasi, Turkey. October 29-November 1, 2008.

Willson, G. D., F. A. Akyuz: 2007. Survival of the western prairie fringed orchid at Pipestone National Monument. The 21st North American Prairie Conference. August 4-8, 2008. Winona, MN.

Akyuz, F. A., B. Mullens, D. Morlock, 2008: Agricultural Application of the North Dakota Agricultural Weather Network. International Conference on Soil Fertility, Land Management, and Agroclimatology. Preceedings, p 104. Kusadasi, Turkey. October 29-November 1, 2008.

**Invited Presentations:**

1. Crop Insurance Conference: "Synopsis of 2007 Weather and 2008 Growing Season Climate Outlook". Jan 21, 2008. Fargo, ND.

2. ND Crop Improvement and Seed Association Meeting: "NDAWN Center and 2008 Growing Season Climate Outlook". Feb. 7, 2008. Minot, ND
3. Subsurface Drainage Workshop: "Weather or not to Drain-Climatological Aspect of Sub-Surface Drainage". Feb 14, 2008. NDSU
4. Northwest Farm Managers Association Meeting: "Synopsis of 2007 Weather and 2008 Growing Season Climate Outlook". Feb. 13, 2008. Fargo, ND.
5. Advanced Crop Advisors Workshop: "Long Range Forecast". Feb. 21, 2008. Fargo, ND.
6. "Climate Change Basics and Climate Forecast Tools". Plant Pathology invited seminar. NDSU. April 4, 2008.
7. "Climate Change". Invited Guest Lecture for Environmental Sociology 661. NDSU. April 9, 2008.
8. North Dakota Climate: NEON (National Ecological Observing Network) meeting. June 11, 2008. NSU, Fargo, ND.
9. North Dakota State Climate Office contribution in National Drought Monitoring: National Integrated Drought Information System (NIDIS) workshop. June17-19, 2008. Kansas City, MO.
10. Agricultural applications of NDAWN. North Central 1018 annual meeting. June 30-July 1, 2008. Geneva, NY.
11. North Dakota State Climate Office Activities in Climate Services: AASC Annual Meeting. July 7-July 10, 2008. Burlington, NY.
12. Global Climate Change and Its Local Implications in ND. Graduate Seminar series. Soil Science. September 3, 2008. NDSU.
13. Master Gardner Teach-in. Atmospheric Moisture and NDAWN Horticultural Applications. September 5, 2008. NDSU
14. Guest Lecture for Geography 262: Global Climate Change. September 8, 2008. NDSU.
15. SNR Student Gathering. NDAWN Center and North Dakota State Climate Office Roles in NDSU. NDSU
16. Global Climate Change: Myths and Facts. October 27, 2008.Istanbul Technical University. Istanbul, Turkey.
17. Agricultural Applications of the North Dakota Agricultural Weather Network, ND, USA. International Meeting on Soil Fertility, Land Management and Agroclimatology. October 29, 2008. Kusadasi, Turkey.
18. Irrigation Scheduling Applications of the North Dakota Agricultural Weather Network, ND, USA. International Meeting on Soil Fertility, Land Management and Agroclimatology. October 30, 2008. Kusadasi, Turkey.
19. Guest Lecturer: Climate vs. Weather. NRM 150. December 1, 2008. NDSU.

**List of radio and TV presentations and spots made:**

1. KXPO Radio Interview: Current Drought Conditions in ND. Feb. 11, 2008. Phone Interview
2. In-Forum with Pat Springer: "How will Climate Change affect 2008 Growing Season". Feb 19, 2008. In-person interview.
3. In-Forum with Pat Springer: "How will Climate Change affect 2008 Growing Season". Feb 20, 2008. In-person interview.

4. Bismarck Tribune with Tony Spilde: Drought Conditions in ND. Feb. 20, 2008. Phone interview.
5. KFYR Radio-Bismarck with Al Gustin, Farm Talk show host: Latest drought conditions in ND. Feb 22, 2008. Phone Interview
6. KFGO Radio with Don Haney. Drought conditions and Spring Forecast. March 5, 2008.
7. KFGO Radio with Don Haney. Revisit with more questions on Drought. March 6, 2008.
8. KFGO Radio Live Show with Joel Heitcamp. Drought, State Forecast and whatever the questions come from listeners. March 6, 2008.
9. "What Farmers Need to Know about the Drought". In-Forum with John Knutson. March 17, 2008.
10. "Drought Conditions and Snow in Dakotas and MT". Farm and Ranch Magazine with Mikkel Pates. March 18, 2008.
11. "Climate Change in ND". In-Forum with Pat Springer. April 3, 2008.
12. "Drought Conditions in ND". KFGO Radio with Don Haney. April 18, 2008.
13. "Red Flag Warning and Western ND Drought". Live Talk-Show with Joel Heitcamp. April 18, 2008.
14. "Current Drought Update". Associate Press (with James McPherson). April 22, 2008.
15. "Current Drought Conditions in ND". McKenzie County Farmer Magazine (with Tina Foreman). April 28, 2008.
16. "ND Drought Monitor". Farm and Ranch Magazine (with Sue Roesler). April 30, 2008
17. "Summer and Fall Weather Forecast for ND". AM890 KQLX Radio Talk show with Mike Kjar. Fargo, ND. May 13, 2008.
18. Why it has been so stormy in ND? The Forum. June 5, 2008.
19. Corn Growing Season of the 2008 Growing Season: Red River Farm Network Radio. June 6, 2008.
20. Current State Drought Status and the Drought Outlook: Jamestown Sun. June 10, 2008.
21. The Latest Rainfall Totals Across the State: Bismarck Tribune. June 12, 2008.
22. Is the drought over? Farm Magazine. June 12, 2008.
23. What's causing the volatile weather across the country? The Forum. June 12, 2008.
24. Storm Reports. The Forum. June 13, 2008.
25. Global Climate Change and Local impacts. Grand Forks Herald. June 25, 2008.
26. US Drought Monitor and ND Drought Conditions: The Dickinson Press. August 1, 2008.
27. Global Climate Change Facts. Prairie Public Radio. August 11, 2008.
28. July Weather, Far from Normal. Prairie Public. Hear it Now Program with Merrill Piepkorn. August 11, 2008.
29. Average Hard Freeze Climatology in ND. Valley News TV (NBC/CBS). September 9, 2008. Fargo, ND.
30. Climate Change: Natural Causes. Prairie Public Radio. September 16, 2008. Fargo, ND.
31. Climate Change: Man-made Causes. Prairie Public Radio. September 17, 2008. Fargo, ND.

32. Frost Date climatology in ND: Jamestown Sun. September 18, 2008. Jamestown, ND.
33. Fargo Frost Dates: The Forum. September 18, 2008. Fargo, ND.
34. North Dakota Rainfall Update. The Forum. October 9, 2008. Fargo, ND.
35. Climate Change: The Forum. October 16, 2008. Fargo, ND.
36. Community Collaborative Rain Hail and Snow Network in ND: KFYR and KBMR Radios. October 21, 2008. Bismarck, ND.
37. Community Collaborative Rain Hail and Snow Network in ND: Minot Daily News. October 22, 2008. Minot, ND.
38. Community Collaborative Rain Hail and Snow Network in ND: Prairie Public Radio on Hear it Now Program with Merrill Piepkorn. November 18, 2008. Fargo, ND.
39. Winter Weather Forecast. KXPO Radio. November 25, 2008. Grafton, ND.
40. Semi-Arid Climates and ND: Are we more prone to Extreme Droughts? Valley City Times. December 12, 2008. Valley City, ND.
41. Winter Weather Forecast. The Forum. December 15, 2008. Fargo, ND.
42. NDAWN Network and CoCoRaHS Role in ND. Steele Ozone. December 17, 2008. Steele, ND.

# Oklahoma Climatological Survey

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***Ken Crawford, Director and State Climatologist***
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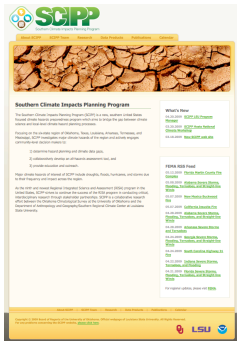
The Oklahoma Climatological Survey was very active and visible locally, nationally and internationally in 2008. OCS played important roles in assessing and publicizing extraordinary drought conditions in the Oklahoma Panhandle; transitioning a new ice accumulation product to statewide production; launching a new multi-million dollar effort at reducing weather-related hazard losses; expanding engagement with teachers, students, and public safety officials; continuing extensive contacts with the media; and participating in national dialogues on weather and climate.

A severe drought in the Oklahoma Panhandle had gone virtually unnoticed in state media until OCS became involved. Through travels to the affected areas and dialogues in national forums such as the Drought Monitor discussion group, international attention was drawn to their plight. Television reports were shown on Japanese TV, Fox News and local channels, while newspaper reports went national, including reports in the USA Today and the New York Times. The attention also drew senior state leadership, including Secretary of Agriculture Terry Peach and Governor Brad Henry, to visit the Panhandle.

Reeling from the aftermath of yet another ice storm in December 2007, OCS was engaged in several efforts to mitigate the effects of future winter weather events. OCS advised the Oklahoma Corporation Commission on ice storm frequencies and climate change, which was included in a study of the costs and benefits of burying power lines. Operationally, OCS collaborated with the Oklahoma Association of Electric Cooperatives (OAEC) and local National Weather Service (NWS) forecast offices to implement a statewide version of the Sperry-Piltz Ice Accumulation Utility Damage Index, developed by OAEC and the NWS Forecast Office in Tulsa. The new winter weather product won the American Public Works Association's Technical Innovation Award, one of few such awards in APWA's history.

In November, OCS unveiled a new Oklahoma City Micronet (http://okc.mesonet.org), consisting of 36 additional miniature weather stations mounted on traffic signals across Oklahoma City, supplemented by three additional full Mesonet stations. The multipurpose network provides critical weather information for the daily operations of Oklahoma City, supports new scientific research focused on urban meteorology, and serves as a resource for the citizens of central Oklahoma. It was developed during a 5-year collaboration between OCS, the Oklahoma Mesonet, the University of Oklahoma, and the City of Oklahoma City.




The RISA-funded Southern Climate Impacts Planning Program (SCIPP; http://www.southernclimate.org) began in August 2008. The program is designed to engage communities in the six-state region of Oklahoma, Texas, Louisiana, Arkansas, Mississippi and Tennessee to improve their planning for a range of climate hazards. The program is collaboration between the University of Oklahoma and Louisiana State University (Mark Shafer and Barry Keim, Principal Investigators) in partnership with the Southern Regional Climate Center (SRCC). The design allows research and products developed as part of the RISA to be transitioned into operations of the SRCC.

OCS hosted six 1-day workshops on "Making Sense of Oklahoma's Climate". These workshops (funded by NOAA's Sector Applications and Research Program in 2007) were designed to provide an understanding of the basics of climate, climate variability and change, special topics such as drought, and how to find and interpret information on the web. The workshops drew 60 participants and included a formal evaluation process to assess the effectiveness of the instruction.

Internationally, OCS scientists led a feasibility study for modernizing the meteorological and hydrological services of the Republic of Croatia, and OCS engineers continued to help the Province of Quebec expand services from their provincial mesonet. OCS was represented at a drought workshop in Canberra, Australia, which was a joint effort between NIDIS and Australia's Bureau of Rural Sciences.

OCS served the climate community through participation in many committees, including several AASC action teams: the American Meteorological Society (Board on Societal Impacts, Symposium on Policy and Socio-Economic Research, Committee on Measurements, Intelligent Transportation Systems), the National Integrated Drought Information System (NIDIS), a NOAA "tiger team" on national climate services, the

National Ecological Observing Network, and a UCAR Atmospheric Sciences Literacy Committee.

***Information Services***

OCS served 7.65 Terabytes of information from 862 million hits to our web pages. We also fulfilled 265 detailed information requests from phone or e-mail – the most logged since 2003. OCS was referenced in 89 articles in the state's major newspapers and issued another 83 news releases.

OCS introduced a new radar display application, RadarFirst. The application is designed as a lightweight radar viewer for OK-First participants and their colleagues. RadarFirst is a stand-alone desktop application that views live radar images from any radar site in the U.S. with easy zoom and scrolling capabilities.

WeatherScope desktop applications software and the associated browser plug-in received a major new release in 2008 plus three updates. The new releases improve system performance, provide for the display of new products and allowed OCS to update and consolidate some key web products.

***Outreach***

OCS hosted or provided content to 23 K-12 programs, providing education to 1,817 students and 66 teachers, and conducted 14 OK-First workshops, educating 179 public safety officials. ScienceFest at the Oklahoma City Zoo drew 5,135 fourth- and fifth-grade students, and 2,500 members of the public attended WeatherFest at the National Weather Center. OCS partnered with the state Insurance Department to host the 4$^{th}$ annual Climate and Loss Mitigation Conference, which drew nearly 200 insurance agents and adjusters.

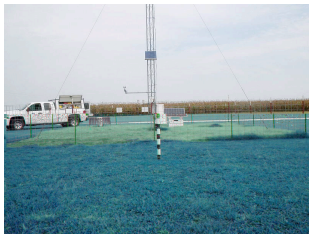
OCS staff provided more than 30 presentations to the public. Topics included climate change, the dust bowl, top 10 weather events that influenced Oklahoma's history, and public safety. Numerous television interviews were provided, including national exposure in *The Weather Channel*'s series "When Weather Changed History: The Dust Bowl." Presentations at many national professional meetings were also given.

***Research***

Two publications were accepted in *Physical Geography* as part of a special issue on climate literacy (organized by Lesley-Ann Dupigny-Giroux, Vermont State Climatologist). An article on Tropical Storm Erin was accepted for publication in the *Bulletin of the American Meteorological Society*. During 2008, 33 publications appeared in print that utilized Mesonet data.

OCS sponsored two students in the Research Experience for Undergraduates program. Their studies looked at freezing rain patterns in the south central United States and the frequency of weather conditions that met criteria for prescribed burns. Both projects were presented at the annual AMS meeting.

***Monitoring and Assessments***



During 2008, the Mesonet completed 2,351 laboratory calibrations of sensors. To maintain our remote sites and sensors in the field, we conducted 817 site visits to 120 Oklahoma Mesonet stations, 78 visits to 35 Little Washita and Fort Cobb Micronet stations, and 56 visits to 36 Oklahoma City Micronet stations. We found and repaired 294 sensor or communications problems in these four networks. Technicians took more than 5,000 photos to document the characteristics of vegetation before and after maintenance was performed at each Mesonet site.

A new Mesonet station was installed at the Lake Carl Blackwell Irrigated Research Farm. The new station, designated CARL, became our 120th Mesonet station. To improve siting conditions, we also moved our Webbers Falls Mesonet station to a new location approximately 1 mile NNE of the old station.

A Capital Bond allowed us to make several major upgrades across the Mesonet in 2008. New auxiliary power systems were installed at all sites, increasing the available solar-generated power at each station by a factor of six. The added power allowed us to install fan-aspirated temperature shelters at each station to improve the quality of our air temperature measurements. New air temperature sensors were also deployed at all stations and all wind direction sensors were refurbished.

# Oregon Climate Service

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Cadee Hale, Faculty Research Assistant

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The Oregon Climate Service (OCS), located on the Oregon State University (OSU) campus in Corvallis, Oregon, is the state repository for weather and climate information. OCS is affiliated with OSU's College of Oceanic and Atmospheric Sciences (COAS).

**Personnel.** During 2008, former State Climatologist George Taylor retired and for the remainder of the calendar year, OCS was staffed by Cadee Hale, website/publications assistant.

On January 4, 2009, Oregon State University announced the selection of Philip Mote to direct the new Oregon Climate Change Research Institute, of which Oregon Climate Services is now a part.

Dr. Mote began serving OSU in March 2009.

**Routine activities.** About 120 observers, all but 10 of whom are NWS cooperative observers, send their climate information directly to OCS. These observations are tabulated in monthly reports, which are in turn sent by snail-mail to a list of recipients. These observations are also archived and made available via the OCS web site.

In addition, OCS responds to about 12-15 inquiries per week concerning the climate of Oregon.

# Pennsylvania State Climate Office

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***Paul Knight, State Climatologist***

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The Pennsylvania State Climate Office database continues to incorporate observations from more than a half dozen separate networks within the Commonwealth. Approximately 250 hourly reporting stations (primarily from the Citizen Weather Observation Program) are now being ingested into the office's relational database. When combined with hourly reports from the FAA and Pennsylvania's DEP, there are nearly 400 observations of temperature, dew-point and wind each hour. The State Climate Office has also implemented a new interactive data archive and a new web interface.

The vision for a Pennsylvania Mesonet remains a priority for the State Climate Office. Opportunities that arose late in 2007 evaporated in 2008 as available funds shrunk during the latter half of the year. The CoCoRaHS network continues to expand across Pennsylvania under the auspices of the state climate office and with the name FROST. By the end of the year, over 180 volunteer observers had enrolled and typically, one hundred faithfully report each day.

***Information Technology Capabilities:***

• About fifty web data requests were logged each month (besides those by phone and US mail)
• Primary users are commercial, educational and government organizations
• The entire North American Regional Reanalysis data set (approximately 4.5 terabytes) has been augmented routinely so that the complete data set is through 12/31/08.

***Communication Capabilities:***

- The web server was separated from the database host to increase the capacity of numerous web inquiries simultaneously. Development of new products has mainly focused on grant-related items, such as those connected with a data inventory for the National Park Service and Wheat Scab model predictions.

***Information Services:***

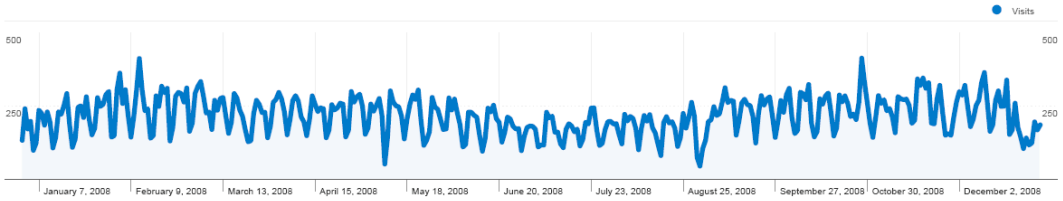
- The development of an Interactive Data Archive continues. This archive allows users to easily obtain data as well as metadata from any of our primary data sources. A collaborative effort with the Northeast Regional Climate Center continues to bring evapo-transpiration data to users and is part of a water budget project.

***User Base Growth:***

- The number of sites has continued to increase from year to year. We anticipate this trend to continue as we work with more state agencies and provide more data products. The following charts show the 2008 user volume and city probes:

climate.met.psu.edu
**Network Location**

Jan 1, 2008 - Dec 31, 2008
Comparing to: Site




**79,649 visits came from 10,520 network locations**

Site Usage

| Visits | Pages/Visit | Avg. Time on Site | % New Visits | Bounce Rate |
|---|---|---|---|---|
| 79,649<br>% of Site Total: 100.00% | 2.29<br>Site Avg: 2.29 (0.00%) | 00:01:21<br>Site Avg: 00:01:21 (0.00%) | 81.55%<br>Site Avg: 81.52% (0.04%) | 62.35%<br>Site Avg: 62.35% (0.00%) |

| Network Location | Visits | Pages/Visit | Avg. Time on Site | % New Visits | Bounce Rate |
|---|---|---|---|---|---|
| comcast cable communications inc. | 6,413 | 2.17 | 00:01:04 | 71.78% | 65.54% |
| verizon internet services inc. | 5,472 | 2.81 | 00:01:36 | 81.62% | 59.41% |
| the pennsylvania state university | 5,328 | 3.26 | 00:03:11 | 38.87% | 61.90% |
| road runner holdco llc | 2,989 | 1.78 | 00:00:48 | 89.76% | 59.42% |

**This state sent 28,834 visits via 944 cities**

Site Usage

| Visits | Pages/Visit | Avg. Time on Site | % New Visits | Bounce Rate |
|---|---|---|---|---|
| 28,834<br>% of Site Total: 36.20% | 3.17<br>Site Avg: 2.29 (38.32%) | 00:02:19<br>Site Avg: 00:01:21 (70.80%) | 61.99%<br>Site Avg: 81.52% (-23.96%) | 61.78%<br>Site Avg: 62.35% (-0.92%) |

| City | Visits | Pages/Visit | Avg. Time on Site | % New Visits | Bounce Rate |
|---|---|---|---|---|---|
| State College | 2,908 | 3.11 | 00:02:30 | 47.35% | 63.20% |
| State College | 2,836 | 2.86 | 00:02:57 | 41.54% | 66.11% |
| Pittsburgh | 1,668 | 2.91 | 00:01:56 | 69.18% | 58.93% |
| University Park | 1,318 | 3.24 | 00:02:15 | 44.16% | 67.83% |
| University Park | 881 | 2.39 | 00:02:45 | 39.16% | 60.61% |
| Philadelphia | 568 | 3.11 | 00:02:18 | 77.11% | 58.98% |
| Philadelphia | 553 | 2.78 | 00:01:25 | 70.71% | 62.21% |
| Altoona | 511 | 2.73 | 00:02:12 | 72.80% | 64.19% |
| Harrisburg | 405 | 3.59 | 00:02:09 | 58.02% | 51.85% |

***Data Quality Control/Assurance:***

- The PA Climate office takes advantage of the sophisticated DQ control routines provided by MADIS on CWOP. Other data is manually QA by student support. A trend comparison of surface temperature and dew point (comparing FAA sites and NARR grid point data) has shown the quality of both data sets for long-term trends.

***Climate Office Projects:***

- In collaboration with the National Park Service, a climate data inventory project is now in its fourth year. Annual and seasonal summaries have been designed which will have applicability to Pennsylvania climate stations that are not part of this project. The interface for the National Park Service data inventory and retrieval has been upgraded to the current state climate interface.

***Special Projects:***

- Collaboration with experts in the College of Agricultural Sciences continues with the development of environmental data monitoring systems for a Wheat Scab project. A project with Pennsylvania DOT and the top forecasters from the forecasting practicum continued in providing an early alert for hazardous winter weather for surface transportation.

***SCEP:***

- The Pennsylvania State Climate Office contributed monthly state weather summaries including its societal impacts to the Northeast Regional Climate Center starting in October 2008 and continuing into September, 2009 as per Task 2.1 of the 2008-2009 NCDC-SCEP agreement.

# South Carolina Office of Climatology

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Wes Tyler, Assistant State Climatologist for Service
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Evelyn Johnson, Administrative Assistant (Part-time)
Ziwase Banda, Climate Intern (Part-time)
Kathryn Perkins, Volunteer Internship Program (Part-time)

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Created in 1986, the Office of State Climatology (SCO), as mandated by the South Carolina General Assembly (Section 49-25-10 et seq., Code of Laws of South Carolina, 1976), represents the State in all climate and meteorology matters. The SCO resides within the South Carolina Department of Natural Resources (SCDNR). The SCO serves as liaison between the National Weather Service and State agencies, such as the Governor's Office, SCDNR, SC Department of Public Safety, and the SC Emergency Management Division. The SCO assists other State and Federal agencies in data acquisition and interpretation before, during, and after periods of severe weather.

The SCO provides a unique service to the state by archiving and distributing climate and meteorological data, reports, and research that dates back to the early 1700s. The SCO also serves as an expert witness in civil and criminal litigation involving weather and climate, averaging 12-24 cases per year. The SCO administers the *South Carolina Drought Response Act*, which requires the office to formulate, coordinate, and execute a comprehensive drought response program for the State of South Carolina.

**ARSCO Qualifications:** The following describes the ways in which the SCO addressed each of the ARSCO qualifications during 2008:

**Communication Capabilities:**

- The office expanded the SCO website (http://www.dnr.sc.gov/climate/sco).
- The office operates an email notification system focused on severe weather notification and tropical advisories. The address list increased to 458 subscribers in 2008. The subscribers are from Federal, State and county agencies, municipalities, and school districts.
- The office maintained the on-line Regional Drought Monitor Application. The application was developed through a partnership with Carolinas Integrated Sciences and Assessments (CISA) and Duke Energy (https://www.dnr.sc.gov/drought/).

**Information Services:**

- During 2008, the SCO averaged 65 monthly phone and email requests for climate data and 30,000 information retrievals from the SCO web site. During significant

weather events these numbers double with 60,000 web information retrievals and 130 email and monthly phone requests.

- Staff assisted SC Department of Natural Resources Law Enforcement and SC Highway Patrol with 55 accident investigations.
- Media inquiries averaged 20 per month.
- The office issued weekly and annual summaries of the State's weather and climate in the *South Carolina Weekly Weather and Climate Report* and the *South Carolina Year in Review,* both of which are available on the SCO website. The SCO also provided a weekly summary of South Carolina Weather and Climate Data to the National Agricultural Statistics Service (NASS) that is published weekly in the South Carolina *Crop Weather Summary*.
- The office issued a weekly weather forecast summary for the SC Soybean Rust Newsletter. The newsletter is distributed electronically by Clemson to over 300 subscribers including county agents, soybean growers, seed/chemical & fertilizer industry personnel, and consultants.
- The Drought Response Program requires regular correspondence with 48 Drought Response Committee Members, four major power companies, and over 2,000 water utilities. Correspondence includes drought projections, official declarations, and suggested response. During 2008, the SC Drought Response Committee was convened six times to review the drought conditions and issue declarations. Bi-weekly drought updates were distributed by email to committee members and list serve subscribers. Staff utilized an online application to monitor water conservation actions implemented by SC water systems http://www.dnr.sc.gov/climate/sco/Drought/drought_water_restriction.php.
- The office worked with hydroelectric dam operators and other resource agencies to enhance drought mitigation efforts as a part of the implementation of their Federal Energy Regulatory Commission's (FERC) hydro-power dam license. Staff served as a member on the Catawba-Wateree and Yadkin Pee Dee Drought Management Advisory Committees participating in monthly meetings or conference calls. Staff also served on a special subcommittee focused on revising the Catawba-Wateree Low Inflow Protocol.

**Research:**

- During 2008, the State Climatologist completed her Ph.D. dissertation on Improving Drought Detection in the Carolinas: Evaluation of Local, State and Federal Drought Indicators.
- The office is a cooperating institution in the Carolinas Integrated Sciences and Assessments (CISA) project focused on integrating climate science and water management in North and South Carolina. Presentations, Publication and grant submission related to the CISA program during 2008 include:
    - Carbone, G.J., A. DeGaetano, K. Dow, H. Mizzell, J. Rhee. "Implementation of a drought mapping tool in the eastern United States, NOAA Transition of Research Applications to Climate Services (TRACS). May 2008- 30 April 2010.

- Carbone, G., K. Dow, H. Mizzell, J. Rhee 2008, Evolution of a drought monitoring tool, *Eos Trans*. AGU, 89(53), Fall Meet. Suppl., Abstract A13D-0276.

**Outreach:**

· During 2008, the SCO provided approximately 50 annual presentations to various governmental, private sector, and civic organizations.

· Staff attended state and national conferences such as the American Association of State Climatologists Annual Meeting, National Integrated Drought Information System Workshop (Developing a drought early warning system in the Alabama/Tallapoosa/Coosa Basins and the Apalachichola/Chattahoochee/Flint Basins), and the Annual Meeting of the Association of American Geographers.

· The office hosted a visit from Dr. Richard Nabb, National Hurricane Center. Staff also worked with the SC Chapter of the Sierra Club to conduct a luncheon for Dr. James Hansen, Director, NASA Goddard Institute for Space Studies.

· SCO article on "Hail: Icy Orbs of Doom" was published in the *SC Wildlife Magazine*.

· The State Climatologist provided a monthly weather and climate segment on the South Carolina Educational Television show "Making It Grow."

· The Assistant State Climatologist serves as commissioned law enforcement officer to assist SCDNR during weather emergencies.

· The State Climatologist completed her two-year term as Secretary-Treasurer for the AASC. · Training and education completed by staff during 2008 included Department of Homeland Security National Incident Management System Class 300 and 400 and 20 hours of deputy law enforcement training.

**Monitoring and Impact Assessment:**

· On March 1, South Carolina joined 28 other states currently participating in the Community Collaborative Rain, Hail and Snow Network (CoCoRaHS). Currently 408 observers have joined with 120 taking regular observations.

· The office installed a weather station at the University of South Carolina Belser Arboretum located within the city of Columbia.

· Staff worked closely with the National Weather Service to monitor the COOP and ASOS data networks to maintain the quality of SC climate observations.

· As a member of the State's Emergency Operations Team, SCO staff participated in quarterly hurricane task force meetings, annual exercise, and training. SCO staff were activated to the SC Emergency Operations Center during the January 17 Winter Weather Event and the passage of Hurricane Hannah. Staff issued 16 weather outlooks, 14 fire weather outlooks, 12 severe thunderstorm/tornado advisories, 9 tropical cyclone advisories, 29 weekly tropical updates, and four cold weather advisories. The fire weather outlooks were customized for the SC Forestry Commission.

# South Dakota Office of Climate and Weather

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***Dennis Todey, State/Extension Climatologist***
Chirag Shukla, Climate Data Specialist

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The South Dakota Office of Climate and Weather is part of the Cooperative Extension Service at South Dakota State University. Consequently the mission of the state climate office of providing climate data and information and trends to the people of the state overlaps the mission of the extension service in providing science-based information to the people of the state. As part of the SD CES, it has connections in every county of the state to communicate with people of the state providing for a direct set of users as well as transfer of information back to the office.

The South Dakota Office of Weather and Climate (SDOCW) was granted ARSCO status in 2005. SDOCW applied and received State Climatologist Exchange Program (SCEP) grant of creating and distributing monthly climate impact report to the High Plains Regional Climate Center (HPRCC). The SDOCW published its first report starting November 2008 and will continue through October 2009.

**New weather stations and upgrades**

Two new weather stations were installed in 2008 –

- **Hamill:** Hamill weather station was installed in April of 2008. The weather station is sponsored by a Tripp County Conservation Board. It is located 23 miles NE of the Winner, SD Airport. The State Climate Office installed routing equipment and requested static IP address on a home DSL line to allow transfer of data through IP. The station senses weather parameters every 3 seconds, summarizes and sends data every 5 minutes to the State Climate Office. The data is archived and distributed to NWS through Unidata-LDM to assist in high resolution forecasting.
- **Sioux Falls:** The City of Sioux Falls owns one weather station monitoring surface weather and one station monitoring soil temperature and moisture at the Landfill. These stations are fully managed by the State Climate office. These stations were linked to the City's network and data is transferred to the State Climate Office through IP.
- **Beresford:** Added 5 level soil moisture profile of soil sensors to the Beresford station and SDSU research farm.

**South Dakota expands CoCoRAHS**

South Dakota welcomed CoCoRAHS in June 2007 and continued its expansion in 2008. There are more than 450 volunteers in the state, of which at least 25% are regular reports and more than 25 report all days of the year. The National Weather Service provides support to the State Climate Office and Cooperative Extension Services in strengthening CoCoRAHS network in South Dakota. Data from CoCoRAHS is archived at the State Climate Office and available through its website.

**The State Climate Office began in-house instrument calibration:**

The State Climate Office (SCO) began implementing in-house calibration of instruments starting with Met-One wind direction sensors. The SCO will expand its in-house calibration to calibrating Met-One's wind speed sensor in 2009 and full in-house calibration is planned by 2011.

**New/Renewed Cooperation and Collaborations**

**Service**

- SCO extended cooperation with South Dakota Ag Statistics through 2009/2010
- Trip county and SCO extended collaborations on weather station maintenance
- SCO rolls out new price rate for various services extended. Implementation of prices and rules will take place in 2009. Users requesting data and formatting, that is otherwise not available on SCO's website, will be charged for at specific rates
- SCO receives and distributes RWIS weather stations data to NWS through Unidata-LDM
- Flandreau Santee Sioux Tribe began collaboration with the SCO to maintain the weather station located on Tribal land in Flandreau
- The office supplied over 200 individual data requests (beyond data from the web site)
- The SCO handled over 30 media requests and interviews during the year
- Dr. Todey delivered over 50 talks to producer groups, at extension meetings, and school groups
- Sinte Gleska Native American community initiated communication with the SCO to discuss weather and climate data needs
- Supplied weekly input to the US Drought Monitor (D- conditions finally removed for the first time in 8 years in the state)

**Research**

- Plant Science and SCO cooperated to model diseases in small grain crops (barley and wheat) and mycotoxins in corn
- Continued work on climate impacts on winter application of manure to fields

**State climate exchange program**

The state climate office was funded to create a monthly climate summary as part of the state climate exchange program. This climate summary is sent to the regional climate center for their report and placed on the state climate web site. In the six months it has been in existence, it had already been used for a state report on widespread spring flooding in cooperation with the National Weather Service and been used for other National Weather Service hydrology reports. Several press releases on precipitation extremes have come about because of this. This report is also being shared with state emergency management and the South Dakota Congressional Delegation.

**Regional collaboration**

Dr. Dennis Todey split time between South Dakota State University and the University of Nebraska-Lincoln for six months to be acting director of the High Plains Regional Climate Center during an extended illness. During this time he hired a replacement for the service climatologist – now regional climatologist. We were able to get the state climatologists from the region to Lincoln for a 2-day meeting to discuss regional cooperation.

**Service to AASC/NWS**

Dr. Todey chaired the state climate extremes committee of the AASC to guide direction for policy on handling state extremes. He also served on the National Data Standards Committee through the National Weather Service.

Continued to serve extension directly in providing data and climate analysis for extension offices and personnel across the state.

# Office of the Texas State Climatologist

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***John W. Nielsen-Gammon, Texas State Climatologist***

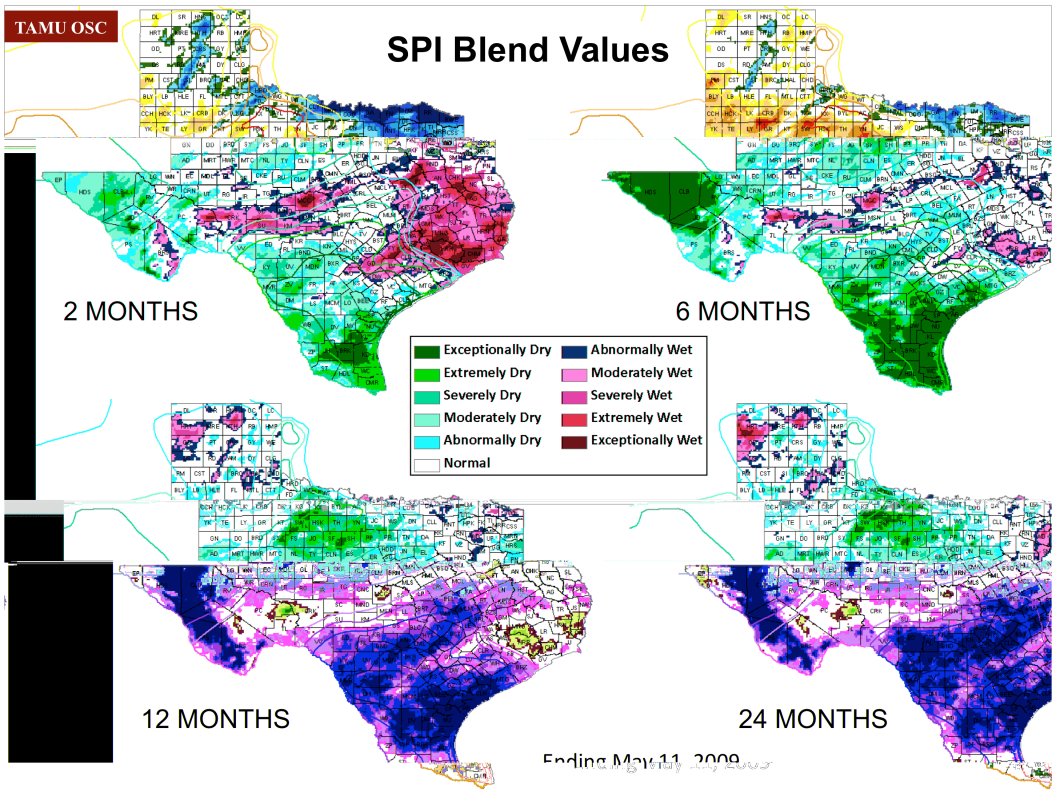
**Physical Location and Funding**:
The Office of the State Climatologist is housed in the Department of Atmospheric Sciences, Texas A&M University. Direct University support for this fiscal year included 50% salary of a research associate (Brent McRoberts) from the Department of Atmospheric Sciences. The College of Geosciences contributed $5,000. Remaining operating expenses were paid by the State Climatologist through returned indirect costs and salary savings. Office space is provided free of charge by the University. In addition to the State Climatologist and the Research Associate, an undergraduate student (Zachary Adian) provides assistance with phone inquiries and data requests. Steven Quiring, a faculty member in the Geography Department, also assisted with OSC activities. Cost recovery is available for large data requests. External funding is provided for sponsored research projects.

**Communication and Information Services**:
In 2008, about 200 electronic climate requests were received and responded to. Annually, the Office receives approximately 100-150 phone calls and sends dozens of facsimiles and mailings.
For the Texas Almanac, the Office provides and verifies a significant amount of climatological data for the publication. On the Office website, http://atmo.tamu.edu/osc, the Office posts monthly climate summaries for the state and the Bryan/College Station area as well as weekly weather forecasts for Texas. The Texas Monthly summary includes a crop report, precipitation and temperature deviations from normal for the major cities in Texas, and a summary of the previous month's weather.

**Research:**
The Office of the State Climatologist is working on a project directed toward documenting and understanding decade-scale changes in the observed precipitation climate of Texas. The basis of this project was the use of an interpolation technique to estimate missing monthly precipitation observations from surrounding stations, thereby eliminating biases associated with changes in network configuration. Though the conventional climate division data in Texas lacks a long-term trend, we have found that overall precipitation has actually been steadily increasing in Texas over the past century. The OSC has produced maps showing the estimated spatial extent and severity of droughts in Texas and neighboring states during the past century.

A similar analysis carried out over the 48 contiguous states identified two sources of inhomogeneity. The first was the use of linear regression that interpolates monthly climate division precipitation averages from linear regression of state averages prior to 1931. The second was the lack of station consistency in the post-1931 calculations of the monthly precipitation average. The Office is generating two new climate division precipitation data sets free of these inhomogeneities, one using all available station locations and one compatible with the current NCDC climate division values using only the same stations that NCDC used in December 2008.

In another project, the OSC has created a high resolution daily SPI product to encapsulate the state of drought in Texas. The product utilizes the Advanced Hydrologic Prediction System (AHPS) daily 4 km precipitation analyses. To calculate SPI, it was necessary to derive historical probability distributions for every grid point. The initial steps used a clustering technique to group Texas stations with long-term precipitation data into quasi-homogeneous regions. A regional frequency analysis algorithm was applied to each station's daily precipitation data and resulted in the creation of station L-moment parameters. Historical CDFs at each station were created for every day of the year and filtered using a harmonic smoothing technique to ensure continuity between days. This yielded the higher-order moments, which were then extrapolated to grid points. The zeroth-order moment, or mean, was assigned from the PRISM 30-year precipitation normals.



In addition to computing SPI in this fashion, we have implemented a new drought index called the SPI blend. The SPI blend is an SPI based on a range of accumulation times, instead of the single accumulation times that the conventional SPI uses. Maps of the SPI Blend are created in ArcGIS to graphically determine the magnitude of drought for several accumulation periods in Texas and help provide local input for the United States Drought Monitor. A sample output product from the SPI blend is included on the previous page.

The Office is continuing its investigation into the local-scale and large-scale controls on summertime precipitation in Texas with three research papers presently in the revision stage. The study was designed to examine direct relationships between precipitation and the factors that control it, using tools developed for convective forecasting. Our study found that precipitation on monthly time scales during the summer in Texas is primarily controlled by variations in convective inhibition (CIN) and is almost unaffected by CAPE. Other research projects have involved historical weather events, wintertime weather variability, and expert review of development of updated storm surge probability maps for Texas.

**Outreach**:
The Office's primary means of outreach is through data access and publications available on the OSC web site. In addition, the OSC responds regularly to media requests and requests for guest lectures. During the past year, the greatest interest among the public has been with regard to topics related to drought, hurricanes, and climate change. During 2008, the Texas State Climatologist gave invited lectures to the following groups and venues: the Gideon Lycecum Master Naturalist Class, University of the Incarnate Word, Texas Region C Water Planning Group, Rio Grande Valley Livestock Show and Exhibition, Upper Trinity Regional Water Planning District, Climate Change Impacts on Texas Water Conference, Far West Texas Climate Change Conference, and Big Bend Rio Grande Workshop.

A newer form of outreach is the blog Atmo.Sphere, hosted by the Houston Chronicle and located at the URL (http://www.chron.com/commons/readerblogs/atmosphere). The blog focuses on climate change, with some discussion of current weather events as well. The blog is written by the State Climatologist and by Barry Lefer, a faculty member at the University of Houston.

**Monitoring and Impact Assessments**:
The State Climatologist is an appointed member of the Texas Drought Preparedness Council, a statewide interagency committee created by the Texas Legislature in 1998 to monitor drought conditions and coordinate drought mitigation activities. The Council meets monthly in Austin. The State Climatologist is also an active participant in the U.S. Drought Monitor mailing list.

Since December 2008, with SCEP funding from NOAA, the Office has produced a monthly climate impacts report that documents the print media coverage of weather and climate effects on the general public and is posted on both the OSC and AASC websites.

Because of an ongoing severe drought in Texas, climate impacts have been widespread. The most recent report, covering the month of April, included over fifty impact reports. Reports are gathered from newspapers and other sources throughout the state. The monthly report includes links to the original source material. The reports are posted on our own web site http://atmo.tamu.edu/osc as well as on http://www.stateclimate.org .

# Utah Climate Center

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***Robert Gillies, State Climatologist***
Esmiel Malek, Associate Director


**Communication Capabilities / Information Services**

The Utah Climate Center (UCC) at Utah State University (USU) continued service for the State of Utah during 2008.

As was stated in the 2007 report the website / climate and weather database will continue development in the core areas of data distribution and new products. Specifically, we will further develop national and incorporate new international data resources. In order that we can deliver the aforementioned data structures the GIS interface will undergo a redesign that will facilitate sophisticated search capabilities, for example, spatial query potential. Dr Gillies will oversee this development and will coordinate the activities with the IT group at the Space Dynamics Lab (SDL) housed at the Innovation Campus of USU. As the topic of climate change becomes more focused in the State of Utah it is anticipated that Dr. Gillies will be called upon, as was again the case in 2008, to provide expertise in the area of climate science and will fulfill this role through presentations and reports as requested.

The UCC received funds from the American Association of State Climatologists (AASC) State Climatologists Exchange Program (SCEP) to set up a data feed with the Western Regional Climate Center (RCC) for the Climate Reference Network (CRN) data. Dr Gillies will coordinate with the programmers at SDL to implement.

Status-to-Date of the SCEP project: We had Greg McCurdy from the Western RCC visit with the USU programmers in April to discuss the project - mainly what needed to be done on either side to set up a data feed for the CRN. They spent about a day in discussion re: best practices etc. A person (Lee) has been assigned to the project and at the meeting on 04-27-2009 he reported that he has installed needed perl modules for this project and has begun a script to access the data which has been tested for a small subset of the CRN data. He informed the group that a test run to pull the data from the RCC was successful.

In the context of modern data collection of climate data the 2006 report stated, "… it is hoped to coordinate the various state entities (e.g., NRCS, BLM) that systematically collect such data into a common structure that will facilitate the transfer of such data for the state into the climate center's database schemas" – Dr Gillies will take the initial lead. The coordination of climate sites is an on-going process and will continue into 2009. In this capacity, negotiations are underway with the University of Utah, meteorology

department who manage MESOWEST, to establish an LDM feed between the meteorology department and the UCC, as this setup will go a long way to collecting extraneous datasets that are difficult to manage.

As in the past, the level of service at the Utah Climate Center continues but evolves. The number of telephone data requests increased over last year but are focused towards either specialized data requests or in the interpretation of climate data. More and more, clients are simply retrieving their data / information from the web server as was intended at the outset; such is evidenced from the fact that the "Climate Datasets" download is the most visited / used page. At the time of writing this report Apr 14-May 14 2009 site usage recorded 4,566 visits with 21,360 pages visited and the monthly trend is increasing.

Not only has there been a shift, as a result of the IT infrastructure that is now in place in the UCC, towards a more service oriented base that is more focused on scientific queries and expertise but also in magnitude of calls in this area. Such is now the experience of the climate center as evidenced by calls to the center for interpretation of climate data. Examples include but are not limited to private citizens, education, business, government, state, county and city offices, law enforcement, attorneys and the media.

After many requests, the UCC – under the direction of Jobie Carlisle (Technician – half time appointment) – has established and will manage a weather station in the Peter's Sink. Also, Mr Carlisle continues to manage the Fruit Growers Network of Utah weather stations and data dissemination that supplies the data for Utah TRAPs (Timing Resource and Alert for Pests), a degree-day calculator, insect phenology, and management tool for agriculture and landscape locations in northern Utah.

As we all know, the National Weather Service is moving towards modernizing the COOP to replace the manual observations with automated ones. The program – termed HCN-M (Historical Climate Network – Modernization) will undergo an initial testing phase that will set up stations in the Western Region for four states of which Utah is one. A detailed site survey has been undertaken in the affected states and for Utah, the 5SW COOP station (managed by the UCC) is a chosen site. Dr Gillies has overseen the administration necessary to make this happen.

Data collection and instrument maintenance will be provided for the State of Utah. The National Atmospheric Deposition Program (NADP), the UVB Project (Colorado State University / USDA) and the COOP (National Weather Service - NWS) are all integral responsibilities of the UCC.

**Research**

It is intended to participate further in the NADP program to visualize the data through the use of micromaps. Drs Gillies and Malek will be responsible for this research initiative and will be involved in the micromapping of the NADP pollution data.

Dr Wang will undertake climate research specific to the State of Utah. Research will become more of a core component of the UCC and will generally be overseen by Dr Gillies but will include associates of the UCC.

**Publications**

- Wang, S.-Y., R. R. Gillies, J. Jin, and L. E. Hipps (2009), Recent rainfall cycle in the Intermountain Region as a quadrature amplitude modulation from the Pacific decadal oscillation, Geophys. Res. Lett., 36, L02705, doi:10.1029/2008GL036329.
- Moller, Alan and Gillies, Robert. 2008. Utah Climate – 2nd Edition, Utah State University Publication Design and Production
- Rico Gazal, Michael A. White, Robert Gillies, Eli Rodemaker, Elena Sparro and Leslie Gordon. 2008: GLOBE students, teachers, and scientists demonstrate variable differences between urban and rural leaf phenology. Global Change Biology, 14, 1568-1580.
- Malek, E. 2008. The daily and annual effects of dew, frost, and snow on a non-ventilated net radiometer. Doi.10.1016/j. atmosres.2008.02.006.

**Outreach (Education, Climate Products, Awareness, Media Contacts)**

The center has been actively involved in educational presentations for elementary, middle and high school students. Other organizations, such as scouts, have requested weather presentations. Visits by and presentation for college students (e.g., Snow College) are also a common occurrence.

Dr Gillies presented at various venues on the subject of climate and climate change.

In last year's report we mentioned that negotiations were underway with Utah Public Radio to serve weather and climate expertise through this medium. The faculty (i.e., the meteorologists) and meteorological students of the Plants, Soils and Climate (PSC) now rotate and are responsible as weekly duty meteorologists to coordinate weather and climate discussions and, prepare the information for UPR. The first airing was on October 1, 2008 and has been a great success from many perspectives least of which has been statewide recognition of the UCC.

The 2nd Edition of the Utah Climate book was released in the later part of 2008. A much requested product, the book was mailed to federal agencies and state offices as well as extension offices. Moreover, a pdf version of the book is maintained on-line and this electronic version will be updated annually and implement the moving normal concept to be adopted by NOAA and NCDC.

The UCC will continue to provide Utah Climate Updates – monthly newsletters which will review the current climate conditions for the state of Utah. One side will focuses on a particular issue such as drought conditions, snowpack, or others as we see necessary. The other side will be standard, giving a general summary of the climate statistics for the previous month.

On July 1, 2008, Utah joined the Community Collaborative Rain, Hail & Snow Network (CoCoRaHS). The UCC is actively involved in the management and expansion of this program throughout the state.

One major event, Focusing Cache (http:www.focusingcache.org) was held on 31 January 2008 here at USU. Our contribution to the nationally coordinated event Focus the Nation. Dr Gillies chaired the organizing committee and raised funds to enable USU to make it a free occasion. Focusing Cache was a community-wide education event, helping all of us better understand and navigate the unique challenges and opportunities of the landscape ahead. The conference had about 450 attendees from all over Cache valley and beyond, and had an introductory welcome from Utah's Governor Huntsman Jr.

We intend to undertake an education initiative with Clayton Brough and Dan Pope who host the website "Utah Center for Climate and Weather". They maintain the site for educational purposes. A meeting was held and it was suggested that we combine the two websites (which tend to obfuscate the public) by building the content of their materials into the UCC climate website after which their website would be taken down. Dr Gillies is constructing a memorandum of understanding to this effect.

# Vermont State Climate Office

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***Lesley-Ann L. Dupigny-Giroux, State Climatologist***

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The Vermont State Climate Office (VTSCO) received its ARSCO recognition in June 2005. The office is housed within the Department of Geography at the University of Vermont (UVM) & State Agricultural College, a land-grant institution that emphasises outreach as one of its core missions. The VTSCO is located in a laboratory setting donated by the Geography department. Climate Database Modernization Program (CDMP)-funded equipment, archival publications and documents are housed there, with adequate facilities for the undergraduate and graduate assistants.

The core mission of the VTSCO is to provide climate research and services to Vermonters and other constituents (university researchers, policy makers, state agencies, legal firms or school children) in a timely and efficient manner. This is facilitated via a dedicated website and e-mail address.

Over the course of the AY 2008-2009, two graduate students were affiliated with the VTSCO and funded by research assistantships from the University of Vermont. The M.Sc. student in Natural Resources assisted with database development, promotion of the climate literacy efforts of the VTSCO and co-authoring seasonal editorials for the Rutland Herald newspaper. The Ph.D. assistant from the Plant and Soil Science department worked on phenological research related to bird migration in Vermont in the 1900s.

**ARSCO Qualifications**
The VTSCO is the AASC-designated state climate office for Vermont. The following activities address each of the Office's ARSCO qualifications.

***Communications capabilities***:
- Continued enhancement of the VTSCO website (http://www.uvm.edu/~ldupigny/sc) with access to both hydrometeorological and geospatial data; ongoing CDMP historical data collection; mitigation awareness resources; data access and; a streamlining of the most commonly requested NCDC datasets
- Provide free data, expert opinions and recommendations via the telephone, facsimile, electronic mail and regular mail

***Information services***:

- Seasonal contributions (with VTSCO research assistant) on aspects of Vermont's weather and climate for the Rutland Herald newspaper.
- Provided five interviews on historical storms and climate change issues and to the Newport Daily Express, WDEV radio, National Geographic Television, Land Letter (Washington D.C. based environmental newsletter).
- Handled over 27 non-CDMP related email, mail and telephone requests.

***Research***:

- "Introduction - Climate science literacy - A state of the knowledge overview" *Physical Geography*, 29(6):1-4.
- Guest editor of *Physical Geography* Volume 29, Number 6 devoted to Climate Literacy. (Organized solicitation and peer review of this special issue which was my suggestion)
- Section leader for Weather, Climate and Climate Change in Vermont. Vermont Monitoring Cooperative 20-year activity report.
- CDMP-related data collection of weather and climate data in personal diaries from the 1700s to early 1900s in the Library Research Annex of the UVM's Bailey/Howe Library. These were imaged and forwarded to the CDMP for uploading to WSSRD. Databases of the contacts, findings and progress of visits around the state were updated. .

***Outreach***:

- Led two web chats on the Vermont PBS programs (Public Square & the EPSCoR-sponsored series on Emerging science)
- 4 presentations on Vermont's perspective in terms of climate change; natural hazards
- Featured on the National Geographic Special - Earth 2009
- Liaise with the Vermont Emergency Management on drought, flooding and hazard issues.

The Vermont State Climate Office hosted the annual meeting of the AASC meeting in Burlington on 7-10 July, 3008. In attendance were a record number of State Climatologists as well as several regional and national NOAA and NWS directors.

# University of Virginia Climatology Office

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***Philip J. Stenger, Director***

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The University of Virginia Climatology Office is a Research and Public Service Center in the Department of Environmental Sciences. The office is also an integral member of the Southeast Regional Climate Center.

The office provides information and conducts research on the atmospheric environment and the impact of weather and climate on economic and ecologic systems to government, education, industry, the media and individuals. Its on-line, "Climate Advisories" feature current climate research and/or educational material, and its web site offers an extensive array of climatic information and guidance to a broad spectrum of climatic data services.

**ARSCO Qualifications:** The AASC has designated the Climatology Office at the University of Virginia as the state climate office for Virginia. The following describes the ways in which the office addresses each of the ARSCO qualifications:

**Communication Capabilities**
The University of Virginia Climatology Office has phone, fax, email and videoconferencing capabilities with high-speed Internet service for the rapid transfer of data. The office maintains a web site devoted to a variety of its educational, informational, data provision and outreach goals.

**Information Services**
The University of Virginia Climatology Office serves as the official repository and provider of climatic records within Virginia. It handles thousands of requests for information annually, and provides general guidance on climate issues of all spatial and temporal scales. Its web-based information services are accessed tens of thousands of times a year, with an estimated total download of information in the hundreds of thousands of pages. These inquiries come from individuals, industry, the media and dozens of governmental and educational entities, worldwide. In addition, the office's monthly video "Climate Advisory," a brief discussion of relevant topics regarding the climate of Virginia, is televised statewide on Public Television, Public Access Channels and agricultural information networks.

**Research**

The office is an integral participant in the ShenAir Institute Research Program, which is designed to expand understanding of the atmospheric environment of the Shenandoah Valley region. Under this program, the office has been involved with the following projects:

- Air Quality Climatology for the Shenandoah Valley
- Asthma Alert System for Shenandoah Valley
- Demographic Relationship to Respiratory Health in the Shenandoah Valley

In addition, major research efforts of the office include:

- Examination of the relationships between U.S. climatic regimes and exacerbation of respiratory distress — in collaboration with the U.Va. Health Sciences Center. This work has been expanded to include studies in Central America.
- More detailed study of the climatic effects on outbreaks of hemorrhagic disease in Virginia wildlife — in collaboration with the Virginia Department of Game and Inland Fisheries.
- Drought and drought impact monitoring research.

**Outreach**

- Provides data and expertise to dozens of state, federal and local government entities, and educational institutions each year.
- The office distributes information via hundreds of contacts with the print, radio and television media.
- The office serves as a lead scientific contributor to the Virginia Drought Monitoring Task Force, with periodic drought reports and analyses.
- Video Climate Advisories regarding aspects of Virginia climate are produced monthly for television and web-based distribution.
- The office has been increasing emphasis on its web site as a vehicle for making information available to potential users. This has been successful in reaching more individuals and organizations in a more cost-effective fashion. The estimated amount of information accessed has nearly doubled from the previous year.
- Presentation of education and training lectures for the Virginia Master Naturalist Program.
- Informational presentations before local government and advisory groups regarding climate-related topics of community concern.
- Involvement with school-related groups regarding climate topics.

**Monitoring and Impact Assessment**

- Development of a web-based interactive system for ready access to short-range forecasts of human health related atmospheric information.
- Provision of data and impact assessment for and service as a member of the Virginia Drought Monitoring Task Force
- Participation as a member of the Virginia Hazard Mitigation Steering Committee, including development of climatic hazards analyses.

**Papers Published in 2008:**

Davis, R.E., D.M. Hondula, D.B. Knight, L.J. Sitka, M.L. Deaton, S.D. Gawtry, P.J. Stenger, C.P. Normile, and T.R. Lee. An Asthma/Respiratory Alert System for the Shenandoah Valley, Virginia, USA,

Giraytys, J.M., C.J. Brodrick, M.L. Deaton, R.E. Davis, S.D. Gawtry, D.M. Hondula, D.B. Knight, T.R. Lee, L.J. Sitka, P.J. Stenger. Decision Support for Public Health and Safety Related to Air Quality, *American Meterological Society Third Symposium on Policy and Socio-Economic Research*.

Hondula, D.M., R.E. Davis, L.J. Sitka, D.B. Knight, M.L. Deaton, S.D. Gawtry, P.J. Stenger, C.P. Normile, T.R. Lee. The Impact of Weather on Predictors of Respiratory Distress in the Shenandoah Valley, USA,

Hondula, D.M., L.J. Sitka, D.B. Knight, R.E. Davis, S.D. Gawtry, T.R. Lee, P.J. Stenger. A Comparison of Back-Trajectory and Air Mass Climatologies for the Shenandoah Valley, Virginia, *International Journal of Climatology,* In review.

Knight, D.B., R.E. Davis, S.C. Sheridan, D.M. Hondula, L.J. Sitka, S.D. Gawtry, T.R. Lee, P.J. Stenger, F. Mazzei, B.P. Kenney. Detection of Climate Change by Examining Trends in Air Mass Frequencies Across the United States, *Geophysical Research Letters,* In review.

Sleeman, J.M., J.E. Howell, W.M. Knox, P.J. Stenger. Incidence Of Hemorrhagic Disease In Virginia Associated With Winter And Summer Climatic Conditions, *2008 Annual International Conference of the Wildlife Disease Association*.

**Papers Accepted For Publication in 2008:**

Hondula D.M., L. Sitka, R.E. Davis, D.B. Knight, S.D. Gawtry, M.L. Deaton, T.R. Lee, C.P. Normile, and P.J. Stenger, A Back-Trajectory and Air Mass Climatology for the Northern Shenandoah Valley, USA, *International Journal of Climatology*.

McLaughlin, A.P., P.J. Stenger, J. Patrie, M.A. Brown, D.G. Hillman, J.M. El-Dahr, T.A.E. Platts-Mills, P.W. Heymann, Emergency Department Visits and Hospitalizations For Asthma Among Children Living In Locations With Different Climates**,** *Journal of Allergy and Clinical Immunology*.

Sleeman, J.M., J.E. Howell, W.M. Knox, P.J. Stenger. Incidence Of Hemorrhagic Disease In Virginia Associated With Winter And Summer Climatic Conditions, *EcoHealth*.

# Office of Washington State Climatologist

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***Philip Mote, PhD, State Climatologist***
Gary Grove, PhD, Associate State Climatologist; Professor, Washington State University
Josiah Mault, Assistant State Climatologist
Karin Bumbaco, Assistant State Climatologist
Rob Norheim, Assistant State Climatologist
Eliza Keeley, Student Assistant
Nathaniel Mote, Student Assistant

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Now entering its seventh year, OWSC has achieved many of its initial goals and has shifted to more of a research focus while maintaining a strong commitment to service and responding quickly and knowledgeably to inquiries from the public, agencies, and the press.

**New Assistant SC**

Josiah Mault, who joined OWSC as a student assistant in 2005 while still an undergraduate and then became full-time assistant state climatologist in 2006, moved to Boston and now works with DNV Global Energy Concepts, providing meteorological data and analysis for the wind energy industry.

We are pleased to introduce Josiah's successor, Karin Bumbaco. Karin completed an MS in Atmospheric Science at Ohio State University. Her thesis project compared hydrometeorological variables from automated weather stations in the Peruvian Andes, where she spent time doing fieldwork, with NCEP/NCAR reanalysis. Before that she earned a BS in meteorology from The Pennsylvania State University, where she was a member of the Penn State Campus Weather Service all four years and also worked in the Pennsylvania State Climatology Office.

**Continued development of web tools**

Having completed a survey of US Historical Climate Network (HCN) stations in the state, we created an online inventory of photos for each station. The inventory includes photos from 8 compass points, toward and away from each instrument, as well as aerial photos of the surroundings if available (www.climate.washington.edu/statetour)

We now serve up snow depth data collected semimonthly by the Northwest Weather and Avalanche Center (www.climate.washington.edu/snowdepth); data are automatically updated twice a month.

We also updated the MODIS satellite cloud fraction data and are working on updating the utility to plot HCN data, using HCN version 2.

**CoCoRaHS.org**

In June 2008 Washington joined CoCoRaHS, with Phil and Josiah serving as state coordinators. Karin has become the state coordinator, with the assistance of Eliza Keeley, and we have 577 observers as of this writing. Observers got quite a workout during the winter, when the Puget Sound region had more than 15 snowstorms and Spokane at times had more than 24" of snow on the ground. NWS personnel expressed great appreciation for the contributions of our new CoCoRaHS observers.

**Surface lapse rates**

Phil teamed up with colleagues Prof. Jessica Lundquist (UW Civil and Environmental Engineering) and Justin Minder (UW Atmospheric Sciences) and wrote a paper, soon to be submitted to Geophysical Research Letters, on surface temperature lapse rates in Washington's Cascade mountains, using a combination of five data sources. Standard assumptions about moist adiabatic are inappropriate.

**Homogenizing precipitation records**

Karin has been working with Dr. John Abotzoglou, formerly of Western Regional Climate Center, on identifying and correcting nonclimatic discontinuities in precipitation records in the state. Not an easy task - now we see why the major data centers like NCDC have thus far only homogenized temperature.

**Three flavors of drought**

Karin arrived and immediately got to work carrying across the finish line a manuscript Phil had begun entitled "Three flavors of drought in the Northwest" using recent examples. In common with much of the West, Washington has dry summers when much of the streamflow exists as snowmelt. The first flavor, then, is low winter precipitation which produces low snowpack, as occurred in 2001. The second flavor is an exceptionally dry summer, as happened in 2003 and 2004 (broken by heavy rain in late August). The third flavor of drought is when low snowpack is caused by high winter or spring temperatures, roughly like 2005.

**Optimal network design; SCEP**

In collaboration with Prof. Greg Hakim, UW Atmospheric Sciences, and Dr. Guillaume Mauger, a recent graduate of UC San Diego, we have been developing an approach to selecting an optimal distribution of observing stations. The approach, ensemble sensitivity, selects the point that explains the most variance, then iteratively selects the next most valuable point after accounting for the variance explained by the first point, and so on, incorporating an estimate of the instrumental error.

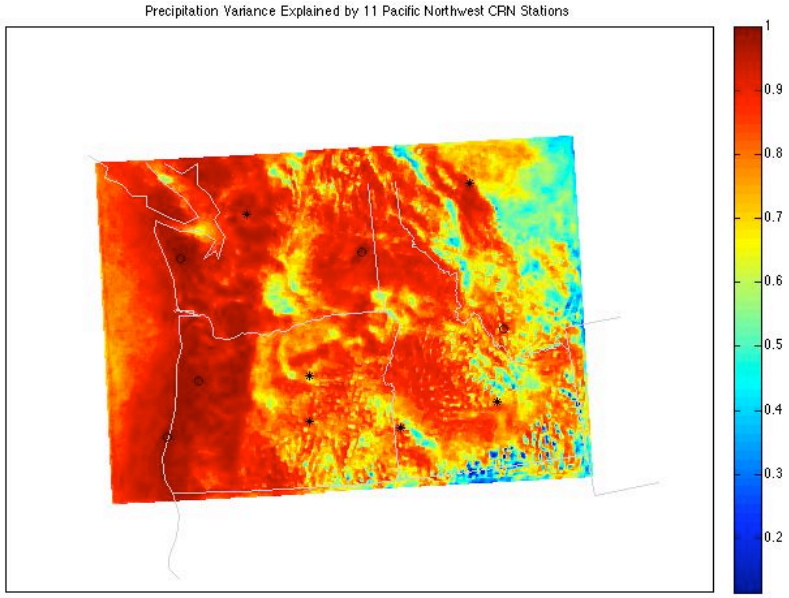
Part of this effort, funded by an AASC SCEP grant, evaluated the effectiveness of the Climate Reference Network in explaining the variance in precipitation in the Northwest. Using the 11 CRN sites in Washington, Oregon, Idaho, and western Montana, and 4-km monthly mean precipitation for March 2004-September 2007 from the MM5 forecast model, we regressed grid point precipitation values onto the precipitation records at the 11 CRN sites (or their MM5 proxies if the CRN records were too short). The percent variance explained at each grid point is shown in the map on the next page. Our analysis shows that the variance in western Washington and western Oregon is very well

explained; in fact, the stations in Marblemount and Quinault, Washington, are nearly redundant. An exception in western Washington is the low variance explained on the northeast part of the Olympic peninsula. Variance in the drier parts of the region, especially the Yakima Valley in Washington, is poorly explained. This suggests that for monitoring long-term trends in drought, climate-quality stations in those areas should have been a higher priority than in the western parts.

We also changed our monthly newsletter for another SCEP grant, adding a human impacts and moving the publication date up a week. Among other things, we featured the impacts of winter storms and flooding, and the consequent federal disaster declaration. Newsletters are available from www.climate.washington.edu/newsletter/

**Legislation**

During its 2009 session, the Washington State Legislature for the third time considered a bill that would establish the Office of Washington State Climatologist, specify how the state climatologist would be appointed, and delineate the duties and functions of the Office, in the context of a bill to create a working group to oversee state agency responses on adapting to climate change. The language establishing the state climate office was stripped from the bill.




Percent variance explained at each 4-km MM5 grid point by a linear regression on the 11 CRN stations (symbols). Stations shown by a star had complete data and the station data were used; stations marked by a diamond were installed after March 2004 and the model time series at that location was used.

# West Virginia State Climate Office (WVSCO)

Marshall University
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***Kevin Law, State Climatologist***

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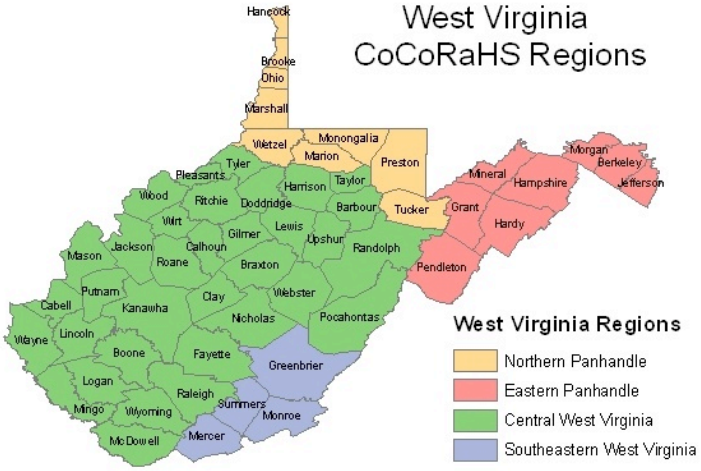
The West Virginia State Climate Office (WVSCO) was successfully transferred from West Virginia State University to Marshall University in 2008. Since Marshall is undergoing a meteorology program, the move was to facilitate the access of climate data and information to the public. The goal of the WVSCO is to provide weather and climate information to public and private entities in order to further climate education. This includes improving weather and climate related mitigation practices and decision-making activities that affect the economic and environmental quality of the state. Climate data and information are provided to research institutions, private firms, media outlets, as well as other agencies and the general public. Invited lectures and other educational outreach programs are also presented throughout the state.

**CoCoRaHS**

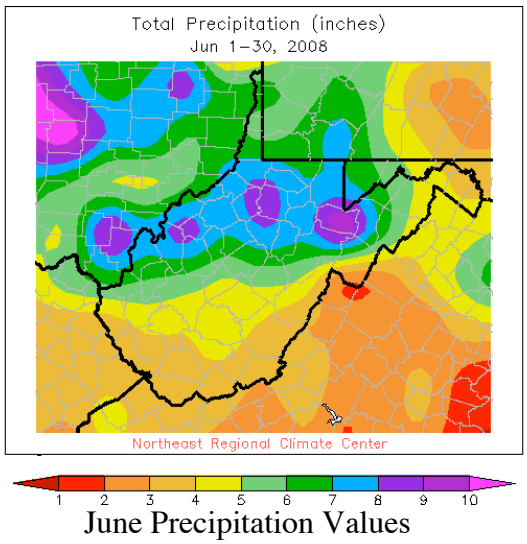
West Virginia became the 43rd state to join the CoCoRaHS network officially launching on May 1, 2009. As of May 14, 2009, West Virginia has 55 registered volunteers. The WVSCO serves as the State Coordinator and cooperates with the four National Weather Service Weather Forecast Offices (NWS WFOs) that serve the state. The WFOs act as Regional Coordinators and have been strongly involved with the WVSCO in promoting the program throughout the state. Several articles have been written and interviews have been given on numerous state media outlets.



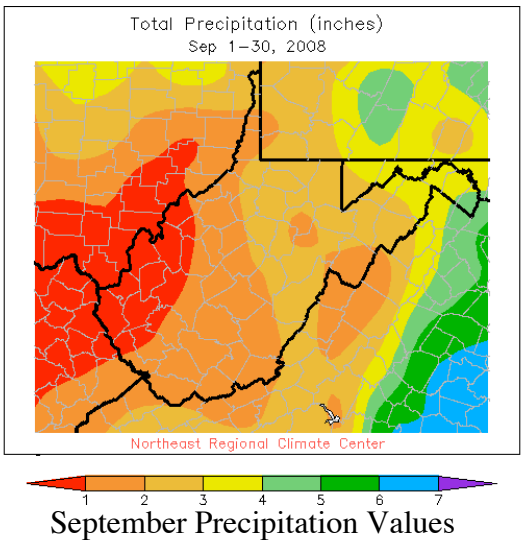
**Weather and Climate 2008: Year in Review**

The average yearly temperature for 2008 in West Virginia was near normal with an average of 51.7°F. Of the 114 years on record, 2008 was the 41st coldest. January and February produced above average temperatures across the entire state as the winter was the 35th warmest on record. The spring brought the return of near normal temperatures again but the summer months, particularly July and August, were unusually cold. In fact, it was the 32nd coldest. The autumn months were not much warmer, as the fall was the 28th coldest. November produced especially cold temperatures as most stations across the state reported 2°F - 5°F departures from normal in their monthly averages.

Annual precipitation values were approximately 3 inches above average across most of the state in 2008 averaging 47.2 inches. It was the 32nd wettest year on record however it was a tale of two seasons. Most of the precipitation fell early in the year causing major flooding in some areas while the late summer and autumn months produced exceptionally dry conditions. The winter and spring months were among the wettest on record ranking 18th and 17th, respectively. The summer produced near normal precipitation values. June and July produced exceptionally high values especially across the northern half of the state. Eighteen counties were declared federal disaster areas due to the widespread flooding. The town of Glenville (Figure on next page) was the hardest hit as the Little Kanawha River flooded 9.16 feet above flood stage. This was the highest crest since the remnants of Tropical Storm Juan affected the region in 1985. August marked the beginning of the dry period that continued throughout the fall as it was the 17th driest on record. September was the driest month especially in the southwestern part of the state. Huntington only reported 0.11 inches the entire month. The below normal precipitation brought drought conditions to the state for the remainder of the year.




June Precipitation Values




September Precipitation Values

Flooding in the town of Glenville in June

# Wisconsin State Climatology Office

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***John Young, State Climatologist***
Ed Hopkins, Assistant State Climatologist

The Wisconsin State Climatology Office (SCO) is affiliated with the Department of Atmospheric and Oceanic Sciences at the University of Wisconsin-Madison and is a partner with the Midwestern Regional Climate Center. The SCO collects and distributes data and information for climate monitoring, provides climate information and interpretation to residents of Wisconsin, develops "value –added" climate for a wide user community, and conducts applied climate research with University and State collaborators.

Specific elements of the SCO mission include:

- Acquisition, archiving, and distribution of past weather observations from nearly 200 weather stations throughout the state.
- Summarization and dissemination of the information to users and for SCO climate monitoring of variability and trends.
- Production of "value-added" analyses of climate information for use in studies of climate impacts, decision making , and advice to the government on droughts, extreme temperature and precipitation events, probabilities of occurrence, & climate change.
- Conduct collaborations on applied climate research on climate variability, trends, extremes, and impacts.
- Stewardship of an extensive collection of original manuscript records for Wisconsin weather stations, some dating back to the 19th century.

**INFORMATION SERVICES**

**Website:** The SCO maintains its website http://www.aos.wisc.edu/~sco that provides an expanding variety of graphical climate information, data, and links for citizens, scientists and clients in the government and private sector. Approximately 100 visits per day were made to this website during 2008. Recent progress on the site includes:

- Development of new sections on Water, Energy, and Agriculture
- Season Pages-products pertinent to each season, and their interannual variability
- Probabilities of temperature, precipitation and extreme events are being developed

- Climate History: Graphics that demonstrate observed climate variability by year and locations through the state are routinely updated. Extensive records for seven cities illustrate interannual and interdecadal fluctuations and recent climate trends.

**Data Services:** The SCO staff provides advice on web links to climate data and maps from regional and national centers. In addition, they also answer questions and fill data requests made by telephone, fax, email and office visits. The public, media, private sector (e.g., legal, insurance), and governmental agencies made approximately 800 data requests per year. Most requests made by the public are answered without charge. A minimal service charge plus costs is assessed for special data requests that require significant time or scientific effort.

**OUTREACH**

The SCO continues to make its presence more widely known to University colleagues and residents of Wisconsin. In addition to interviews with the electronic and print media in the state, the staff gives lectures at service groups, universities and business conferences.

**University of Wisconsin**- John Young continues to be liaison with the Department of Atmospheric & Oceanic Sciences and climate-related research faculty in other departments. In November 2008, he spoke at his AOS "retirement Colloquium" on the revolution in climate and weather during his 50-year career in the field & as a professor in AOS. He also spoke on Chaos in Weather and Climate to the graduating AOS seniors. Ed Hopkins' role as "Dr. Data" has expanded to include assistance to student researchers from six departments, and consultation on data issues with the Center for Climate Research.

**Climate Change**- Young was an invited speaker, discussant, and breakout session leader at two public Symposia on global climate change. They were hosted by other campuses: UW Fond du Lac (March 2008) and UW-Stevens Point (Lt. Governor Lawton's Climate Summit).

**WICCI**- In 2008, the SCO was recognized as the collaborator within the developing Wisconsin Initiative on Climate Change Impacts, a multidisciplinary program involving university and government scientists. This collaboration is likely to lead to an expanded SCO mission in Wisconsin climate change science applications in the future.

**National Weather Service**- SCO regularly interacts with three NWS offices. In May 2008, we also co-hosted the NWS Central Region Data Stewardship Meeting at the University of Wisconsin.

**RESEARCH—**Ed Hopkins is analyzing weather extremes reported at individual stations throughout the state and is a member of the State Climate Extremes Committee. He coauthored a chapter on early weather observations in the Old Northwest that will appear in an edited book on the early instrumental record and climate variability in North America. Young is developing plans to expand the probabilistic content of our data analyses, which will provide a clearer starting point for analysis of climate extremes and their trend. Particular attention is being paid to the recurrence probabilities for heavy multi-day rains. The SCO continues to collaborate in a climate research project with the

Center for Climatic Research and the Nelson Institute for Environmental Studies at the University of Wisconsin-Madison involving regional climate change.

**PROJECTS AT END OF 2008 –**

- Create a more formal relation of the SCO with the University
- Formally define all staff positions and develop funding for them
- Establish ARSCO status
- Partner with local, state and federal government agencies on matters relating to climate services and long-term climate change
- Continue expansion of website information, smoothed graphics, & probabilities
- Expand collaborative research with campus and state in WICCI.
- Continue contacts with media and issue timely press releases.
- Develop small applied research projects & collaborations with AOS researchers.

# Wyoming State Climate Office

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| | |
|---|---|
| ***Steve Gray*** | ***Director and State Climatologist*** |
| Tony Bergantino | Assistant State Climatologist |
| Chris Nicholson | Outreach and Technology Coordinator |
| Barbara Muller | Librarian and Archivist |
| Jodi Preston | Office Administrator and Data Manager |
| Scott Laursen | Data Services/Research Associate |
| Michelle Ogden | Data Services/Research Associate |

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The **Wyoming Water Resources Data System** (WRDS; http://www.wrds.uwyo.edu/) and its **State Climate Office** branch (SCO; http://www.wrds.uwyo.edu/wrds/wsc/wsc.html) are the single largest providers of water and climate-related data in the state. Housed within the Department of Civil and Architectural Engineering at the University of Wyoming, WRDS and the SCO are funded primarily through contracts with the Wyoming Water Development Commission.

The WRDS-SCO office provides a variety of services, ranging from the development of enhanced drought-monitoring products to the online dissemination of water and climate data. WRDS and the SCO also support a wide range of groups by assisting in the development of the State Water Plan and helping to coordinate climate- and hydrologic-monitoring efforts throughout Wyoming.

**Activities Related to the ARSCO Mission**

***Information Services***

Data and information services at the Wyoming SCO are provided primarily via the World Wide Web. The links below provide a sampling of related products:

- http://www.wrds.uwyo.edu/
- http://library.wrds.uwyo.edu/
- http://www.wrds.uwyo.edu/sco/data/data.html

In addition to internet services, we also responded to almost 150 direct requests (i.e. via phone, mail, or other personal contact) for climate data and climate-related information. We also continued to work with several state and federal agencies to (1) improve infrastructure related to climate monitoring and (2) improve methods for online access to climate data. Towards these ends we developed cooperative agreements with the NRCS, NOAA-NWS, Wyoming Dept. of Agriculture and Wyoming State Engineers Office that allowed for cost sharing on new instrumentation, upgrades to existing climate/water

monitoring sites, and improved data access. Highlights of this work include new equipment installations or upgrades at 25 soil-moisture monitoring sites since mid-2007, and a cooperative agreement that brought six new NRCS SNOTEL sites to the state.

***Outreach***

While dry conditions eased somewhat in 2008, drought and water supplies continued to be a major concern in Wyoming. Climate change also continues to be a topic of tremendous interest. In turn, we focused much of our effort on high-impact events designed to educate the public and members of state government about drought and climate science. Out of some 25 invited presentations, key examples include:

- S.T. Gray, "Potential Climate Change Impacts and Natural Resource Management in Wyoming". Invited presentation to the Director and Executive Committee, Wyoming Game and Fish Department. Cheyenne, Wyoming. January 2008.
- S.T. Gray, "Drought, Climate Change and Water Resources in the Platte River Basin ". Annual Water Policy Conference, Platte River Recovery Program. Scotts Bluff, Nebraska. March 2008.
- S.T. Gray, "Climate Change and Wyoming Agriculture". Invited Presentation to the Director and Board, Wyoming Department of Agriculture. Cheyenne, Wyoming. May 2008.
- S.T. Gray, "Drought, Climate Change and the Future of Wyoming's Water Resources". Invited presentation to the Wyoming Water Development Commission. Alpine, Wyoming. August 2008.
- S.T. Gray, "Climate Change Impacts and Wyoming Water". Stroock Forum on Wyoming Lands and People. Pinedale, Wyoming. November 2008.

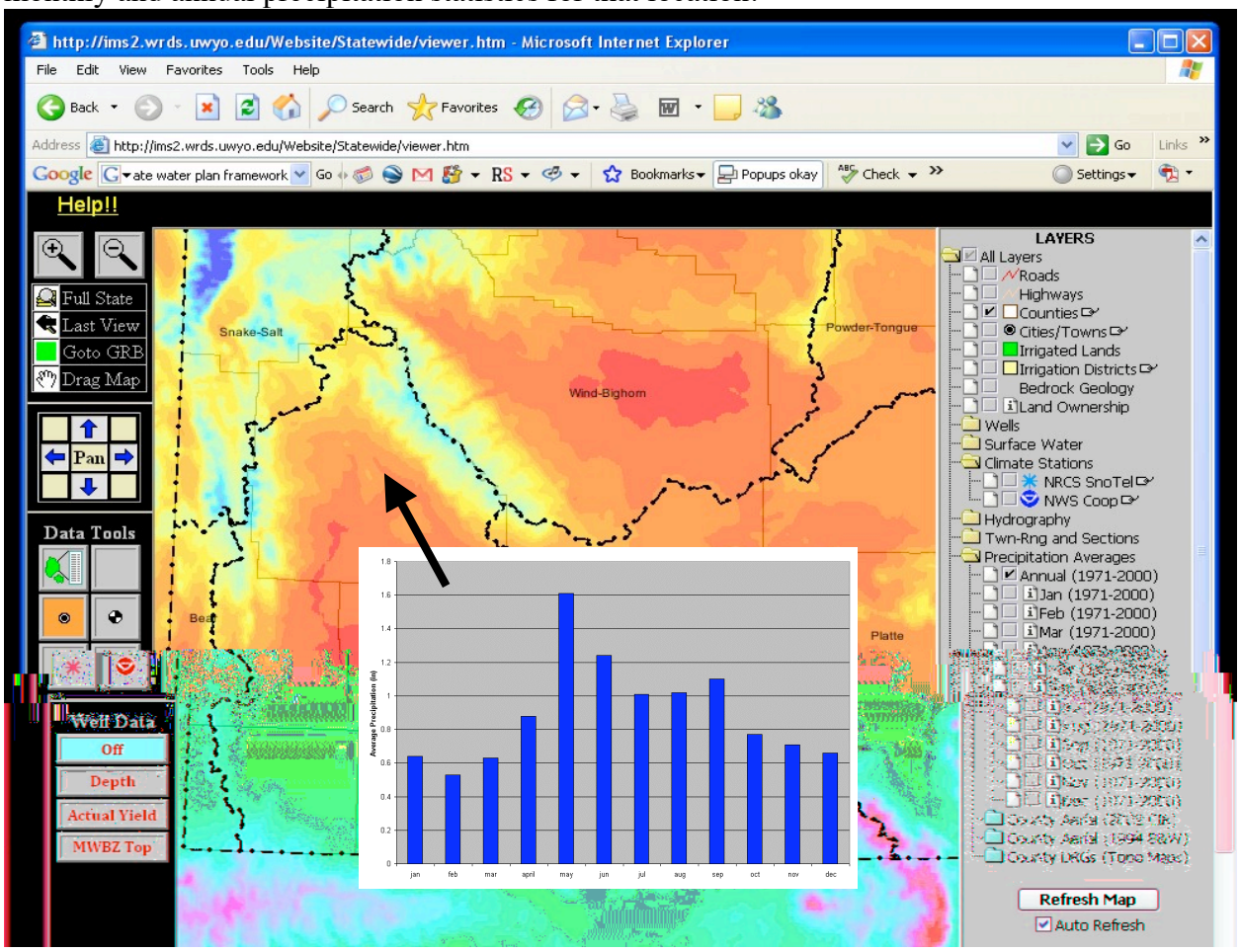
In addition, the Wyoming SCO co-organized a workshop on drought, climate variability and climate change with Montana Game and Fish, USGS, the World Wildlife Fund and Wilderness Conservation Society. In total, we conducted over 50 print, radio and television interviews with media outlets from throughout the state and surrounding region.

***Developing Improved Communications Capabilities***

One of our most important accomplishments in 2008 was the launch of a new Wyoming SCO website: http://www.wrds.uwyo.edu/sco/climate_office.html. The new website features improved navigation and overall ease-of-use. Launch of the new website also allowed us to concentrate on the development of new data products tailored to address specific stakeholder needs. Examples of specific products can be found at:
http://www.wrds.uwyo.edu/sco/data/normals/1971-2000/delta_TMin.html
http://www.wrds.uwyo.edu/sco/data/wtryr/wtryr.html

Work also continues on the development of an Internet Map Server that supplements existing methods of data retrieval. In early 2008 we launched a fully operational version of this system that allows users to access real-time and historical climate data provided by multiple state and federal agencies. This system provides "one stop shopping" for data, and allows users to explore and view Wyoming's climate in a variety of user-friendly contexts. In mid-2008 we expanded this system to include several features driven by

PRISM-based estimates. The example below shows a feature where users can view maps of average annual precipitation based on PRISM and then click on any cell to retrieve monthly and annual precipitation statistics for that location.




***Research***

In 2008 the Wyoming SCO was directly involved in a variety of research projects, including work related to:

- Design of climate monitoring systems for high-mountain areas
- Long-term history of Wyoming and western U.S. climate
- Ecosystem impacts of drought

Examples of papers published or accepted for publication in 2008 include:

McCabe, G.J., J.L. Betancourt, S.T. Gray, M.A. Palecki, and H.H. Hidalgo. 2008. Associations of multi-decadal sea-surface temperature variability with U.S. Drought. *Quaternary International*, doi:10.1016/j.quaint.2007.07.001.

Watson, T.A., F.A. Barnett, S.T. Gray and G.A. Tootle. 2009. Reconstructed stream flows for

the headwaters of the Wind River, Wyoming, USA. *Journal of the American Water Resources Association,* 45:224-236.

Kelleners, T., V.B. Paige, S.T. Gray. 2009. Measurement of the dielectric properties of Wyoming soils using electromagnetic sensors. *Soil Science Society of America Journal*, In press.

# AASC 2008 Annual Meeting
# Business Meeting Minutes
# July 9-10, 2008, Burlington, VT

Minutes of the 2007 meeting were approved in September 2007 via email.

Hope Mizzell (SC) reported that paperwork to become a 501c3 organization has been submitted, but it may take several more months to receive approval. She provided a handout of the budget; which was discussed. The budget update was presented by calendar year to coincide with tax requirements for the filing of the 990EZ form. The budget report was accepted by the membership by voice vote.

The membership was asked to approve the 501c3 'Conflict of Interest - Incorporation Policy' document; which is required for incorporation in North Carolina (the corporation address is Patton Ave in Asheville, North Carolina). Upon request from O'Brien (COAPS -FL), Knight (PA) provided additional information on the policy. A voice vote accepted the document.

Hillaker (IA) was nominated and approved by the membership as the next Secretary-Treasurer.

North Dakota, Missouri, Kentucky and Michigan were suggested as possible meeting locations for the 2009 meeting; which is to be held in the mid-west. Jeff Andresen (MI) provided a presentation that proposed Grand Rapids, Michigan as a host site. Christy (AL) offered to co-host from the south by providing support since it is difficult for southern states to host in summer. Michigan was approved as the site of the 2009 meeting by a voice vote.

Knight (PA) said that the AASC Executive Council had worked to increase the SCEP funding (State Climatologist Exchange Program), which was increased from $10,000 to $25,000. However, in late breaking news he re-introduced McGuirk (NCDC) who said that Vicki Nadolski, and Charlie Baker (who were part of the National Climate Services, NCS, panel) must have been impressed by the AASC this year. NCDC had just advised her that a proposal for $100,000 for the SCEP would be acceptable. Areas for the proposal would include monthly state of the climate, CRN & HCN-M climate network monitoring, and development of products and papers using those data. This would work towards an exercise of NCS with SCOs coordinated with RCCs working together. Coordinated proposals through RCCs possibly for scACIS, for HCN-M data analysis, supporting RCCs, support for a climate services portal, and monitoring could be considered. There needs more structure in SCOs for RCCs to be bigger player in NCS.
Stooksbury (GA) asked if that would include travel money to which McGuirk (NCDC) replied that for things like the convening of SCs by RCCs, yes. O'Brien asked if the money would be for FY 08 (available now) which was answered by yes. Knight (PA) suggested the spending deadline could actually be something like April 1, 2009. Nielsen-Gammon (TX) asked who would administer to which Knight (PA) said the AASC

executive committee would administer the funds. Dutcher (NE, HPRCC) asked how money would be allocated through the RCCs to which Knight (PA) responded it was not clear. Knight (PA) pointed out that such a proposal would put AASC's integrity on-the-line as to how well we deal with such funds. ARSCO eligibility might be required for access to funds. Stooksbury (GA) suggested that the membership vote to empower the executive committee to decide /negotiate on the members behalf on the SCEP proposal. The members approved that motion with a voice vote. Knight (PA) also offered that the new finance committee will work on the issue as well.

Stooksbury (GA) provided update on Journal of Service Climatology. The time to publication is about six months if no problems come up. 'Nasty-gram's will be sent to reviewers for being too slow with a response. Reviewers should let him know if a document cannot be reviewed in a timely manner. Stooksbury (GA) will post new article announcements via email list serve. Angel (IL) asked how many articles were published so far which was answered as three unsolicited. Stooksbury (GA) said that every paper will have a volume number and a paper number (of the volume) and that each paper starts with 'page 1'. Finance committee will work on page fee that will be reflected in 990EZ filing.

The dissertation award announcement was made. Crawford (OK), Curtis (NRCS), Brewer (NCDC) served on the Dissertation Award Committee. A motion to spend money for advertising the award passed. A discussion of the terms of the award followed. One requirement is that the dissertation must result in publication; which is good for three years. Stooksbury (GA) suggested that the recipient should present at the AASC meeting. Knight (PA) explained that the original funding for the dissertation award came from an anonymous donation.

Several honorary members were proposed by the members (Bob Lefler, George Taylor, James O'Brien, Grant Goodge, Glen Conner, Steve Doty). A discussion ensued about how to formalize the nomination process. It was decided that the proposer submit a paragraph giving a background narrative nominating an individual to the nominations committee (Crawford, Boyles, Knight). Crawford (OK) brought up that AMS does not allow more than a certain number of honorary members per year based on percentage of full membership. A plaque for accepted individuals was suggested.

Mizzell (SC) explained that the Executive Committee will remove names from the membership list if they have not paid dues. They will lose access to the List Serve Email and eligibility for the Journal.

**Thursday, July 10, 2008, morning session**

Knight (PA) extended thanks to Lesley-Ann Dupigny-Giroux (VT) for hosting the meeting and to Hope Mizzell (SC) for being Secretary-Treasurer. He also recognized Marjorie McGuirk's invaluable assistance in enhancing our relationship with NCDC resulting in an increase from $10,000 to $100,000 for the AASC State Climate Exchange Program funding.

There was a motion and approval to nominate 15 new associate members:
Mark Brooks (North Carolina State University), Bryan Aldridge (North Carolina State University), Aaron Sims (North Carolina State University), Ameenulla Syed (North Carolina State University), Ashley Frazier (North Carolina State University), Barbara Mullins (North Dakota State University), Steven Quiring (Texas A&M), Marcus Williams (FL COAPS), Matthew Gerbush (NJ SCO), Josiah Mault (WA SCO), Michael Meyer (NRCC), Jason Shafer (Lyndon State College), Charles McGill (NWS/Burlington), Stephen Hogan ( VT SCO), and Joanne Logan (University of Tennessee).

Knight (PA) recommended membership form seven standing committees to better serve the organization. The goal is to get every member involved. Only members can serve. The seven proposed standing committees include meetings, proposals, finance, policy/procedure, partners, membership/nominating, and journal.

There was discussion about need to quickly develop a White Paper on AASC's role in National Climate Services. AASC will focus on two-page summary by September 2008. Standing Committee will focus on additional short and long-term planning. Redmond (WRCC) recommended creating vision for AASC for next 15 to 20 years such as document created by RISA's on their vision for 2020. AASC should consider what society will be asking for in the future and how AASC plans to respond and meet those needs. Robinson (NJ) explained that NOAA's plan was to have proposal on National Climate Services before current administration leaves. The Review Committee wanted four recommendations created to bring to new administration rather than proposal.

Executive Committee will recommend the chair for Standing Committees. McGuire recommended adding Committee on data and combining Partners Committee with Policy and Procedures Committee. Knight (PA) recommended keeping the same for now will adjust after first year.

Mote (WA) recommended summarizing standing committees and send by email to encourage participation by those not at meeting. Members suggested including newer members as well as older members. We must also include NCDC and NWS.
Action teams formed during 2007 Business Meeting will be absorbed into new Standing Committees as needed.

Members signed up for various Standing Committees, which include:
**Meeting**: Adnan Akyuz, Phil Mote, Lesley-Ann Dupigny-Giroux, Jeff Andresen
**Strategic Plan**: Kelly Redmond, Mark Shaffer, John Nielsen-Gammon, Jim Angel, Mike Anderson, Deke Arndt, David Stooksbury
**Finance**: Hope Mizzell, Harry Hillaker, John Christy
**Policy and Procedures**: Ken Crawford, Jim Zandlo, Pat Guinan, Jan Curtis, Dave Robinson, Stu Foster, John Young
**Partners**: Ryan Boyles, Dennis Todey, Art Degeatano, Jan Curtis, Dave Robinson

**Membership**: Ryan Boyles, Barry Keim, Deke Arndt, Al Dutcher, Paul Knight
**Journal**: Dave Stooksbury, Editors

Closed meeting with motion from Steve Hilberg (MRCC) and Jeff Andresen (MI) provided second.