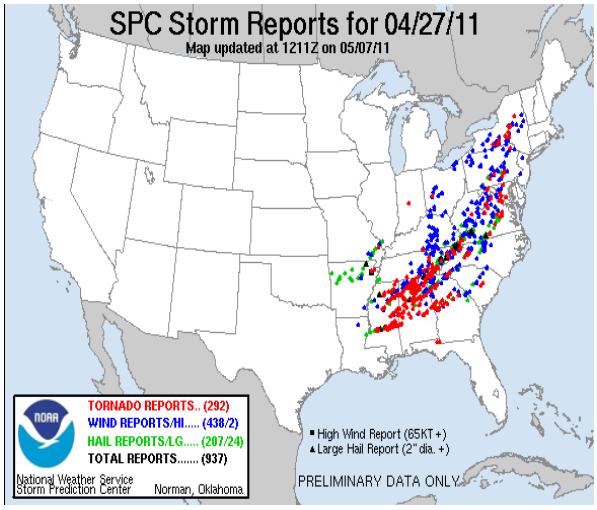
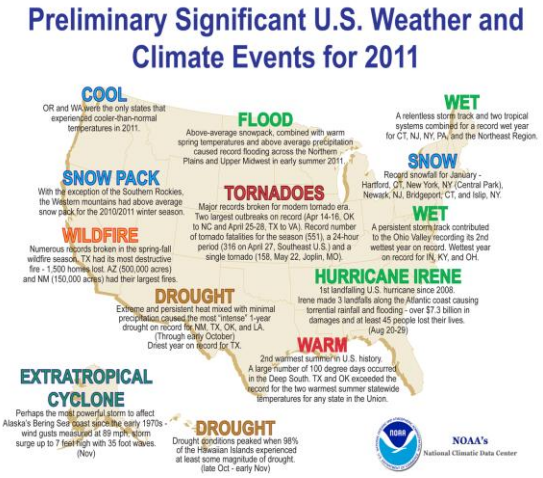
THE STATE CLIMATOLOGIST

2011/12 Annual Summary

Volume 30, Issue 1

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





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 editor of this year's edition spanning the period of January – December 2011 (with some reports also extending into early 2012).

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.

Mathieu R. Gerbush
Office of the NJ State Climatologist
Rutgers University

June 29, 2012

Table of Contents

Summer 2012

Dear Fellow Climatologists, Partners and Friends of the AASC:

Welcome to the 2012 publication of The State Climatologist, the annual update of activities of the state climatologists, regional climate centers and other partners in climate services across the country. These summaries "tell the story" of the important work being done in the country to serve the clientele at state and local levels where people live, work and need to make decisions on a daily basis about how weather and climate affect their lives now and in the future.

The last year has been another impressive one for climate impacts. The southern United States experienced a major multi-seasonal drought which required the response and input of many state climatologists, regional climatologists, RISAs and NOAA partners to deal with the impacts and deliver information about the drought.

The northern Plains also experienced a major climate event, though a much wetter event. Several steps (including a wet fall, winter snow and heavy spring rains) combined to produce a flood on the Missouri River, unseen in the time of the Missouri River Dam system. Many people had their livelihood or dwellings impacted because of this. Several climatologists were involved in dealing with the current issues and follow-up to the event.

A very warm and snow-free winter and early spring introduced another set of potential issues for horticultural crops and to a certain extent agricultural crops across much of the northern and central parts of the country. Climatologists in this case were able to be proactive and talk with people about potential issues ahead of some of these events to mitigate some damage.

These major climate events and many other lesser events are what state climatologists and their partners work on daily. Developing tools, innovative ways of assessing or accessing data or using data to make decisions are all ways that these people continually serve the needs of their clientele. As I end my term as president of the American Association of State Climatologists I thank these people for their service and applaud them for continually striving to develop new ways (usually with very limited resources) to serve their stakeholders. Their collegiality and dedication to service are refreshing to see every day.

Sincerely,

Dr. Dennis Todey
President American Association State Climatologists
South Dakota State Climatologist

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.

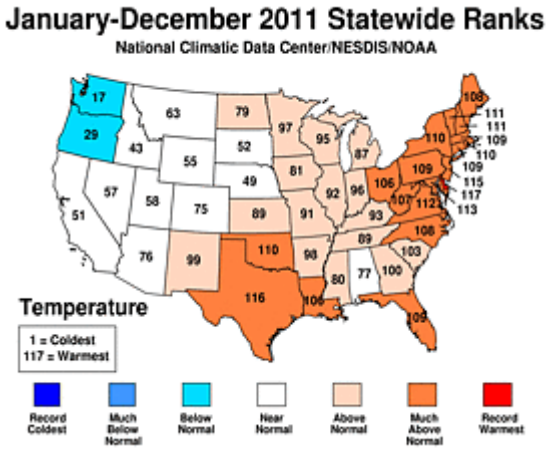
Candidate offices must demonstrate the following capabilities:

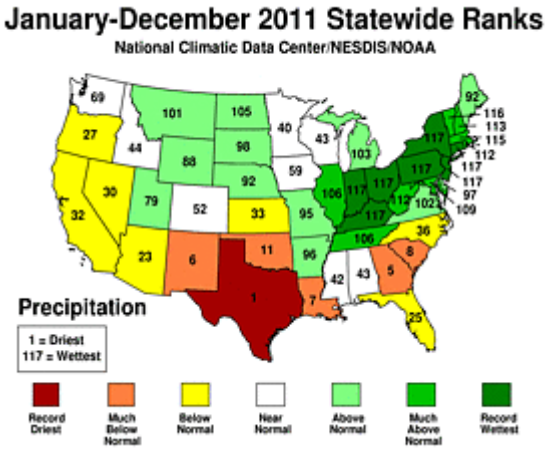
- Communication capabilities – the office must be able to communicate with its clientele via multiple media, including telephone, Internet, mail, E- mail, and fax;
- Information services – the office must be capable of providing a range of data and information;
- Research – the office must conduct research 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, 38 states have received ARSCO status.

2011 SUMMARY OF THE UNITED STATES CLIMATE

Compiled from reports by the National Climatic Data Center





In 2011, the contiguous United States (CONUS) average annual temperature of 53.8 degrees F (12.1 degrees C) was 1.0 degree F (0.6 degree C) above the 20th century average, and was the 23rd warmest year on record. Since 1895, the CONUS has observed a long-term temperature increase of about 0.12 degree F (0.07 degree C) per decade. Precipitation across the CONUS in 2011 was 0.36 inch below the long-term average (LTA). Over the long-term, precipitation averaged across the CONUS, is increasing at a rate of about 0.18 inch (4.6 mm) per decade.

On a statewide and seasonal level, 2011 was a year of temperature and precipitation extremes for the United States. Most states east of the Rockies had annual temperatures which were above average. Sixteen states had annual temperatures among their ten warmest. Delaware was record warm for the period, with an annual temperature of 58.2 degrees F (14.6 degrees C), or 3.5 degrees F (1.9 degrees C) above average. Texas had its second warmest year on record, with an annual temperature anomaly of 2.2 degrees F (1.2 degrees C), just shy of the annual record of 2.5 degrees F (1.4 degrees C) set in 1921. The western states had annual temperatures which were near average, with the exception of Oregon and Washington, which were the only two states with annual temperatures below average.

Although the CONUS as a whole was drier than average for the year, several states and cities were record wet during the year. Above-average precipitation was widespread across the northern CONUS during 2011, with the wettest part of the country being the Ohio Valley and Northeast. Seven states across the two regions — Connecticut, Indiana, Kentucky, New Jersey, New York, Ohio, and Pennsylvania — had their wettest year on record. Below-average precipitation was present across the West, and along the southern tier of the country. Georgia (5th driest) New Mexico (6th), Louisiana (7th), and South Carolina (8th) had annual precipitation totals among their ten driest. Texas was record dry for the year, with 14.89 inches (378 mm) of precipitation — 13.03 inches (338 mm) below the 20th century average. The year 2011 surpassed 1917 as the driest year on record for Texas, when 14.99 inches (381 mm) of precipitation was observed across the state. When the wetter-than-average conditions across the northern CONUS are averaged with the drier-than-average conditions across the southern CONUS, they nearly cancel each other out in the nationally averaged precipitation total. When the precipitation extremes are combined cumulatively, like in the U.S. Climate Extremes Index (CEI), they tell a different story. The

combined percent area of the country experiencing either extremely-wet or extremely-dry conditions during 2011 was record high at 58 percent.

A list of select cities breaking annual temperature and precipitation records during 2011 can be found here.

Seasonal highlights in 2011 include a cooler-than-average winter (December-February) across much of the CONUS, with the coolest temperature anomalies (the temperature compared to the 20th century average) anchored across the Southeast. Spring (March-May) brought precipitation extremes to much of the CONUS, with ten states across the northern U.S. having a wettest spring on record, with flooding occurring across the Upper Midwest and the Ohio and Mississippi Valleys. The Southern Plains were extremely dry during spring, a precursor for the record drought which persisted into summer. Wildfires ravaged the Southern Plains and Southwest during spring, with record acreage burned during the 3 months. Numerous tornadoes impacted the Southeast in April, with 748 confirmed during the month — a new national record for any month. Summer (June-August) 2011 was the second warmest three months on record for the CONUS, with much of the U.S. having much-above-average temperatures, with the exception of the Northwest. Oklahoma and Texas both exceeded the previous records for warmest summer on record for any state. Hurricane Irene, the first land-falling U.S. hurricane in three years, made three landfalls along the Atlantic coast in late August, causing damage from the Carolinas to Vermont.

This annual report places the temperature and precipitation averages into historical perspective, while summarizing the notable events that occurred in 2011. More detailed analysis on individual months can be found through the Climate Monitoring home page.

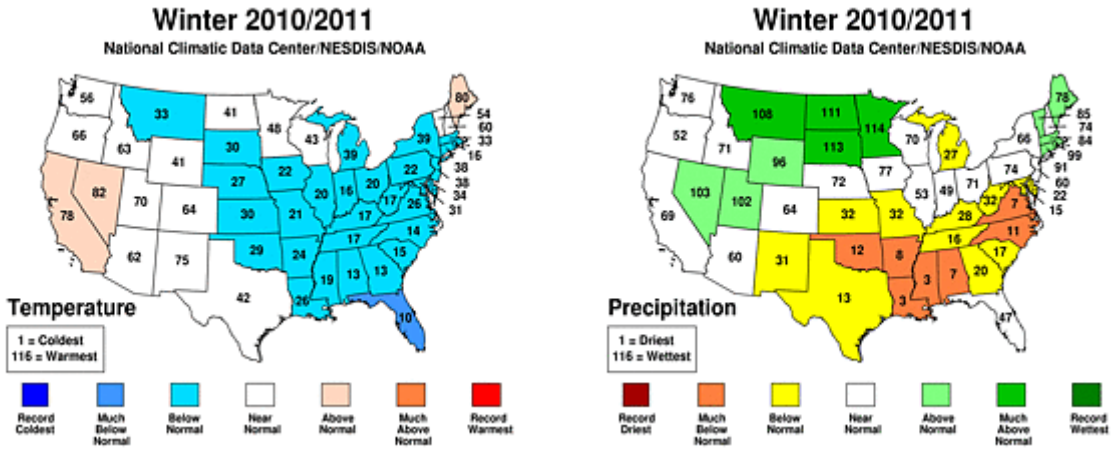
Top Ten U.S. Weather/Climate Events for 2011

The following is a list for the top ten U.S. weather/climate events which occurred during 2011. These events were selected by a panel of weather/climate experts from around the country. For additional information on these events, please see our Top Ten U.S. Events webpage.

Rank	Event
1	April 25th–28th Tornado Super Outbreak
2	Southern U.S. Drought (spring–summer)
3	Joplin, Missouri EF-5 Tornado (May 22nd)
4	Mississippi River and Ohio River Flooding (spring)
5	Oklahoma and Texas — Hottest 3-month Statewide Temperatures on Record (summer)
6	Hurricane Irene (August)
7	Northern Plains and Upper Midwest Flooding (early summer)
8	U.S. Wildfire Season (spring-summer)
9-tie	Tropical Storm Lee (September)
9-tie	April 14th–16th Tornado Outbreak

Seasonal Analysis

Winter

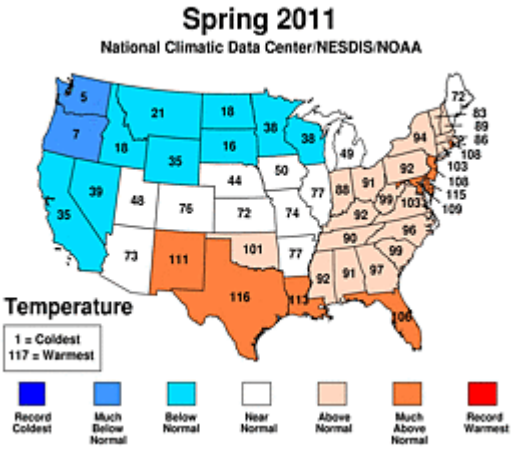


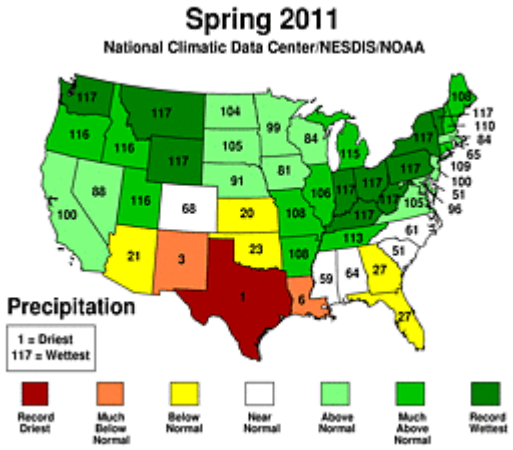
The 2010/11 winter season was marked by anomalously cold temperatures across the eastern half of the country, with the coolest temperature anomalies across the Southeast. The CONUS had an average winter temperature of 32.2 degrees F (0.1 degrees C), which was 0.7 degrees F (0.4 degrees C) below average. Florida had its tenth coldest winter on record. A strong negative phase of the Arctic Oscillation (AO) was associated with much-cooler-than-average temperatures across the eastern U.S. during the first half of winter. Florida and Georgia both had their coolest December on record, with temperature anomalies of more than 9 degrees F (5 degrees C) and 8 degrees F (4 degrees C) below average, respectively. By mid-January, the negative phase of the AO had subsided, and more seasonal to above-average temperatures returned to the Southeast by February. A different scenario played out across the West, with the winter season beginning warmer than average but ending much cooler than average. On the regional scale, only the West climate region had winter temperatures that were above normal. The Southwest and Northwest were near-normal, while all climate regions east of the Rockies were cooler than normal.

The presence of La Niña during winter influenced precipitation patterns during the season. The 3-month average CONUS precipitation of 5.71 inches (145 mm) was 0.76 inch (19 mm) below average. Drier-than-average conditions were observed across much of the southern U.S., from New Mexico to Virginia. Louisiana, Arkansas, Alabama, Mississippi, and Virginia had winter precipitation totals ranking among their ten driest. A persistent storm track brought above-average precipitation to the Northern Plains and Upper Midwest, where Montana, North Dakota, South Dakota, and Minnesota had a winter season ranking among the ten wettest. The above-average precipitation across the Northern Plains contributed to a much-above-average snowpack across the region. A massive winter storm impacted the central U.S. during February, dropping 2 feet (61 cm) of snow in the Chicago area. The storm caused at least 1.8 billion U.S. dollars worth of damage, and killed at least 36 people. The storm track across the Northern U.S. and few storms making it into the South and Southeast are consistent with La Niña conditions. The wetness across the

Northern Plains primed the region for spring and summer flooding, while the dryness in the South was a precursor to the spring and summer drought.

Spring



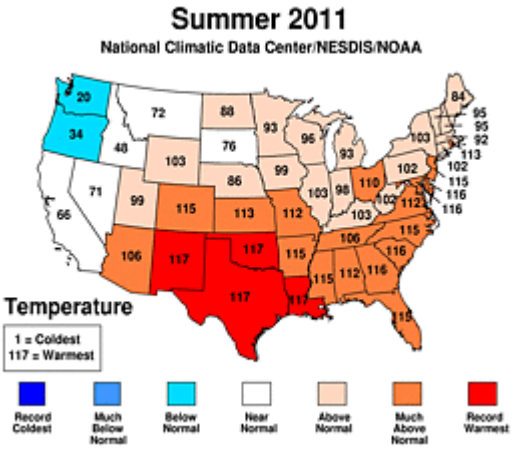


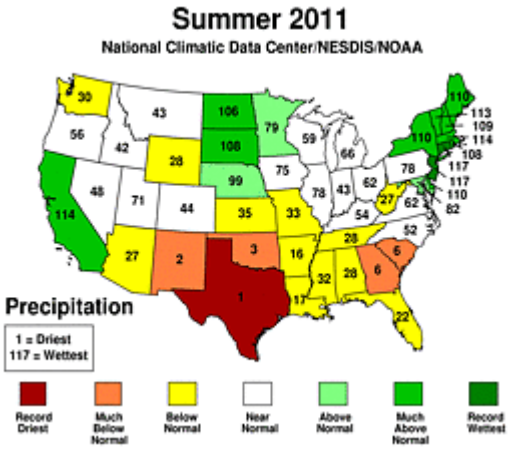
The spring (March-May) average CONUS temperature of 52.3 degrees F (11.3 degrees C) was 0.5 degree F (0.3 degree C) above average. Regional spring temperatures were consistent with an upper level trough across the West and an upper-level ridge across the South and East. Above-normal temperatures were present from New Mexico, across the South, and along the Eastern Seaboard. Texas had its second warmest spring on record. The West, Northwest, and Northern Plains were cooler than average during spring — Washington had its fifth coolest spring on record and Oregon its seventh coolest.

The precipitation (and lack of precipitation) was the big story during spring 2011. The nationally-averaged precipitation during the season was 1.41 inches (39 mm) above average. Consistent with a spring La Niña, a persistent pattern set up in which the Pacific Northwest and Northern Rockies saw frequent storm systems and invasions of cold air. In the South, storm systems repeatedly developed in the mid-Mississippi Valley, just a few hundred miles from the drought-stricken Southern Plains, then raced northeastward. In general, drought intensified in the South, while much of the Northeast, Ohio Valley and Northwest were subjected to historic or near-historic wetness. A total of 10 states were record wet during spring, and an additional 11 states had spring precipitation totals ranking among their ten wettest. The storms brought snow pack totals across much of the West to more than 180 percent of normal. The record precipitation and snow melt caused significant flooding in late spring and early summer along several rivers, including the Mississippi, Ohio, Missouri, Souris, and James. The runoff from the precipitation put significant stress on the levee systems along these rivers, and several levees were deliberately breached to flood farm lands and protect cities. In contrast to the wetness, Texas was record dry for the three-month period. Its statewide-averaged precipitation for spring was a paltry 2.56 inches (65 mm), more than 5 inches (127 mm) below normal. The dryness across the Southern Plains was associated with record wildfire activity during the spring period, when approximately 3.2 million acres (1.3 million hectares) burned — a new spring record. The active storm pattern brought a record-breaking severe weather season to the South and Southeast. As strong storms moved into the warm and moisture-

rich atmosphere across the Southeast, 1,155 tornadoes were spawned, killing hundreds of people and causing over 20 billion U.S. dollars worth of damage.

Summer

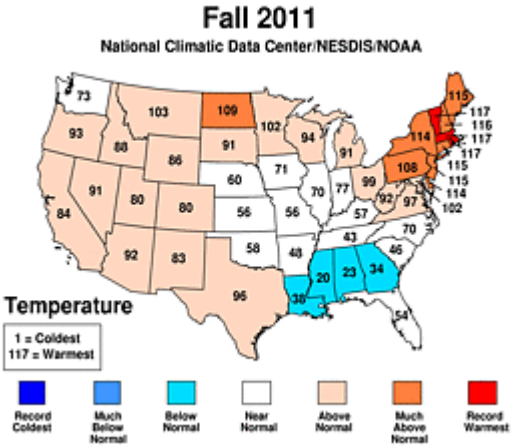


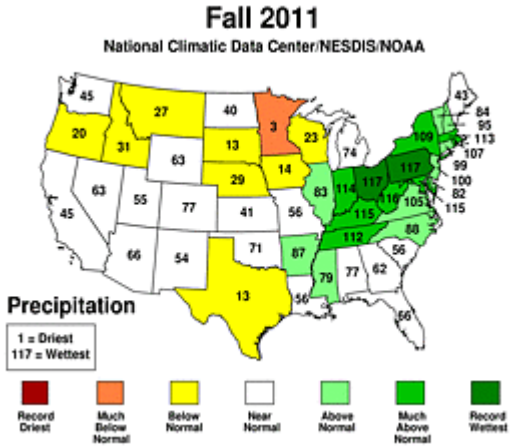


The summer period (June-August) was warm for much of the CONUS, with only Oregon and Washington having summertime temperatures ranking among the bottom third of their historical distributions. The CONUS, as a whole, had its second warmest summer period on record with an average temperature of 74.5 degrees F (23.6 degrees C), 0.1 degree F (0.1 degree C) below the warmest summer on record in 1936. A persistent ridge across the eastern U.S. brought the epicenter of the hot temperatures to the Southern Plains, where New Mexico, Texas, Oklahoma, and Louisiana had their warmest summer on record. The statewide average summer temperature of 86.9 degrees F (30.5 degrees C) in Oklahoma marks the warmest three-month period for any state on record. During the summer of 2011, all states across the contiguous U.S., with the exception of Vermont, experienced at least one day with a location having a daily maximum temperature exceeding 100 degrees F (37.8 degrees C).

The drought across Texas was amplified during the summer of 2011, due to the very warm temperatures and the lack of precipitation. The state had its driest summer on record with a statewide average of 2.44 inches (62.0 mm) of rain accumulating. This is 5.29 inches (134.4 mm) below the long-term average, and 1.04 inches (26.4 mm) less than the previous driest summer in 1956. At the end of August, 81 percent of Texas was in the worst category of drought (D4, 'Exceptional' Drought), and analysis of tree-ring records dating back to 1550 indicated that the summer of 2011 drought is matched by only one summer (1789) in the 429-year tree-ring record. A persistent dome of high pressure was present for much of the summer across the Southern Plains, limiting storms from entering the region and causing temperature to soar. The Northeast was wetter than average during the summer period, partially because of Hurricane Irene bringing heavy rainfall to the region the last week of August. Connecticut and New Jersey were record wet for the summer. As a whole, the CONUS was drier-than-average with a nationally average precipitation total 0.9 inch (23 mm) below the LTA.

Fall

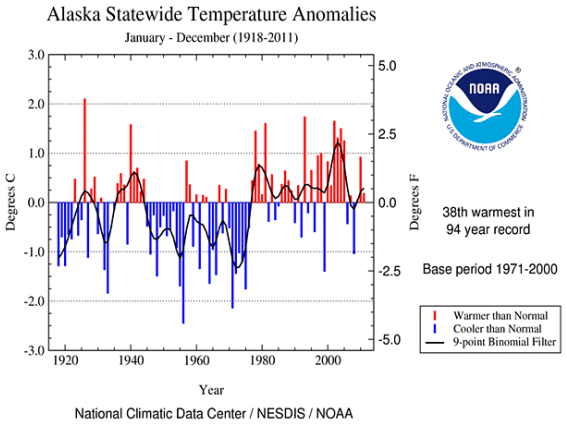


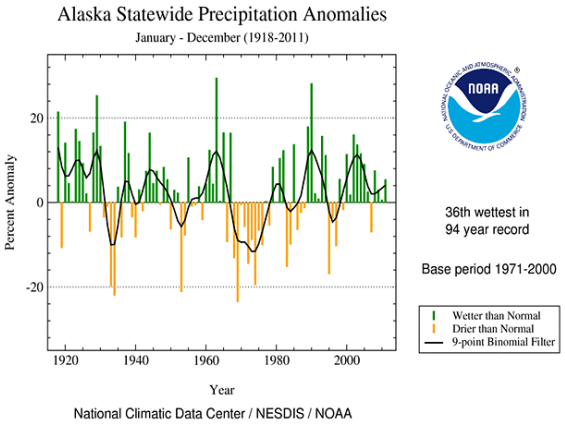


Although autumn (September-November) 2011 brought several extremes to the U.S., it was a significantly quieter season compared to the spring and summer. The average autumn temperature for the CONUS was 1.3 degrees above average. Most states had autumn temperatures near average, while Massachusetts, Rhode Island, and Vermont had their record warmest fall. Eight other states had an average temperature that was one of the ten warmest on record. Conversely, four states in the Southeast and along the Gulf Coast had below-average autumn temperatures.

Two significant storms impacted the CONUS during autumn. Tropical Storm Lee made landfall along the Louisiana coast on September 4th, and moved along a frontal boundary into the Ohio Valley and eventually into the Northeast. The storm brought much needed precipitation to the drought stricken Gulf Coast, but added to the annual precipitation totals of the Ohio Valley and Northeast. An early season storm brought heavy snow accumulations to the northeastern United States on October 29th-31st. The heavy, wet snow falling on the autumn foliage, combined with strong winds, caused havoc across the region. During autumn, the western half of the CONUS had precipitation which was near to slightly below the LTA. Beneficial precipitation fell across the core drought areas of Texas and Oklahoma. Minnesota had its third driest autumn on record. In contrast, many states across the Ohio Valley and Northeast had a very wet autumn. Pennsylvania and Ohio were both record wet for the period, and five other states had autumn precipitation ranking among their ten wettest.

Alaska Annual Summary



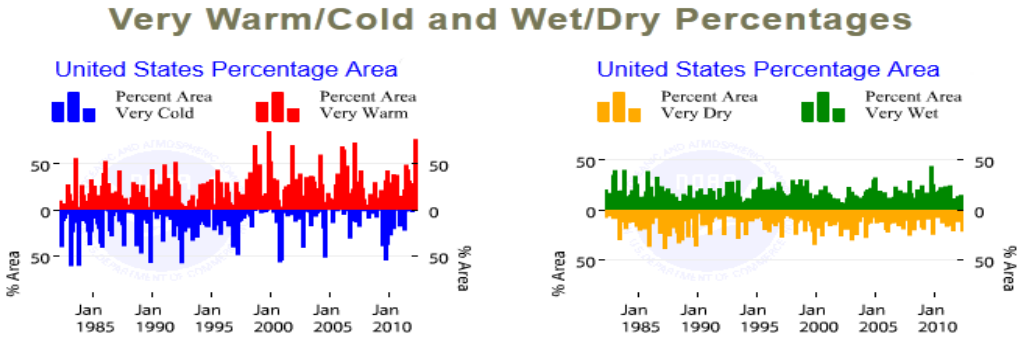


Alaska temperatures in 2011 were above the 1971-2000 average, continuing the upward trend of the last 20 years. However, there was variation between the seasons. Winter temperatures in 2010-2011 were 0.4 degrees F (0.2 degrees C) below average. Spring temperatures were 0.9 degrees F (0.5 degrees C) below average, summer temperatures were 0.7 degrees F (0.4 degrees C) below average, and fall was 0.4 degrees F (0.2 degrees C) warmer than the average. For the annual period, Alaskan temperatures were 0.2 degrees C above average, driven almost entirely by very warm temperatures in December (third warmest December).

Precipitation in Alaska in 2011 was slightly above average. The winter season brought near-normal precipitation to Alaska, while the spring was much drier than average. Summer was wetter than average across Alaska and autumn precipitation was slightly below average.

In November, a large and powerful extratropical cyclone slammed into western Alaska, with extremely high tides, strong winds, heavy rain, and blizzard conditions. Winds gusted to over 80 mph (130 km/hr) and the storm surge topped 8 feet (2.4 m), marking the strongest storm to impact the region in decades.

Very Warm/Cold and Wet/Dry Percentages



United States Percentage Area

One way to assess the magnitude of warm/cold and wet/dry episodes is to compute the percent area of the contiguous United States that was "very warm/very cold" and that which was "very wet/very dry". The figures above depict these values for each month in the past 30 years. These percentages are computed based on the climate division data set. Those climate divisions having a monthly average temperature/precipitation in the top ten percent (> 90th percentile) of their historical distribution are considered "very warm/very wet" and those in the bottom ten percent (< 10th percentile) are "very cold/very dry".

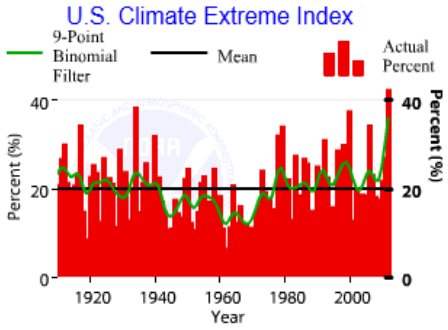
During 2011, the U.S. experienced a cooler-than-average winter, which transitioned into a warm spring, summer, and autumn. In terms of the area of the contiguous U.S., 18 percent experienced temperatures that were in the bottom 10th percentile or categorized as "very cold" in December 2010. This definition correlates well with "much below normal" in terms of NCDC ranking methods. The extremely cool temperatures dissipated during January and February. The percent area of the country experiencing “very cold” conditions reached its highest value of 2011 during May, when it reached 22.7 percent. Most of those cool temperatures were present across the West, where Washington, Oregon, and Wyoming had a top ten cool month. Influenced by a strong Bermuda High and dome of high pressure, “very warm” conditions prevailed for April (22 percent of the country), June (29.7 percent), July (48.8 percent), August (43.5 percent), and September (25.44). The warm season, which as defined at April-September, was the seventh warmest for the CONUS, and Texas and Oklahoma were record warm.

Large areas of the CONUS experienced “very wet” and “very dry” conditions during 2011. The wetter-than-average conditions across the northern regions of the CONUS were counterbalanced by drier-than-average conditions across the southern regions. The percent area of the country experiencing very wet conditions peaked in April, when 24.3 percent of the CONUS was “very wet”. The smallest percent area of the country classified as “very wet” during 2011 was in June when the percent area dropped to 6.7 percent. The drought across the Southern Plains and Southeast contributed to large areas of the CONUS being “very dry” in 2011. The percent area of the U.S. as “very dry” peaked in August at 21.7 percent and again in December at 25.0 percent. A large area of the western U.S. was near-record dry during December 2011.

When the area of the country that experienced “very warm” conditions in the summer period (June, July and August) are averaged, the total area extent of 40.7 percent surpasses the previous record of 38.1 percent set in 1934, the fourth warmest summer on record. The effects of the record warmth in

the Southern Plains during the summer period were compounded with the parched soils. More than 16 percent of the country was considered "very dry" most of it concentrated in the southern plains. The area of "very warm" conditions combined with "very dry" conditions was only second to 1936.

Climate Extremes Index

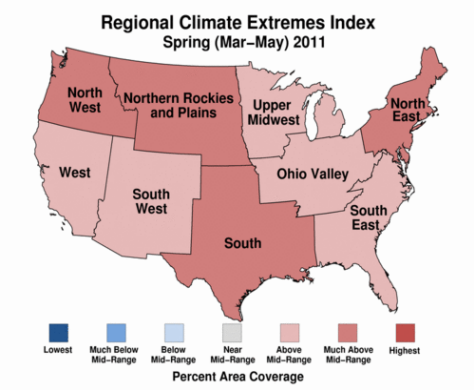


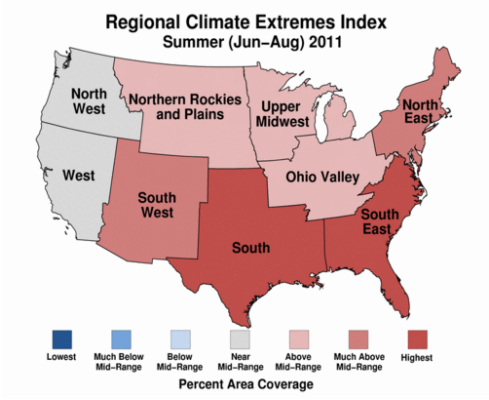
U.S. Climate Extreme Index

The U.S. Climate Extremes Index (CEI) measures the occurrence of several types of climate extremes, such as record or near-record warmth, dry spells or rainy periods. In 2011, extremes in both temperature and precipitation were observed around the country and had a large impact on several regions. Persistent drought plagued much of the South and southeastern U.S., while parts of the Ohio Valley and the Northeast experienced record rainfall. In addition, much of the Mid-Atlantic, Northeast and South experienced much-above-average temperatures throughout the year, while the Pacific Northwest remained relatively cool. For the contiguous U.S., the spatial extent of extremes, as measured by the CEI, during the annual season was approximately 12 percent greater than the historical average. This above-average extent of extremes was primarily due to extensive extremes in warm maximum and minimum temperatures, extreme wetness and dryness, as denoted by the Palmer Drought Severity Index (PDSI), and an abundance of days in which precipitation fell. Regions which experienced some of the most wide-spread extremes during 2011 include the South, Southeast and Northeast. Nearly half of the South region was impacted by a blend of extremes in warm maximum and minimum temperatures as well as PDSI dryness. Over one third of the Southeast was impacted by a combination of warm maximum and minimum temperatures as well as PDSI dryness. Over 70 percent of the Northeast experienced extremes in warm maximum and minimum temperatures in addition to PDSI wetness, extremes in 1-day precipitation, and an abundance of days in which precipitation fell. During 2011, the most prominent and widespread extremes occurred during two seasons: spring and summer.

At the National level, the spring season was near normal for both temperature and precipitation, despite large regional differences. Warm extremes were confined to the Deep South and parts of the Mid-Atlantic states, while cool extremes occurred across the Northwest and northern-tier states. Record wet conditions persisted across much of the Ohio Valley and into the Northeast as well as across parts of the Northwest. Record dryness existed across Texas with much below average precipitation realized in other parts of the South.

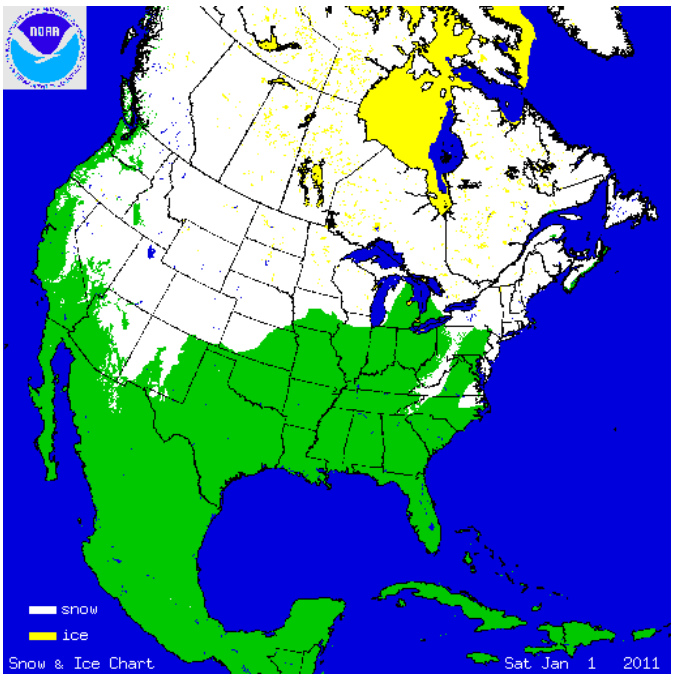
For the contiguous U.S., the spatial extent of the CEI was nearly twice the historical average during spring. Factors contributing to the elevated 2011 spring value were large footprints of warm and cold maximum temperatures, areas of extreme PDSI wetness, and an abundance of days in which precipitation fell. Regions of the country which were most significantly impacted by extremes during the spring season were the Northwest, Northern Rockies and Plains, South and Northeast regions. In fact, the Northeast and the South regions had their 2nd highest extent of extremes on record with 57 percent and 43 percent of each region affected by extremes during this season, respectively.

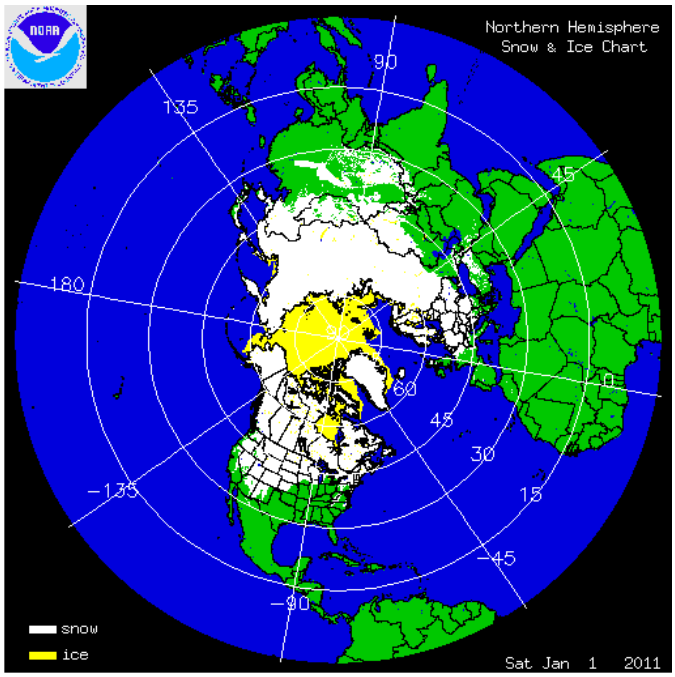




The summer season was second warmest on record for the U.S. with much above average temperatures to record heat extending from the South though the Mid-Atlantic states. Precipitation received from Hurricane Irene impacted parts of the Northeast while drought conditions persisted across one third of the U.S. The CEI for the contiguous U.S. was approximately twice the historical average during summer. A record 63 percent of the South region was impacted by extremes during the summer months. Approximately 96 percent of the region succumbed to extremes in warm maximum temperature, 95 percent to extremes in warm minimum temperature and 78 percent to extremes in PDSI dryness. For the Southeast, extremes impacted a record 53 percent of the region with the largest contribution coming from extremes in warm maximum temperature, warm minimum temperature and PDSI dryness.

National Snow & Ice

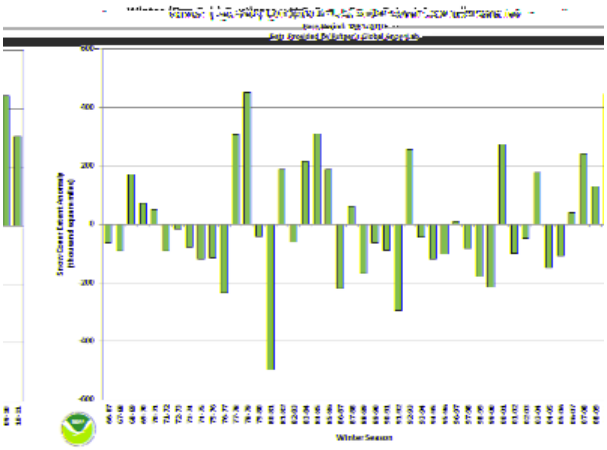




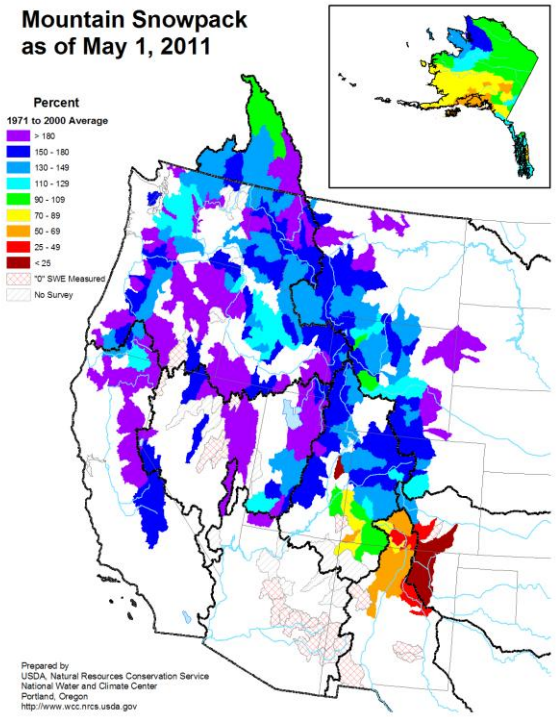
(click for national and hemispheric animated loops)

The 2010-2011 winter began with a bang for much of the Eastern U.S. with several snowstorms and cold temperatures impacting the Eastern Seaboard during December and January. However, the end of the winter season was much quitter when above normal temperatures returned to the region in February. The change in the weather regime coincided with the transition of the Arctic Oscillation (AO) from a near-record negative phase to a positive phase. Significant snowfalls occurred throughout the winter season across the Intermountain West, across the Northern Plains and into the Ohio Valley. The active pattern across these regions is consistent with the La Niña conditions which were present for the entire season across the equatorial Pacific. The heavy snowpack, combined with above-normal spring precipitation caused significant flooding across the Northern Plains and the Mississippi and Ohio Valleys when warm temperatures returned in late spring.

When conditions are averaged for the three-month winter period (December 2010 - February 2011), below-normal temperatures were anchored across the eastern half of the country, with above-normal temperatures for the Southwest. Drier-than-normal conditions were widespread across the South, Southeast, and into the Mid-Atlantic. Wet conditions were present for the Northern Plains, stretching into the Northeast. Snow cover extent, which is measured from NOAA satellites and provided by Rutgers Global Snow Lab, was above average for each winter month, stretching into the spring. Across the U.S., each month from



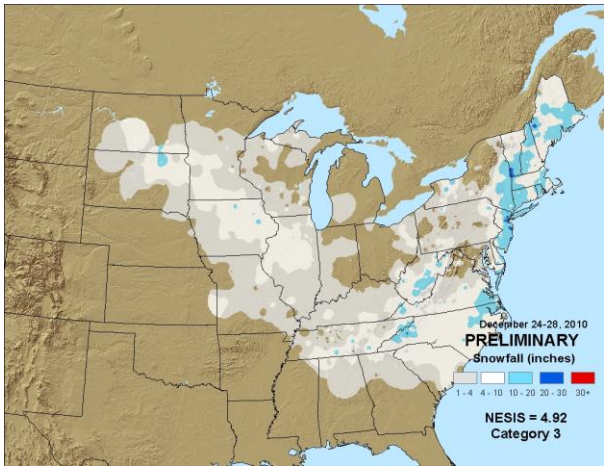
December through April had snow cover extents were among the ten largest on record. The winter (December-February) average snow cover extent for the contiguous U.S. was 305,000 square miles (790,000 square km) above the 1981-2010 average and ranked as the fifth largest winter snow cover extent in the 1966-present period of record.



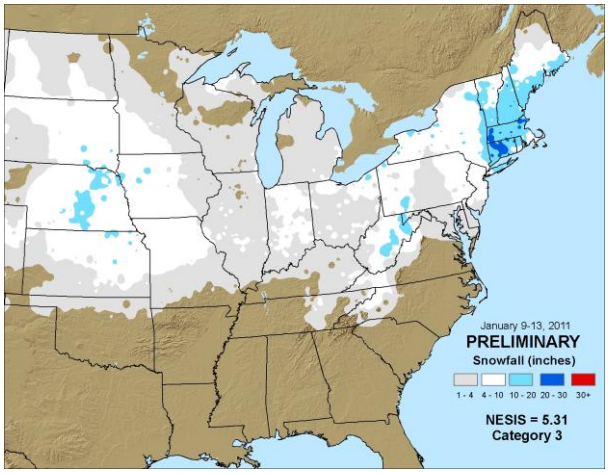
Winter and spring mountain snowpack provide a crucial water source across much of the western United States. The total annual water budget for agriculture and human use in the mountainous West is based upon the amount of snow melt that will occur in spring and is proportional to the amount of snow on the ground. The annual snowpack typically reaches its maximum value at the end of March. This year, late season snowfall across the Central and Northern Rockies contributed to a much above average snow cover extent well into April. According to data from the USDA, as of May 1st, 2011, much above normal snowpack was observed from the Cascade Mountains, southward into the Sierra Nevadas, and across the Central and Northern Rockies. Snowpack values more than 180 percent of normal were widespread. Below-normal snowpack was observed across much of the Southern Rockies of Arizona, New Mexico, and southern Colorado. Some areas of New Mexico had snowpack totals below their 25th percentile. Alaska generally had near-normal snowpack at the end of the snow season. Slightly below-normal snowpack was present across the southern coasts of Alaska while above-normal snowpack was observed across the western regions of the state.

Select Significant Events

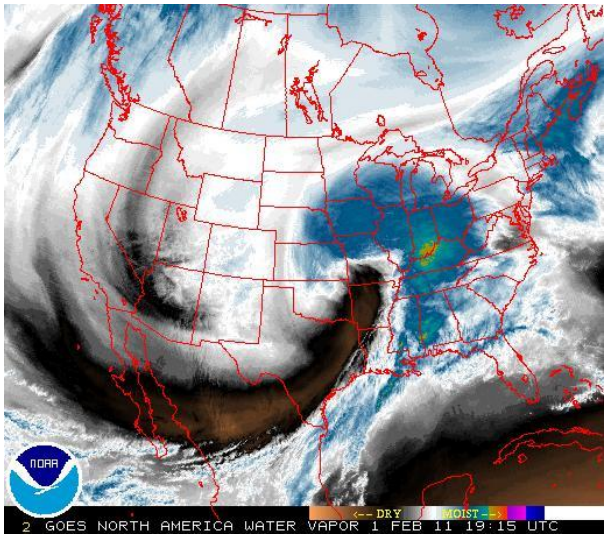
A strong blizzard hit Minnesota, Iowa, and Wisconsin on December 10th-12th 2010, bringing over a foot of snow to the region and sustained winds of 35 mph (56 km/hr). The 17 inches (43 cm) of snow that fell in Minneapolis was the 5th largest snowstorm accumulation ever for the city and the largest December snowfall on record. Minneapolis set a new December snowfall record with a monthly total of 33.6 inches (86 cm), the previous December record was set in 1969 when 33.2 inches (85 cm) of snow was reported. Data for the city goes back to 1884. The 22 inches (56 cm) which fell in Eau Claire, Wisconsin on the 11th is the highest single calendar day snowfall total in history for the city. An unusual aspect of the storm was the high snow-to-water equivalent, which represents how heavy the snow was. The heavy nature of the snow, as well as the amount and strong winds, contributed to the collapse of the Metrodome roof, home to several professional sports teams. Fortunately the building was empty at the time of the collapse, and no one was injured.



A low pressure system moved across the southern U.S. and interacted with another system moving from the Northern Plains the last week of December 2010. The two systems brought widespread snowfall from Minnesota, southward to Alabama and Georgia and along the Eastern Seaboard to Maine on December 24th-28th. Many locations in the Southeast experienced their first white Christmas on record, and many cities broke daily snowfall records because of the storm. As the system moved up the Atlantic Coast, it strengthened, bringing heavy snowfall to the major cities in the Northeast. Central Park in New York City received 20 inches (51 cm) of snow, marking the sixth largest snowfall there, while Boston received 18.2 inches (46 cm), the city's eighth biggest snow storm on record. The 20.1 inches (52 cm) which fell at the Atlantic City International Airport was a single snowstorm record. The Northeast Snowfall Impact Scale (NESIS) score, which measures the areal extent of snow and impact of snow extent/depth on populated areas, was a Category 3 (major).

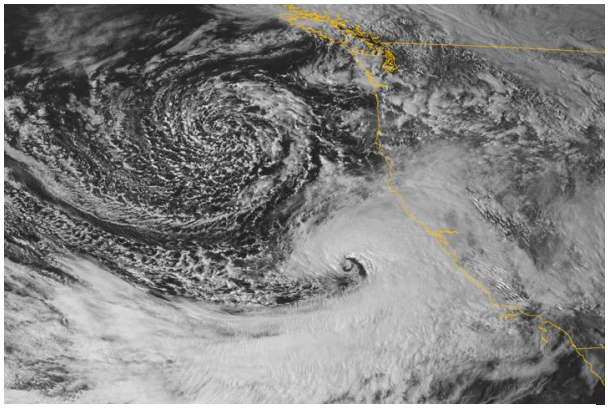


The first major winter storm complex during 2011 impacted the eastern half of the United States between January 9th-13th, dropping over a foot (30.5 cm) of snow for many locations across the Central Plains, Midwest, Southeast, Mid-Atlantic, and Northeast. A significant freezing rain and icing event occurred across many portions of the South and Southeast. The event began across northeast Texas on the 9th where over 6 inches (15.2 cm) of snow accumulated. The upper level low pressure system progressed along the Gulf Coast, drawing moisture from the Gulf of Mexico, causing a large precipitation shield over the Southeast. Parts of Mississippi, Arkansas, Tennessee, Alabama, and Georgia received over 10 inches (25.4 cm) of snow by the 10th. Huntsville, Alabama received 8.9 inches (22.6 cm) of snow, marking the third largest snow storm on record for the city. Parts of the Atlanta metropolitan area received eight inches (20 cm) of snow, shutting down the city for days. In the North Carolina mountains, up to 20 inches (51 cm) of snow were reported. The storm system then moved northward along the Atlantic Coast, bringing heavy snow to the population centers of the Northeast. Blizzard conditions were reported in Boston for several hours on the 12th. The 24 inches (61 cm) which fell at Bradley International Airport in Windsor Locks, Connecticut broke the previous all-time greatest storm record of 21.9 inches (56 cm), set on February 12th, 2006. Six states declared states of emergency. After the event, 49 of 50 U.S. states (all except Florida) had snow on the ground. The preliminary NESIS score was a Category 3 (major).



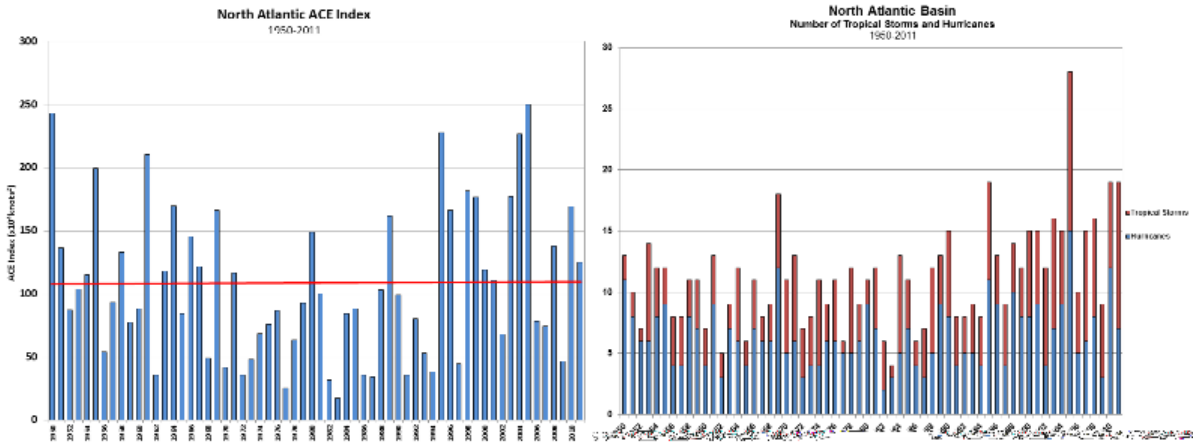
On February 1st-3rd a large and powerful winter storm, dubbed the 'Groundhog Day Blizzard', hit the central and northern regions of the United States from New Mexico northward to Wisconsin, and eastward to New England. The storm stretched for thousands of miles, leaving behind at least five inches (12.7 cm) of snow in 22 states. The multi-faceted storm also brought an inch of ice to portions of the Ohio River Valley. Winds gusting upwards of 70 mph (113 km/hr) created widespread blizzard conditions, and snow drifts were reported as high as 10 feet (3 meters). Numerous highways were forced to close and thousands of flights were cancelled nationwide. The storm began across the Southern Plains on the 1st, where it dropped 1 to 2 feet (30.5 cm 61 cm) of snow across Texas, Oklahoma, and Missouri. The largest snow amounts occurred across northern Illinois and southern Wisconsin on the 2nd. At Chicago's O'Hare Airport, the 20.2 inches (51.3 cm) of snow was the third largest storm accumulation ever recorded for the city. Racine, Wisconsin observed 26 inches (66.0 cm) of snow during the event, breaking the city's 48-hour and 72-hour snowfall records. Snowfall records date back to 1886 for Chicago and to 1896 for Racine. The storm then moved off into the Northeast on the 3rd, where it left behind a foot of snow. Damages from the storm exceeded one billion U.S. dollars.

A series of large Pacific storms made landfall along the U.S. West Coast between March 18th-26th. The storms brought incredible amounts of rain and snow from Washington State to Southern California. These storms contributed to many high-elevation observation stations having impressive snowfall totals for the month and the winter season. Squaw Valley at Lake Tahoe, California reported 241 inches (612 cm) of snowfall during March 2011. Alpine Meadows, California reported 315 inches (800 cm) of snow on the ground after these storms moved through, and several snow observation stations in the Sierra Nevadas received as much as 145 inches (368 cm) during the 9-day period. The snow added to the amount of water contained in the snow pack measured by snow water equivalent (SWE). At the end of March, some high elevation stations in California had SWE values approaching 80 inches (203 cm). For California as a whole, the average snowpack was 48 inches (122 cm) on April 1st, 168 percent of average. At some locations in the Sierra Nevadas, the snow depth exceeded the height of the automated weather stations in the SNOTEL network, causing underestimates in the measurement of snow on the ground.



Satellite Image of landfalling storms along U.S. West Coast 20 March 2011; Source: NASA

Hurricanes & Tropical Storms



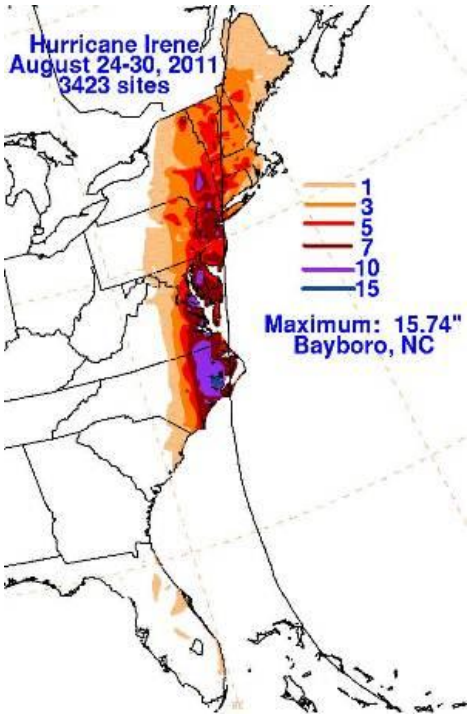
The 2011 North Atlantic hurricane season had 19 named storms, seven hurricanes, and three major hurricanes. The 19 named storms tied with 2010, 1995, and 1887 as the third busiest year for tropical cyclones in the basin. The second most active tropical cyclone year for the Atlantic basin was 1933. An average season has 11 named storms, six hurricanes, and two major hurricanes. The seven storms which reached hurricane strength and the three that reached Category 3 status (major hurricane) are both near the average, despite the high number of tropical storms. One hurricane (Irene) and one tropical storm (Lee) made landfall in the U.S. during the 2011 season. Hurricane Irene was the first Hurricane since Ike in 2008 that made landfall in the nation.

The Accumulated Cyclone Energy (ACE) index of tropical cyclone activity also indicated an above-average season. The ACE index is used to calculate the intensity of the hurricane season and is a function of the wind speed of each tropical cyclone. The 2011 Atlantic hurricane season had an approximate ACE value of 125 ($x10^4 knots^2$), which is 20 percent above the 1981-2010 average ACE value of 104 ($x10^4 knots^2$). The highest ACE value on record of 250 ($x10^4 knots^2$) occurred in 2005. Although there were an extremely high number of tropical storms during the year, the near average number of hurricanes and major hurricanes kept the seasonal ACE value relatively low compared to more active years. The first eight storms of the season failed to reach hurricane

strength, marking the first time in the Atlantic that this many consecutive storms in a single season failed to reach hurricane strength.

The above-average season was partially attributable to lower-than-average wind shear across the basin and warmer than average sea surface temperatures. The lower than average wind shear is consistent with the presence of La Niña conditions across the equatorial Pacific during most of the hurricane season. Drier-than-average conditions persisted as air from the African Sahara made its way into the middle layer of the atmosphere above the tropical Atlantic for most of the season. This likely inhibited many of the named storms from developing into stronger hurricanes.

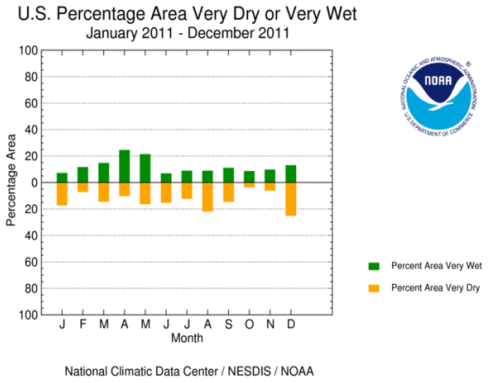
Only two of 19 named storms, 11 percent of the storms, made landfall in the contiguous U.S. during the 2011 season, which is below average. Steering currents caused most of the storms that formed over the open waters of the Atlantic to curve out to sea, missing the U.S. as they moved northward and eventually northeastward. The storms that formed across the Caribbean were steered into Mexico and Central America. It should be noted that although only two named storms made landfall in the U.S., four storms — Arlene, Harvey, Nate, and Rina — made landfall across Central America and Mexico causing significant flooding, damage, and loss of life across those regions.



Hurricane Irene was the first hurricane to make landfall in the U.S. since Hurricane Ike hit the Gulf Coast in 2008. Irene formed from a tropical wave moving off the Cape Verde Islands on August 21st, and moved westward across the central North Atlantic. Irene made landfall on the 22nd over Puerto Rico as the storm strengthened into a hurricane. The storm then moved through the Bahamas as it strengthened to Category 3 strength and it curved more northerly in its track. Irene made landfall on the 27th near Cape Lookout, North Carolina as a Category 1 hurricane. The storm then moved back over the coastal Atlantic waters and made a second landfall near Little Egg Inlet, New Jersey, as a strong tropical storm. Irene moved over open water again, and made landfall as a tropical storm near Coney Island, New York on the 28th. Irene was a massive storm, with tropical storm force winds extending outward 300 miles (485 km). The storm was also slow moving as it traversed the Mid-Atlantic. Irene claimed at least 48 lives and caused over 7 billion U.S. dollars in damages in the U.S. and 3.1 billion U.S. dollars of damage in the Caribbean.

Drought

National Drought Overview



On a month-by-month basis, 2011 was characterized by large areas of dry and large areas of wet weather. Nine months (all except February, October, and November) had ten percent or more of the country experiencing very dry (at the tenth percentile of the historical record or drier) precipitation anomalies, with two months (August and December) having more than a fifth (20 percent) of the country very dry. This was counterbalanced by large areas (ten percent or more of the country) experiencing very wet (monthly precipitation totals at the 90th percentile of the historical record or wetter) precipitation anomalies in February through May, September, and December. The spring months were especially wet with April and May having more than a fifth of the country very wet. When averaged together, the wet and dry anomalies resulted in the 14th driest January, 24th driest June, 19th driest July, and 29th driest August, nationally, in the 1895-2011 record. Large areas of the country also experienced unusually warm conditions. Ten percent or more of the contiguous U.S. was very warm (monthly temperatures at the 90th percentile of the historical record or warmer) during eight months (all except January, February, May, and October). Conditions were especially warm during the summer, with nearly half (49 percent) of the country very warm in July and over 40 percent very warm in August. The unusual and persistent warmth, especially during the growing season, increased evaporation and intensified local drought conditions. The monthly values for June, July, and August, when averaged together, resulted in 16 percent of the country very dry and 41 percent very warm, or a total of 57 percent very warm and/or dry. This is the second highest such summer total in the 1895-2011 record.

An important feature of the weather conditions in 2011 was the persistence of the wet and dry areas. Dry weather dominated the year in the Southwest to Southern Plains, especially during March-September, with dry weather prevalent across much of the Gulf Coast to Southeast from April to August, the western Great Lakes to Upper Mississippi Valley and parts of the Northern Plains from August to December, and Far West from August-September and November-December. Wet conditions were the rule across much of the West (except the Southwest) from March to July, the Northern Plains from January-August, the Midwest from February-May and September-December, and the Northeast from February-May and August-October, with widespread flooding frequently the result. The persistence of these dry and wet anomalies shows up clearly in the 2011 annual precipitation state and climate division rank maps.

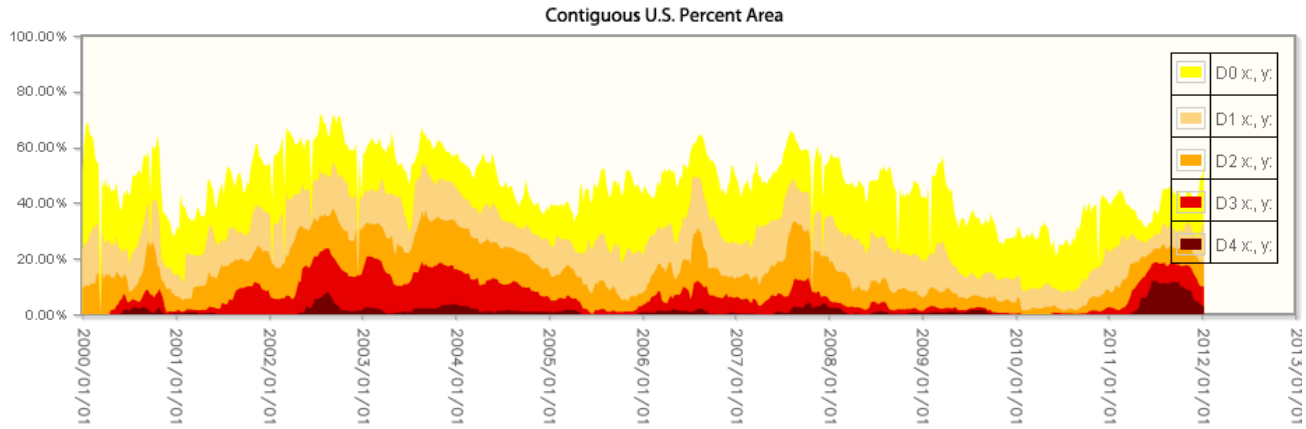
2011 Standardized Precipitation Index maps:

- January,
- February,
- March,
- April,
- May,
- June,
- July,
- August,
- September,
- October,
- November,
- December.

2011Palmer Z Index maps:

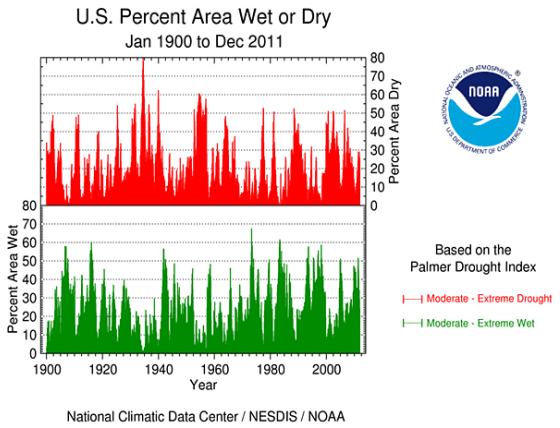
- January,
- February,
- March,
- April,
- May,
- June,
- July,
- August,
- September,
- October,
- November,
- December.

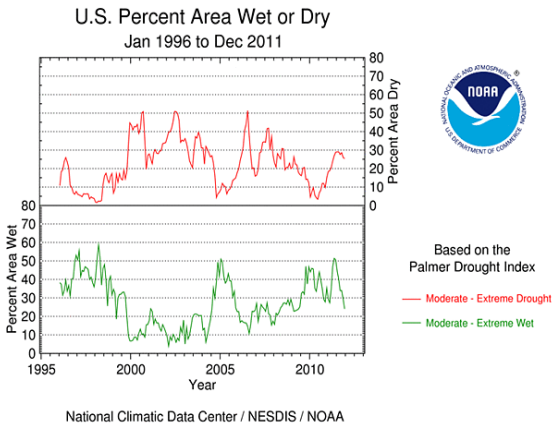
The year started out with areas of drought stretching from the Southwest and Central Plains to the Southeast, with moderate to extreme drought covering about 18 percent of the country (based on the U.S. Drought Monitor [USDM]). By the end of spring, drought had expanded and intensified, especially in the South, with 21 percent of the country in moderate to exceptional drought. The heat and dryness of summer further expanded and intensified drought, with expansion occurring in the Ohio to Mid-Mississippi valleys and about 28 percent of the U.S. classified in the moderate to exceptional drought categories. Some contraction occurred in the drought area during the autumn and early winter months, especially in the Midwest to Central Gulf Coast, but drought developed in the Upper Mississippi Valley, Northern Plains, and Far West, with about 27 percent of the country in moderate to exceptional drought by year's end. The percent area of the U.S. experiencing the worst USDM category (D4, exceptional drought) reached a peak of about 10 percent during the summer and early fall, which is a record in the 12-year history of the USDM. Drought continued during 2011 in Hawaii, but not as severe as it was in 2010.



The percent area* of the contiguous U.S. experiencing moderate to extreme drought (based on the Palmer Drought Index) started the year at about 18 percent, grew steadily to a peak of about 29 percent during the summer, then contracted slightly during the last two months, ending the year at about 25 percent. The Palmer Drought Index data go back 117 years.

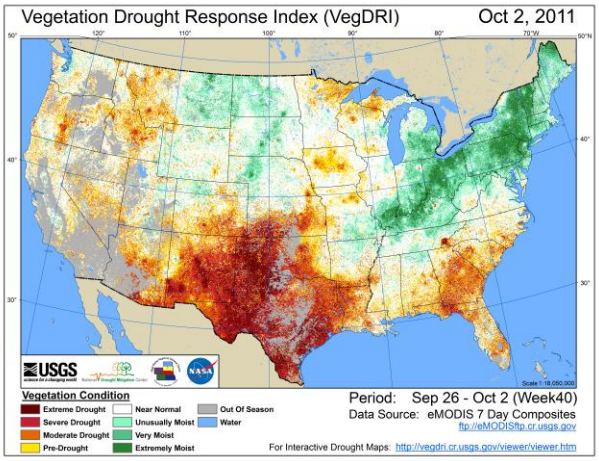
*This drought statistic is based on the Palmer Drought Index, a widely used measure of drought. The Palmer Drought Index uses numerical values derived from weather and climate data to classify moisture conditions throughout the contiguous United States and includes drought categories on a scale from mild to moderate, severe and extreme.

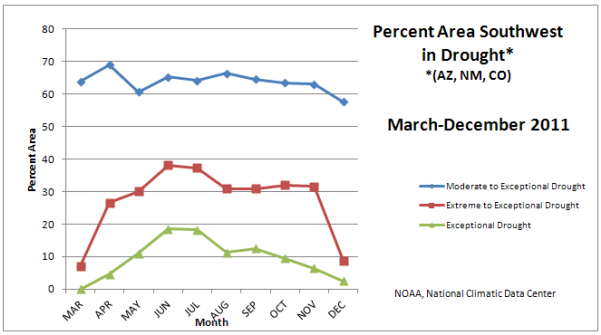




Regional Drought Overview

The drought epicenters during 2011 were the Southwest to Southern Plains, the Central Gulf Coast to Southeast, and Hawaii. Secondary drought areas developed in the Midwest, Upper Mississippi Valley to Northern Plains, and Far West. Low stream, reservoir and stock pond levels, and depleted soil moisture combined with high temperatures and evaporation to ravage agricultural (pasture, range and crop) lands as the growing season progressed.

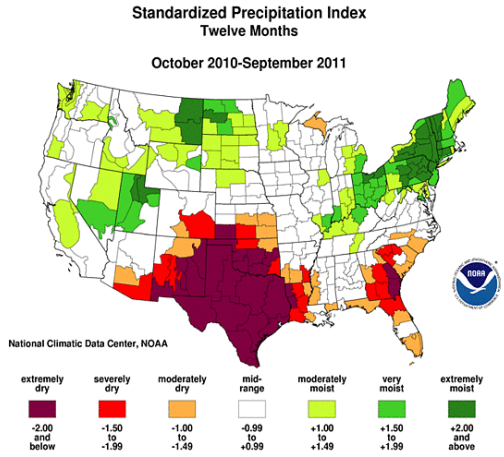


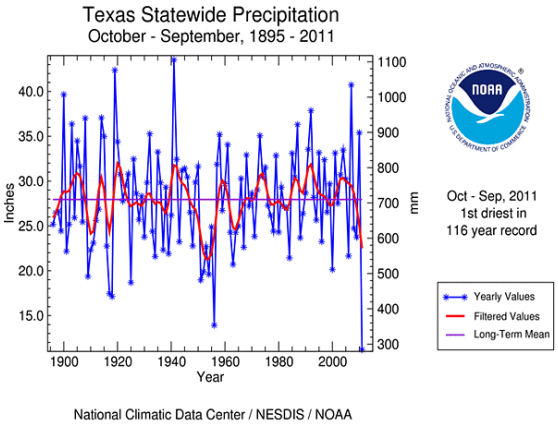


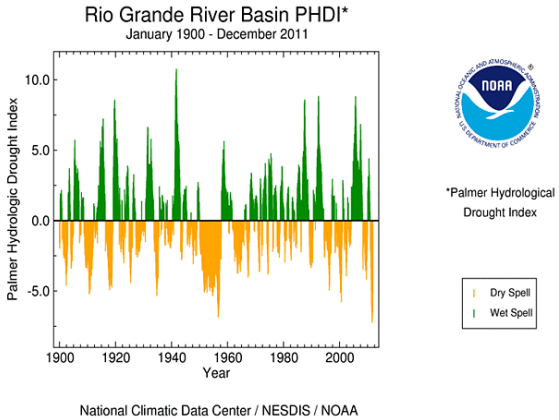
The Southwest (Arizona-New Mexico-Colorado) drought peaked in mid-summer with nearly 40 percent of the region experiencing extreme to exceptional drought.

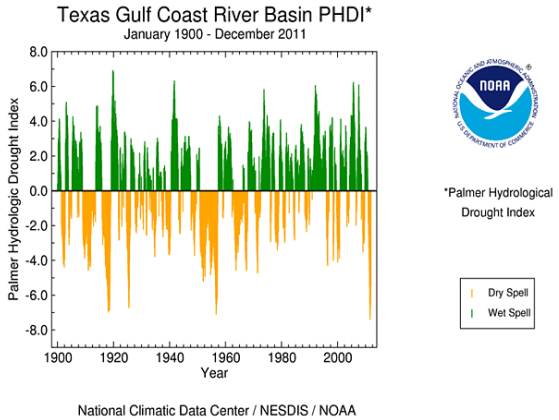
Southwest and Southern Plains:

The Southwest and Southern Plains were hardest hit by drought this year, with the southern drought centered squarely on Texas. The 2011 dry spell generally began in October of 2010 following a very wet period. Beneficial rains fell in some areas during October and November 2011, with December 2011 actually averaging wetter than normal for the state. Texas had the driest hydrologic year (October 2010-September 2011) in the 1895-2011 record, with New Mexico and Oklahoma ranking second driest and Louisiana third driest. The Rio Grande and Texas Gulf Coast river basins also had the driest hydrologic year on record. The dryness was so severe that, even with a wet December, 2011 still ranked driest on record for the calendar year (January-December) for Texas. Record heat occurred during the summer with Texas, New Mexico, Oklahoma, and Louisiana having the hottest-ever June-August and Texas experiencing record potential evapotranspiration (natural water demand). Several climate divisions in Texas, New Mexico, Oklahoma, and Louisiana, as well as Texas statewide and the Rio Grande and Texas Gulf Coast river basins, had record low values for the Palmer Hydrological Drought Index in a record that goes back 117 years.



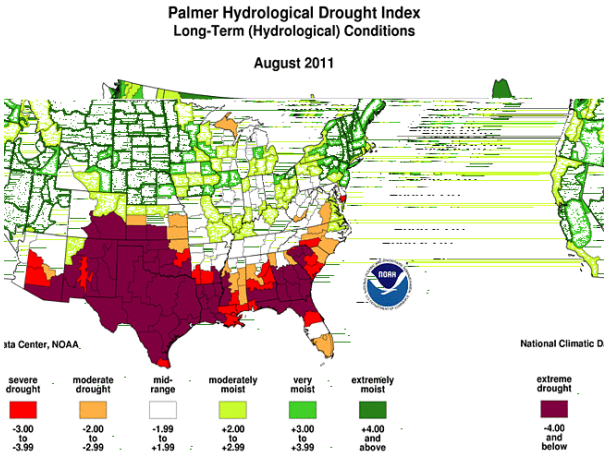


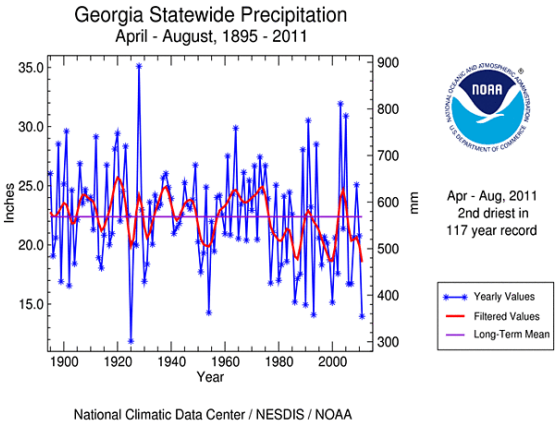




Gulf Coast to Southeast:

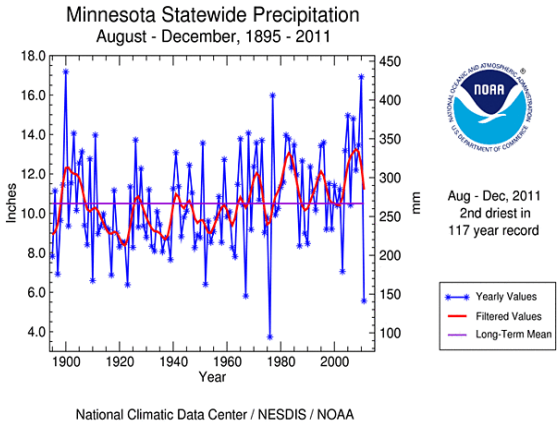
The Gulf Coast had drier-than-normal conditions in February, April-June, and October-December. Heavy rains from Tropical Storm Lee cut a wet swath through the middle of the Gulf Coast drought area during September. For the Southeast, March and September were wetter than normal, with January-February, April-August, and December being much drier than normal. Georgia, the epicenter of the Southeast drought, had the second driest April-August in the 1895-2011 record.





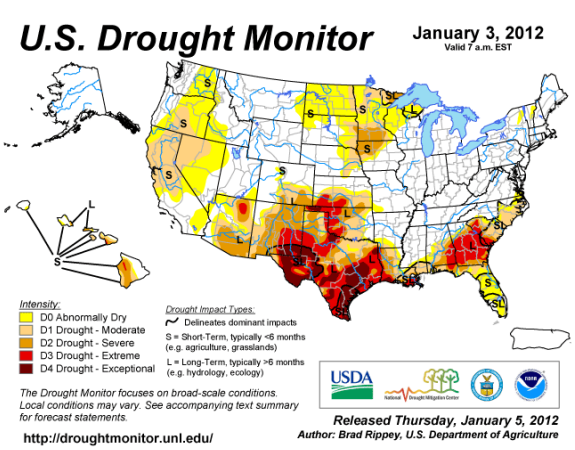
Midwest to Upper Mississippi Valley and Northern Plains:

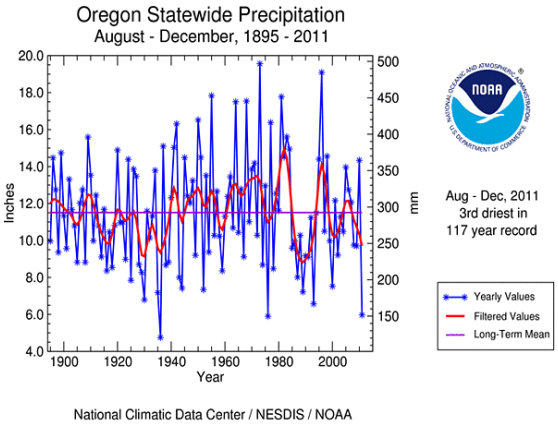
The Midwest/Ohio Valley was especially wet during the first half of the year. July and August were much drier than normal, with moderate-to-severe drought developing by the end of summer from Kentucky and Indiana into Iowa. Precipitation returned beginning in September, effectively ending the dry spell. The first half of the year was wet for the Upper Mississippi Valley and Northern Plains as well. Dry conditions set in beginning in August, with Minnesota having the second driest August-December on record. Moderate to severe drought spread into the area by year's end, in spite of the earlier wetness.



Far West:

Much of the West (except for the Southwest) had much-above-normal precipitation during the 2010-2011 wet season (October 2010-March 2011) and following spring and early summer. By May 31st, mountain snowpack and snow water equivalent were well above average. A drier-than-normal weather pattern dominated during the late summer and first part of the 2011-2012 wet season. Oregon had the third driest August-December, and moderate drought had spread from Oregon and Nevada into California by the end of the year.

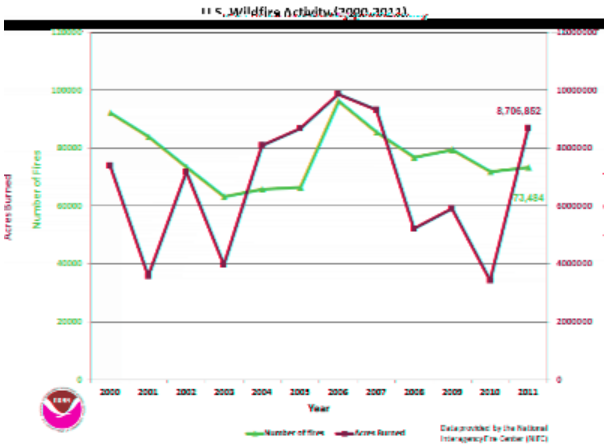




Pacific Islands, including Hawaii:

Drought conditions in Hawaii were not as severe in 2011 as they were in 2010, but moderate to extreme drought lingered with significant long-term rainfall deficits remaining (last 12, 24, 36 months). Severely dry conditions caused by La Niña affected other Pacific islands under the jurisdiction of the United States early in 2011. The dry conditions peaked in February. Kapingamarangi was especially hard hit, with September 2010-February 2011 rainfall totaling 15 percent of normal and water conservation measures strongly encouraged at that time. Above-normal rainfall finally returned to Kapingamarangi in June 2011.

Wildfires



2000–2011 U.S. Wildfire Counts
Data Source: NIFC

During 2011, drier-than-average conditions were observed from the western states across the southern tier of the country and into the Southeast. The driest area of the country was the Southern Plains of Oklahoma, Texas, and New Mexico. These regions also experienced warmer-than-average conditions during 2011. The Western Great Lakes were also drier than normal during the latter half of the year, but areas across the Northern Plains, Ohio Valley, and Northeast were wetter than normal for the annual period. Many locations across the Ohio Valley and Northeast had their wettest year on record. The overall pattern during 2011 created ideal wildfire conditions across most of the southern U.S. during the year and the driest areas of the Southern Plains experienced above average wildfire activity. New Mexico, Texas, Arizona, and Minnesota all had record-breaking wildfires during 2011.

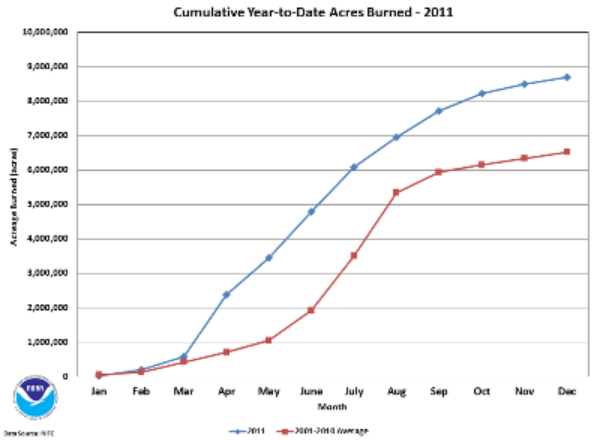
Year-to-Date Wildfire Statistics*

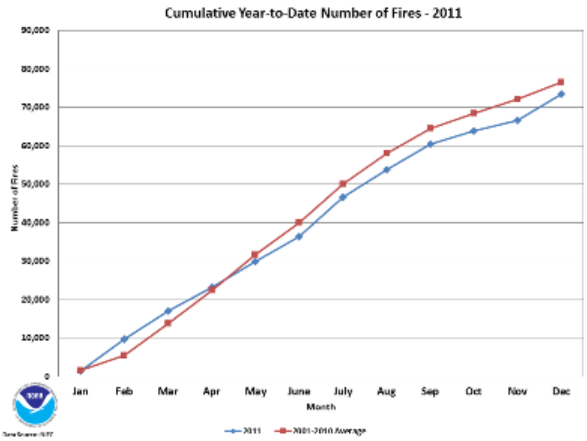
	January–December	Rank (out of 12 years)	Record		10-Year Average (2001-2010)
			Value	Year	
Acres Burned	8,706,852	3rd Most 10th Least	9,873,745	2006	6,520,307.5
Number of Fires	73,484	7th Most 6th Least	96,385	2006	76,468.1
Acres Burned/Fire	118.5	3rd Most 10th Least	131	2005	85.6

*Data Source: The National Interagency Fire Center (NIFC)

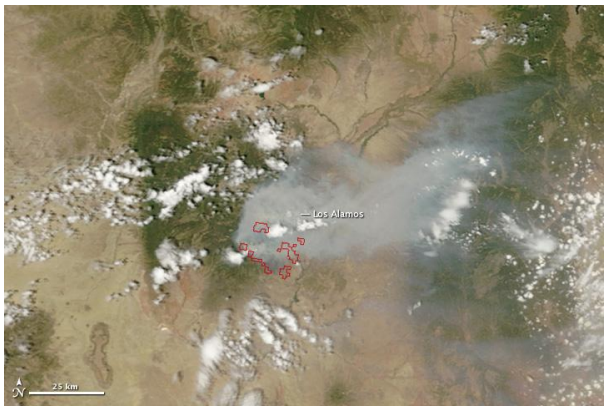
Through December 30th, the nationwide number of fires year-to-date was 73,484 which burned 8.7 million acres (3.5 million hectares), with an average of 119 acres (48.2 hectares) per fire. The spring and summer were particularly active wildfire periods, while the fall season was quieter than average. The fires across the southern U.S. led 2011 to having the third most active wildfire season with respect to acres burned and sixth least active in terms of number of fires. Texas had the most acres burned of any state during the year, with over 3.7 million acres (1.5 million hectares) burned across the state during 2011, 43 percent of the national total. Several of the large fires were destructive and expensive to control, with the state of Texas spending over a million dollars a day to control the fires during the very active spring period. During 2011 the damages from wildfires across the U.S. will exceed one billion U.S. dollars.

The spring wildfire season (March-May) was particularly noteworthy. During the three month period, 20,100 fires burned over 3.2 million acres (1.3 million hectares) across the U.S., mostly across Texas, Arizona, and New Mexico. The acres burned were record high for the 3-month period, surpassing the spring of 2008 when 1.5 million acres (607,000 hectares) burned nationwide. Wet conditions during the 2010 summer caused an abundance of vegetative growth across the Southern Plains. The region then experienced a very dry winter and spring season, causing the new vegetation to dry, creating a significant source of wildfire fuels. During the January 1st through April 30th period, 2.2 million acres (0.9 million hectares) burned across Texas alone. Several fires during the season affected populated areas in Texas, including the Wildcat Fire which forced an evacuation in San Angelo, Texas, and the Rock House Fire, which burned over 40 homes in Fort Davis.





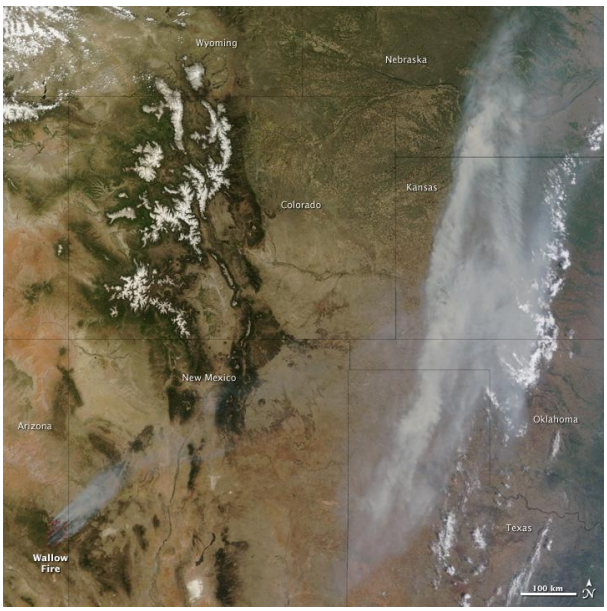
Significant Events during 2011



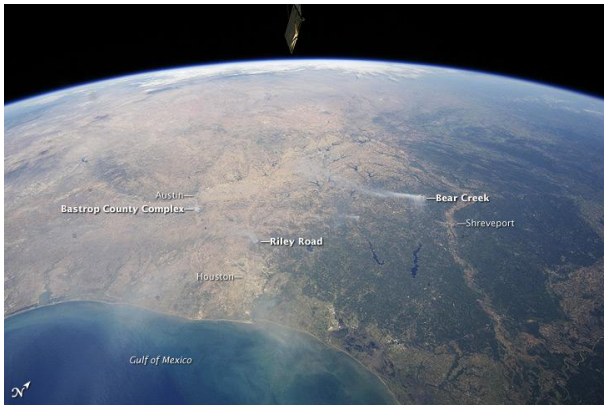
Satellite Image of Las Conchas Fire 27 June 2011
Source: NASA

The Las Conchas Fire burned in northern New Mexico during June and July. The fire consumed over 156,500 acres (63,000 hectares). This fire surpassed the Dry Lakes Fire of 2003 as New Mexico's largest wildfire on record. The fire was driven by strong winds and extremely dry fuels. The largest concern of the firefighters was the town of Los Alamos, home to the country's premier nuclear research facility. The fire encroached upon the grounds of the research facility several times, but fire crews were able to keep the flames from spreading. According to media reports, the blaze was said to be as close as 50 ft away from the grounds of the lab, raising fears it could reach a cache of 30,000 drums, each containing 55 gallons of plutonium-contaminated waste. This prompted the Environmental Protection Agency to deploy air monitors and aircraft to monitor radiation levels. The lab, as well as the Bandelier National Monument, was closed and several cities nearby including Los Alamos, Cochiti Mesa, and Las Conchas were evacuated as a precaution. Over 1,200 crews from around the country were called in to battle the blaze.

During May and June, the Wallow Fire ravaged over 538,000 acres (217,700 hectares) across Arizona. The Wallow fire was the largest fire ever reported in the state of Arizona, surpassing the Rodeo-Chediski Fire by nearly 70,000 acres (28,328 hectares), which occurred in July 2002. The fire threatened several communities in eastern Arizona, forcing the evacuation of Sunrise, Greer, Blue River, Alpine, Nutrioso, Eager, and Springerville. The fire had far reaching impacts beyond Arizona, with the strong winds blowing the smoke as far away as the Great Lakes, creating poor air quality conditions from Arizona to Wisconsin.



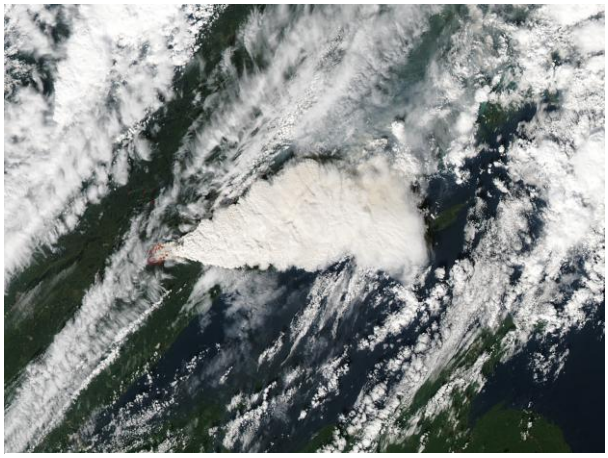
Satellite image of Wallow Fire 7 June 2011
Source: NASA



Satellite image of Texas Fires 6 September 2011
Source: NASA

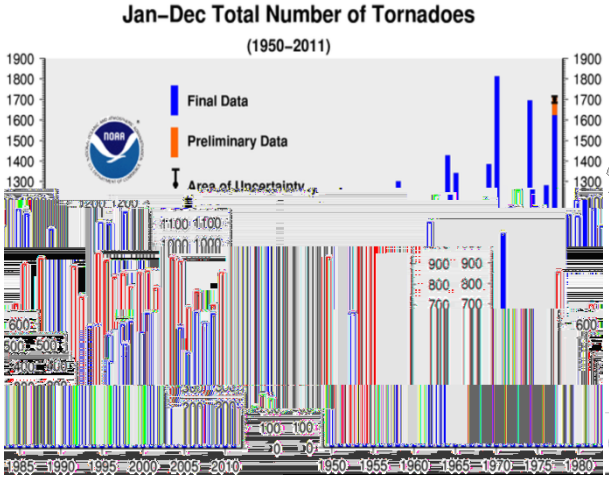
During the first week of September, the Bastrop fire raged in central Texas. As Tropical Storm Lee made landfall along the Louisiana coast, the storm caused strong winds to whip up across Texas. The strong winds, combined with the ongoing drought, created ideal wildfire conditions. The Bastrop fire was ignited on September 4th, just east of Austin, Texas. The fire burned rapidly out of control. By the end of the month, the fire had burned over 34,000 acres (13,800 hectares) and destroyed over 1,600 homes. According to media reports, the fire broke the record for the number of homes lost due to a single fire in Texas history.

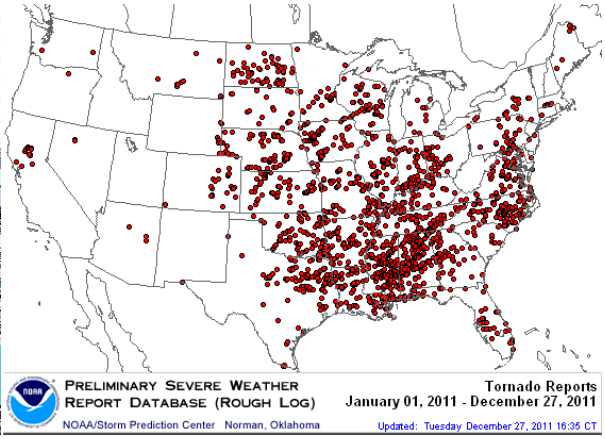
The Pagami Creek fire burned approximately 93,000 acres (37,600 hectares) in the Superior National Forest in northern Minnesota during September and October. The fire was ignited on August 18th by a lightning strike. The fire was not initially suppressed to allow natural processes to take place in the forest. The fire had grown to only 13 acres (5 hectares) by September 12th. But after the 12th, strong winds and dry conditions caused the fire to grow rapidly out of control. The acreage burned is the tenth most by a single fire in Minnesota history, and the largest fire to affect the state since the Cloquet-Moose Lake Fire in 1918. By the end of September over 5.7 million dollars had been spent to control the wildfire.



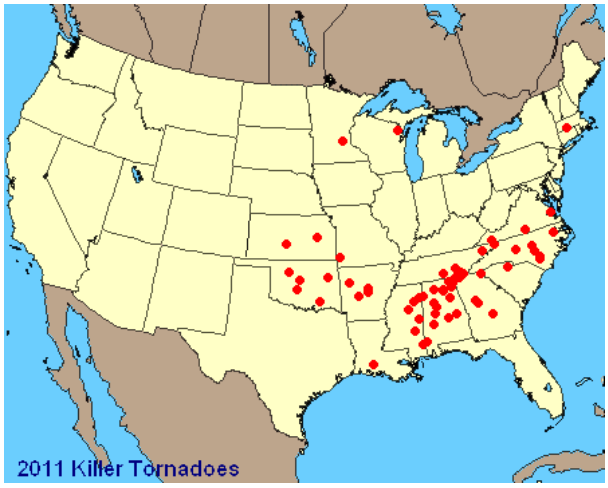
Satellite image of Pagami Creek Fire,
12 September 2011; Source: NASA

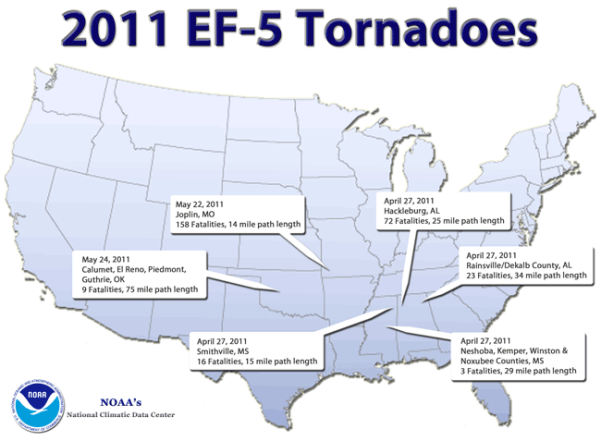
Tornadoes



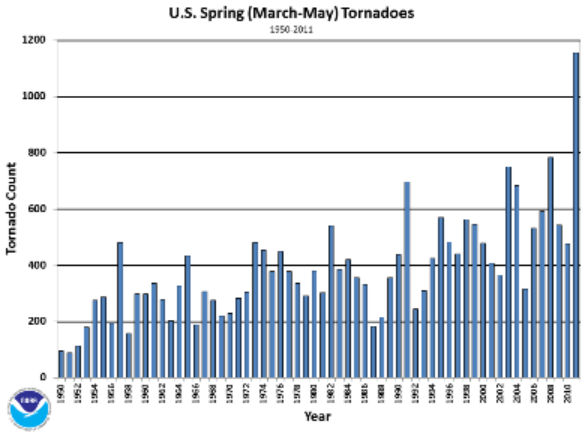


The U.S. spring and summer of 2011 will likely be remembered as one of the most destructive and deadly tornado seasons to ever impact the nation. During the time period, there were seven individual tornado and severe weather outbreaks with damages exceeding one billion U.S. dollars, and total damage from the outbreaks exceeding 28 billion U.S. dollars. This represents the most property damage from severe weather in a single year since record keeping began in 1980. As of mid-January 2012, the 2011 confirmed tornado count stood at 1,625, with 93 tornado reports still pending for November and December. This places 2011 as the second or third most active year on record for number of tornadoes since the modern record began in 1950, depending on the confirmation rate of the end-of-year tornado reports. There were six EF-5 tornadoes confirmed during 2011, the strongest category on the Enhanced Fujita scale. This ties with 1974 as the most (E)F-5 tornadoes during a single year (Please note that NOAA switched from using the Fujita (F) scale to the Enhanced-Fujita (EF) scale in 2007). The annual total number of fatalities from tornadoes was 551, the most in the 62-year period of record.



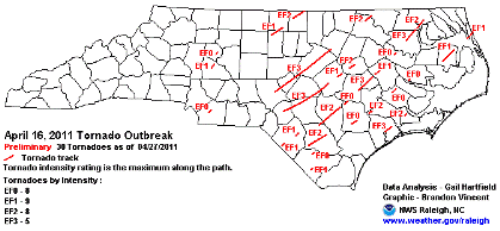


Looking beyond the modern tornado record (1950-present), 2011 ties with 1936 as the second deadliest year for tornadoes in U.S. history. In 1925, 794 tornado-related fatalities were reported, the deadliest tornado year on record. The extensive damage and loss of life due to tornadoes during 2011 was a product of an above-average tornado year and strong tornadoes hitting densely-populated areas. During the year, the two largest tornado outbreaks on record for the nation impacted the southern U.S., and the single deadliest tornado since the modern record began in 1950 hit Joplin, Missouri.



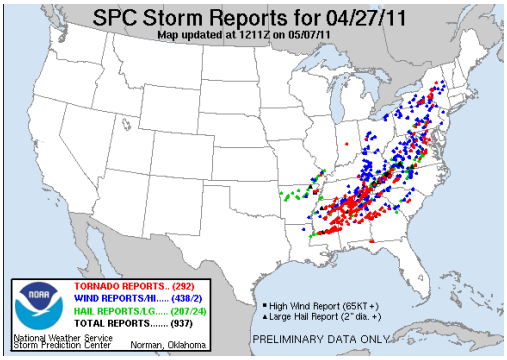
The most active tornado period of the year was the spring season (March-May). During the three month period, there 1,150 confirmed tornadoes across the country, the most on record for any three month period. The most active month of the year was April, when 748 tornadoes were confirmed. This is the most on record for any month, surpassing May 2003 when there were 550 tornadoes. The extremely high tornado count during April was driven by two very large tornado outbreaks — the two largest tornado outbreaks on record. The tornado counts for the April 14th–16th and April 25th–28th outbreaks both surpassed the April 1974 Super Outbreak for number of tornadoes during a single outbreak. The 199 tornadoes on April 27th, was the most for any single day on record and the 316 fatalities on the same day was the most in the modern record for a 24-hour period. The May 22nd Joplin, Missouri tornado caused 3 billion dollars worth of damage and 158 fatalities, surpassing the previous records for damages and fatalities from a single tornado in the modern tornado record.

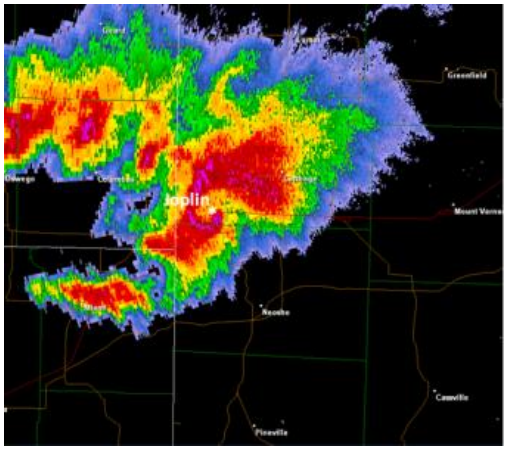
Significant Events



The April 14th–16th tornado outbreak was spawned from a strong upper-level low pressure system moving through the Central Plains. Very warm, moist air was advected northward ahead of the associated cold front. Behind the cold front, very cool Canadian air filtered into the central parts of the U.S., and the boundary between these two air masses was the trigger for the unprecedented tornado outbreak. Over the three days, 177 tornadoes occurred across 16 states (Oklahoma to North Carolina), surpassing the April 1974 outbreak as the most active tornado outbreak on record. The 30 tornadoes which were confirmed in North Carolina, where 22 of the fatalities were reported, was a state record. The damages from the outbreak will exceed 2.1 billion U.S. dollars, and there were 38 reported fatalities in all. The outbreak was the deadliest in the U.S. since 2008.]

The April 25th–28th tornado outbreak occurred under similar circumstances as the April 14th–16th event, with a strong low pressure system moving through the center of the country. This was one of the largest, deadliest, and most destructive tornado outbreaks in the history of the United States. During the four days, there were 343 confirmed tornadoes which killed 321 people — both are records for a single outbreak. Alabama bore the brunt of the damage, where 240 people were killed, including 78 people from a single EF-5 in the northern portion of the state. Several metropolitan areas were directly impacted including Tuscaloosa, Birmingham, and Huntsville in Alabama and Chattanooga, Tennessee, causing the estimated damage costs to soar. Damages from the outbreak are expected to exceed 10.2 billion U.S. dollars.





Radar Image of Joplin Tornado

The May 22nd Joplin, Missouri tornado was spawned from a severe thunderstorm moving from Kansas into Missouri during the late afternoon hours. The tornado was rated an EF-5 with winds in excess of 200 mph. The tornado was on the ground for 6 miles and had a maximum width of three-quarter miles as it moved through the densely populated southern portion of the town. The tornado killed 158 people and injured thousands more, making it the deadliest tornado in the 1950-present modern tornado record. Damages from this single tornado are expected to exceed 3 billion U.S. dollars, the most on record for a single tornado in U.S. history.

Additional information is available in the Spring 2011 Climate Extremes Special Report and the monthly tornado summaries.

Natural Resources Conservation Service (NRCS)
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 (NRCS) within the United States Department of Agriculture (USDA). 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 quality snow, water, and climate information and technology*."

Additionally, the Center's Snow Survey and Water Supply Forecasting (SSWSF) Program provides water and climate information and technology support for natural resources management in the 12 Western states (Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming).

Staffing

The NWCC is organized into three branches under the Center's Director, Mike Strobel: Tom Perkins, Water and Climate Services (WCS), Tony Tolsdorf (acting), Water and Climate Monitoring (WCM), and Laurel Grimsted, Information Systems (IS).

Another aspect of the NWCC is to provide climate services for the NRCS and other cooperating USDA agencies nationwide. This function is directly under the direct supervision of the Center Director. The key climate services staff members of the Center are:

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

Data Interpretation

With the close of the 2010 water year, the NWCC started calculation of the 1981–2010 Normals. (Climate "Normals" typically refer to the latest three-decade averages of climatological variables, such as the water content of the snowpack, temperature, and precipitation.) The new 30-Year Normals product will replace the current 1971–2000 Normals product. Final values will be released by 1 October 2012.

Adjusted streamflow normals will also be available. (Streamflow forecasts are projections of runoff volumes that would occur without influences from upstream reservoirs or diversions.) These values are referred to as natural, unregulated or adjusted flows. To make these adjustments, changes in reservoir storage, diversions, and inter-basin transfers are added or subtracted from the observed (actual) streamflow volumes.

Spatial Climate Services

NWCC coordinates and manages datasets produced in cooperation with Oregon State University and its PRISM Climate Group. This cooperative effort produces and delivers spatially-distributed precipitation and temperature data at 800-meter resolution for the entire United States and its possessions. These data are used in the Conservation Tool Kit, the Conservation Effects Assessment Project (CEAP) evaluations and programs, animal waste analysis programs, wetlands evaluations and mitigation, as well as direct input to conservation planning and evaluations.

These data are also the primary input to the Basin Analysis GIS (BAGIS) application, which is used to evaluate monitoring station distribution and new climate stations. The BAGIS application was designed by the NWCC and developed by Portland State University. PRISM data are directly used for erosion estimation in the Revised Universal Soil Loss Equation (RUSLE) and its updated version RUSLE II.

PRISM information is being incorporated into the Risk Management Agency's operations for Crop Insurance and Compliance. A new agreement between the Risk Management Agency, Oregon State University and NRCS is currently being developed by the NWCC. The project will provide crop production information directly to the NRCS for conservation planning purposes, along with new PRISM products including daily PRISM precipitation and temperature layers, spatial evapotranspiration, plant hardiness impacts, and much more.

PRISM information on a daily and monthly time interval will also be the basic input to the tools under the Conservation Division Streamlining Initiative.

Climate Data Services

NWCC coordinates and manages the Agriculture Applied Climate Information System (AgACIS) (e.g. Pick a state, pick a county, select Section II, expand Climatic Data and click AgACIS) in cooperation with the Regional Climate Center program under NOAA and the National Climate Data Center. This system provides basic input data sets to most of the current hydrologic and ecologic sciences evaluation programs. AgACIS is a main component of the electronic Field Office Technical Guide (eFOTG) and is the only official source of the Wetlands Climate tables, which are used by all Federal agencies that provide wetlands evaluations and determinations. The use of the Wetlands Climate tables is mandated by law in the Wetlands Legislation. The Federal agencies required to use these tables include the three agencies responsible for wetlands determinations: Natural Resources Conservation Service, U.S. Army Corp of Engineers, and the Environmental Protection Agency.

NWCC provides the basic input data and evaluations for Soil Climate Narratives. These narratives and climate evaluations are required for every soil survey completed in the United States and its possessions.

Data Retrieval Tool

Metadata is at the heart of all types of data and the Center recently developed a useful tool for determining data inventory by network, location, weather data elements, and for soil data elements.

The Center is currently developing tools to integrate data and interpret them dynamically, eventually replacing and upgrading current products and access to those products. The first step is the release of a Beta version data retrieval tool. This release provides users the opportunity to give feedback, identify any difficulties in operation, and suggest improvements.

NWCC participates in Review of the Missouri River Regulation during 2011 Flood

The Missouri River Flood of 2011 was the largest annual volume of water on record dating back to 1898, breaking the previous record by more than 20 percent and causing massive damage. The unprecedented runoff was a result of record snowpack and rainfall. The Army Corps of Engineers appointed a technical panel, comprised of a representative from Colorado State University, USGS, NWS, and NRCS-NWCC, to review the Corps' actions. Among many findings, the panel's December 2011 report noted that, over the period of record, the most extreme runoff years have occurred in the last several decades; therefore, planning studies need to be updated to reflect the new probabilities.

Standards and Specifications

The Center is finalizing a major revision to the National Engineering Handbook, Part 22, Snow Survey and Water Supply Forecasting. Last updated in 1972, the new Handbook (Part 622) contains chapters on automated and manual snow sampling site selection, installation, component maintenance and calibration, and data management. A comprehensive set of Standards and Specifications document the requirements for automated and manual snow data collection sites and their components. Several chapters of the handbook are finalized. When complete, the entire handbook will be available via the NRCS eDirectives System.

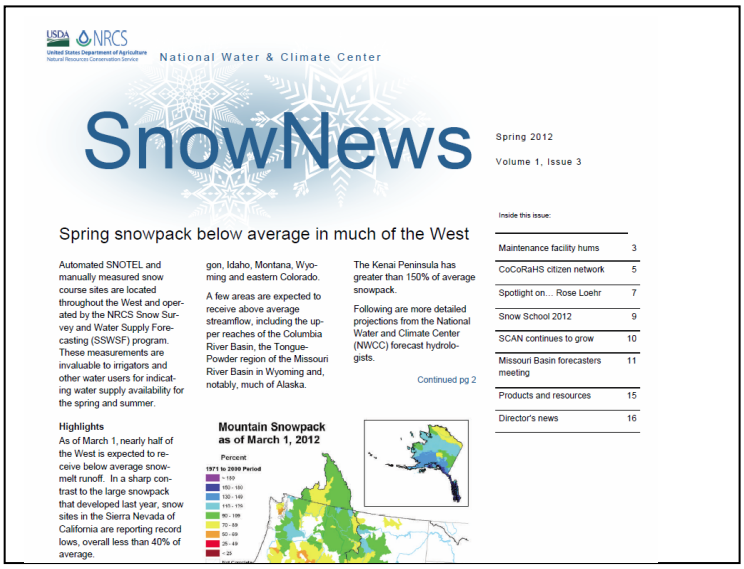
Other Recent Publications

Follow this link to find professional publications by members of the NWCC staff. These publications include peer-reviewed journal articles, conference proceedings, fact sheets, brochures, newsletters, and general information about the Snow Survey and Water Supply Forecasting Program.

Announcing "SnowNews"

SnowNews is the new quarterly newsletter of the National Water and Climate Center and Snow Survey and Water Supply Forecasting Program. The newsletter highlights recent activities within the Center and introduces new projects, products, and resources. Each issue features a close-up look at an agency employee, plus an update from the director.

We are very pleased to share this newsletter and hope it serves to inform those familiar and not so familiar with the Program. Link to all issues of ***SnowNews*** are available here.



USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

National Water & Climate Center

SnowNews

Spring 2012

Volume 1, Issue 3

Spring snowpack below average in much of the West

Automated SNOTEL and manually measured snow course sites are located throughout the West and operated by the NRCS Snow Survey and Water Supply Forecasting (SSWSF) program. These measurements are invaluable to irrigators and other water users for indicating water supply availability for the spring and summer.

Highlights

As of March 1, nearly half of the West is expected to receive below average snowmelt runoff. In a sharp contrast to the large snowpack that developed last year, snow sites in the Sierra Nevada of California are reporting record lows, overall less than 40% of average.

gon, Idaho, Montana, Wyoming and eastern Colorado.

A few areas are expected to receive above average streamflow, including the upper reaches of the Columbia River Basin, the Tongue-Powder region of the Missouri River Basin in Wyoming and, notably, much of Alaska.

The Kenai Peninsula has greater than 150% of average snowpack.

Following are more detailed projections from the National Water and Climate Center (NWCC) forecast hydrologists.

Continued pg 2

Mountain Snowpack as of March 1, 2012

Inside this issue:

Midwestern Regional Climate Center (MRCC)

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

Beth Hall, Director

Administration

Beth Hall joined the MRCC staff in January 2012 as the Director. Dr. Hall came to the MRCC from Towson University in Maryland, where she was a faculty member. Dr. Hall received her M.S. and Ph.D. in Atmospheric Sciences from the University of Nevada in Reno and her B.A. in Geography from Indiana University in Bloomington.

Molly Woloszyn joined the MRCC staff in July 2011 as the Extension Climatologist, a joint position with Illinois-Indiana Sea Grant. Molly received her B.S. in Meteorology from Northern Illinois University, and her M.S. in Atmospheric Science from Colorado State University.

Yeon-Tae Hechler joined the MRCC staff in July 2011 as the IT Technical Associate, specializing in programming. Yeon-Tae received her B.S. in Mathematics and M.S. in Computer and Information Science from Ewha Woman's University in South Korea.

Allan Curtis joined the MRCC staff in October 2011 as the Service Climatologist. Allan received his B.S. in Meteorology/Climatology and is finishing his M.S. in Meteorology/Climatology from the University of Nebraska in Lincoln.

Climate Services and Collaborations

Over the past year, representatives from several sectors (i.e. legal, consultants, and engineers) contacted the MRCC service office regularly for climate data and special products, with over 650 offline contacts since July 2011. Including access to the MRCC online data system, MACS, there have been over 33,000 page views since July 2011.

A number of products were developed or improved on MACS, Midwest Climate Watch, and the main MRCC webpage. Several MRCC products (including MACS products, Climate Calendars products, and Midwest Climate Watch maps) were upgraded to utilize the new 1981-2010 NCDC normals dataset.

In response to the early warmth in March 2012 and as a complement to the existing spring freeze maps on the Midwest Climate Watch website, the MRCC added freeze maps to include information on the earliest date of the last spring freeze (28°F and 32°F) for the central United States. To launch the freeze maps, the MRCC widely distributed a press release in late March discussing the early warmth, its impacts, and highlighting the new freeze maps. The maps are available on the Midwest Climate Watch website (http://mrcc.isws.illinois.edu/cliwatch/watch.htm).

The MRCC is working towards several tasks to improve climate services, including:

- In response to National Weather Service office requests, the MRCC is working to add NWS county warning areas (CWAs) as an option on MACS when producing gridded maps of data.
- Also at the request of National Weather Service offices in our region, we are working to add ThreadEx stations to MACS as well.
- A new webpage is being developed called "Living with Weather", which will highlight the various weather extremes that impact our region and information on how the public can better prepare for them.
- The MRCC is working on improving the internal infrastructure of MACS to make it more efficient to maintain and update in the future.

Collaboration Efforts and Outreach

Over the past year, the MRCC has been actively involved in the National Climate Assessment. Involvement included revising the Midwest climatology, attending regional planning meetings, and leading an Ag Survey project in Illinois, Indiana, and Missouri. The MRCC also developed an online climate map tool of NCA, NWS, and RCC regions for use by the project.

The MRCC teamed up with Illinois-Indiana Sea Grant to create a joint Extension Climatologist position, beginning in July 2011. In addition to several ongoing projects with the joint position, the two programs are collaborating on a project with the Illinois State Climatologist and the city of Chicago, Illinois.

The MRCC has been actively involved in the U2U project, which is led by Purdue University, with nine other universities and the HPRCC also collaborating. *Useful to Usable (U2U): Transforming Climate Variability and Change Information for Cereal Crop Producers*, is an integrated research and extension project that seeks to improve the resilience and profitability of farms in the North Central Region.

At the end of April 2012, Director Beth Hall and Extension Climatologist Molly Woloszyn took a trip to the eastern Midwest (northern Indiana, southern Michigan, and northern Ohio) to meet with several current and potential collaborators in the region. The MRCC met with National Weather Service offices, universities, State Climatologists, Michigan State and Ohio State Extension, Sea Grant programs, NOAA, GLERL, and GLISA.

As an effort to communicate Midwest climate information to the public, the MRCC started a Facebook page and Twitter account. The MRCC updates these social media outlets regularly with timely climate information and resources, resulting in a steady increase of fans since the accounts began. As an effort to promote collaboration between the RCCs and increase exposure to the RCCs using social media, the MRCC started the RCC Social Media Network in March.

Other outreach efforts by the MRCC include attending conferences as exhibitors, developing new educational activities and handouts for teachers and parents (found on the MRCC K-12 education page), presenting at climate-related workshops, collaborating with Extension and other colleagues

on climate literacy projects, hosting a very popular exhibit at the Naturally Illinois Expo, and talking to students at an elementary school about precipitation measurements.

Alabama Office of the State Climatologist (AOSC)

University of Alabama in Huntsville
Cramer Hall, Room 4040
320 Sparkman Drive
Huntsville, AL 35805
Tel: 256-961-7763
http://vortex.nsstc.uah.edu/aosc

John Christy, State Climatologist
Bob Clymer, Assistant State Climatologist

It is the role of the Alabama Office of the State Climatologist 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.

2011 Conditions

In October 2010, the AOSC began posting a monthly summary of climate information which includes information from many sources such as NCDC, CoCoRAHS, AOSC, and news reports (http://nsstc.uah.edu/alclimatereport/). Responses from stakeholders have been universally positive. We now have done so for over the entire year of 2011 and this has increased our exposure, particularly with the in-state media.

Of key interest are the stories that are included about specific events or features from the past. Also popular is the listing of all record events (though this is a little misleading as we note because some of the NOAA period-of-records are shorter than is actually the case, so "records" tend to occur more frequently than in reality). Moisture indices are important as we experienced drought, especially in the southern portion of the state for much of the year.

The most unusual climate feature of the climate of 2011 was the continuation of a very cold winter that began in late Dec 2010. Many stations in Northern Alabama received their 2nd or 3rd snowiest season on record with associated temperatures well below average.

However, the story that dominated our weather attention was the horrendous tornado outbreak of 27 April 2011. Estimates now indicate 246 fatalities from 62 tornadoes, including 4 classified as EF5. The UAHuntsville graduate program and researchers were/are heavily involved in documenting and researching this event, participating in the official surveys.

In terms of climate, this is a difficult problem to quantify as no previous outbreak received such careful surveying (areal, ground-based, radar-guided, etc.) Thus we cannot place this outbreak in a quantitative ranking relative to previous events. In terms of fatalities, this ranks as the 2nd worst

after 1932. Our teams used so many advanced detection techniques that previous data are simply not comparable. For example, prior to the late 1990s, Alabama experienced an average of 22 tornadoes per year. Now, the past 10 years indicates an average of 60 – due entirely to the new surveying and detection advances.

Thus, as I write climate descriptions for economic development packages, I have updated the threat from tornadoes, though adding that most of the (now-documented) tornadoes are quite weak and short-tracked. On 27 April, it appears that 1 percent of the state's area was touched by at least some damaging winds, and that a yearly average would be about 0.2 percent. This information is important to those who intend to build significant infrastructure in the state. However, it would probably be useful to develop a statistic to describe the tornado threat in probabilistic terms.

Drought Monitor

While there had been an informal collaboration-of-opportunity when preparing the Alabama drought level lines of the Drought Monitor each week, in 2010 we began a formalized, state-wide process. On Monday a.m., the SC emails all entities involved in drought monitoring and impacts at the four NWS offices, the State Office of Water Resources, other state agencies, industry and municipal users with a preliminary assessment. Through the day on Monday and morning of Tuesday, information is passed among the players and by Tuesday afternoon the SC sends to the DM our consensus recommendations. This centrally-planned process has helped greatly in expressing the best recommendations we can generate. After a full year of operation, we continue to follow this methodology.

Historical Climate Network upgrades

Due to NOAA budget cuts, it has been proposed that 8 of our 17 Regional Climate Reference Network stations be decommissioned and perhaps removed. We are working to keep this infrastructure active.

CoCoRaHS

On 1 November 2007, Alabama became an official member of the CoCoRaHS network. As of 12 Mar 2009 there were 670 stations registered, and as of 20 Mar 2012 there were 820, a gain of 41 from 2010. 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 public service activity. A few media stories still appear in which we ask for volunteers.

AWEP Program

With efforts from the AOSC and the Alabama Universities Irrigation Initiative, the USDA budgeted over $60M for farmers to develop better water resources. In Alabama, over 20 projects were funded, mostly to build irrigation ponds. The AOSC was involved in pond sizing based on climatological rainfall estimates. In 2010, the project began and there are now some completed projects as a result of this effort.

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. As of this writing two bills are in the Alabama legislature for consideration on expanding irrigation in an environmentally and economically sustainable way. The AOSC is involved at the state and federal level on water policy formulation.

Various economic interests contacted the AOSC in 2010 for information and speaking engagements related to climate change legislation. The SC appeared before state legal hearings (in and out of Alabama) on various climate issues as states struggle with legislation on carbon emissions. 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, exporting over 45 million MWt-hrs (30%) out of state. 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, including congressional testimony, for the development of policy.

Alaska Climate Research Center (ACRC)

Geophysical Institute
University of Alaska Fairbanks
903 Koyukuk Drive
Fairbanks, AK 99775
Tel: 907-474-7885
http://akclimate.org

Gerd Wendler, Director and Professor Emeritus
Kevin Galloway, Webmaster
Blake Moore, Programmer
Liangbiao Chen, Student Assistant

Purpose

The purpose of the center is threefold:

- Dissemination of climatological data (free of charge)
- Research on climate variability and climate change in Alaska and Polar Regions, and
- Education

Dissemination

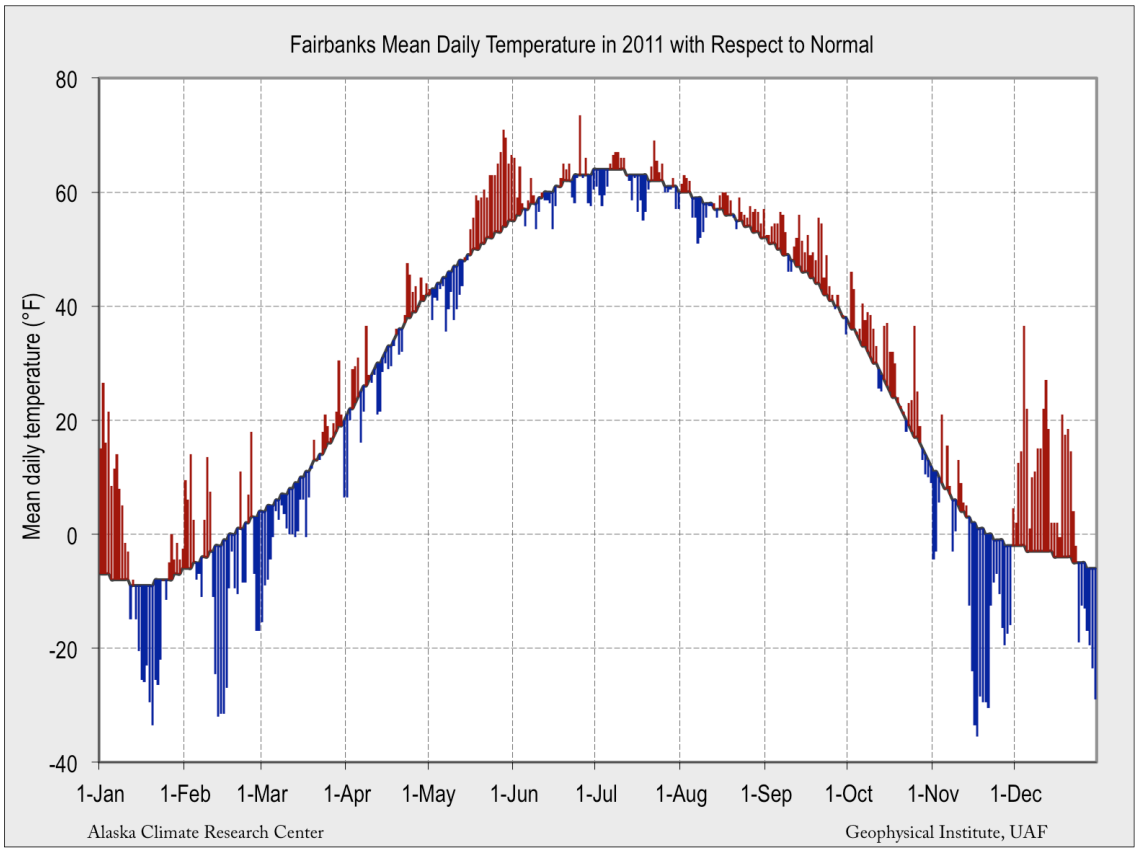
For nearly three decades we have made climatological data available to the public, research organizations and interested industries. Today this is mostly accomplished via our website (http://akclimate.org/) which received on average 26,000 hits a day in 2011. Assuming that the average stake-holder opens 7 pages, this represents some 3,700 stakeholders daily. Analyzing by domain, .net is the most frequent source of visitors, followed by .edu. From the international realm Germany, Canada, Great Britain and the Netherlands are the most interested. Over the course of a year, winter is the busiest season, probably due to the fact that frequently very cold temperatures (down to -40° and colder) occur paired with ice fog, which makes driving difficult, if not dangerous.

The ACRC website contains many summaries, products, meteorological, and climatological information. Furthermore, from our home page, users can select any number of links: Fairbanks weather and climate, our popular webcam and on-campus weather station, climatological data, up-to-date summaries, Alaska weather, information for tourists, seasonal and other weather and climate links, and a 'spotlight on climate' section giving a list of the latest features posted.

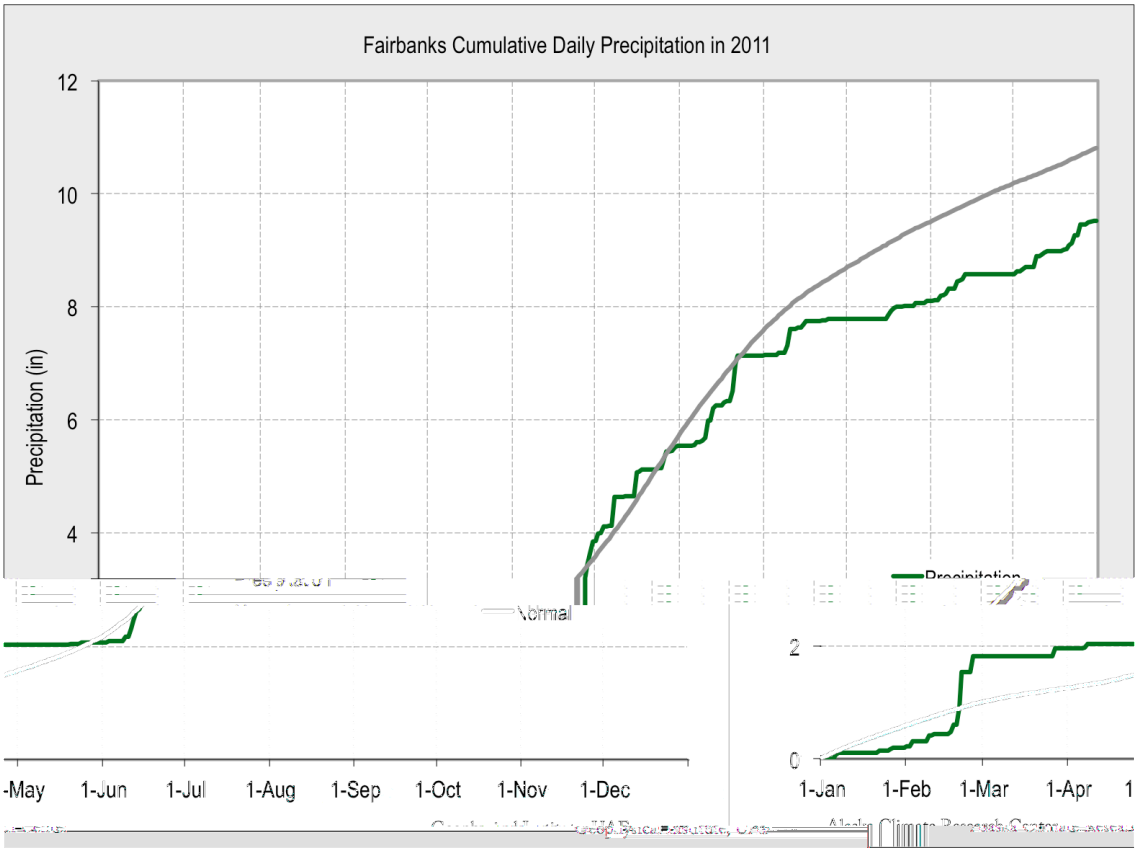
Specific request of data, normally received on line, by telephone, and sometimes by walk-ins are filled free of charge. It should be noted that we do not make predictions on future climate change, nor assess the socio-economic and biophysical impacts of such predicted climate projections. The focus is on observations.

As an example we discuss here a summary of the weather of 2011 for Fairbanks; more details can be seen from our website. The average annual temperature in 2011 for Fairbanks was 28.0°F (see

figure below), a positive departure of 0.3°F from new normal (1981-2010). From the middle of January until the middle of March, and again in November too, cold temperatures were observed. Interestingly, November was colder than December, which was far above normal with a positive deviation of 8.1°F. The positive deviation in the second part of May and the beginning of June, started forest fires early, however, the rest of the summer was slightly below normal, and 2011 did not become a bad wildfire year. Some 1 million acres burn an average every summer. The highest temperature of the year was 88°F, which was observed on 6th June, earlier than normal. The coldest temperature was -41°F, observed on 15th February, and there were 6 days at or below -40°F during the year.



The mean annual precipitation (see figure below) was 9.52", which is 1.29" below normal. Snowfall, however, was close to normal, recording 63.6" in the calendar year. This is 1.4" below average for Fairbanks. The year started out dry for the first 6 weeks, but heavy snowfall was observed in the last two weeks of February. Hardly any precipitation occurred thereafter for more than 3 months. Summer precipitation was fairly normal, but Fall recorded below normal values.

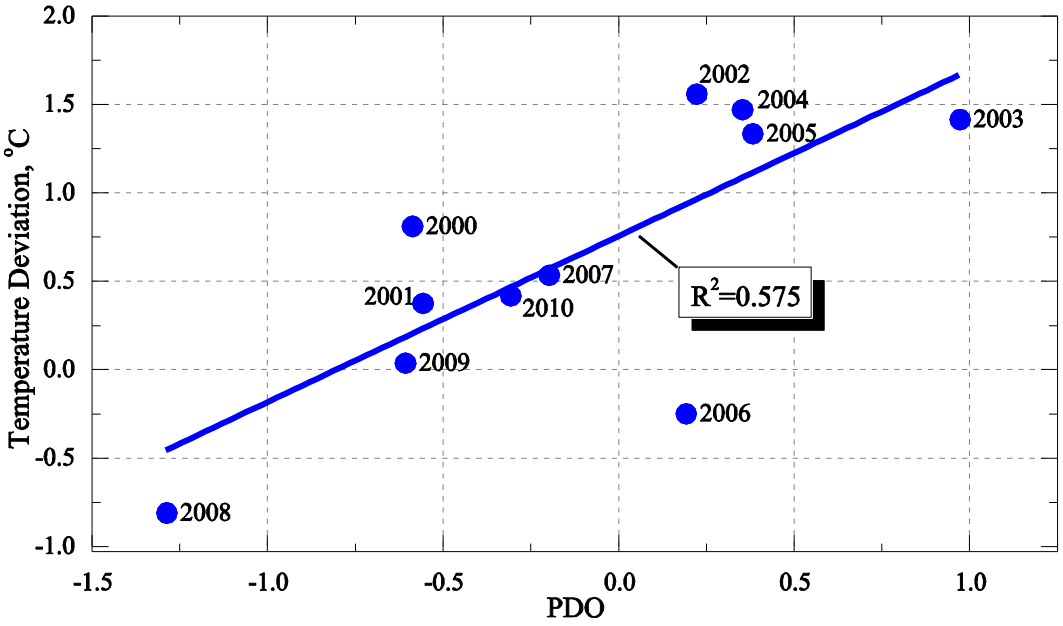


Research

A substantial number of publications on the climate of Alaska and Polar Regions have been produced over the years. In 2011 we published (besides conference proceedings) one journal article, namely:

> *Wendler, G., J. Conner, B. Moore, M. Shulski and M. Stuefer 2010:* Climatology of Alaskan wildfires with special emphasis on the extreme year of 2004. ***Theoretical and Applied Climatology****, 104, 459-47.*

Two additional papers are under review or fairly advanced. One discusses the first decade of the new century and showed for 19 of the 20 first order climatological stations in Alaska a cooling trend instead of the expected warming. The only exception was Barrow (Arctic Alaska), where a strong warming continued. This is understandable, as the sea ice in the Arctic Ocean has substantially decreased. We showed that the cooling is related to the PDO (Pacific Decadal Oscillation), which has changed from dominantly positive to dominantly negative values during this time frame. A correlation coefficient between temperature and PDO of r=0.76 was calculated, significant at the 99% confidence level (see below).



Averaged mean annual temperature deviation from the norm against the Pacific Decadal Oscillation values for the first decade of the 21st century

Education

Besides giving talks and seminars on the climate and observed climate change in 2011, we employed one student assistant, who worked on climate change in the Bering Sea, which, in contrast to the Beaufort Sea, has not seen a substantial ice retreat over the last 30 years. He (L. Chen) did a marvelous job, hence he is co-author in one of the upcoming journal publications.

Office of the Arizona State Climatologist (ASCO)

School of Geographical Sciences & Urban Planning
Arizona State University
Tempe, AZ 85287-1508
Tel: 480-965-6265
Fax: 480-965-1473
selover@asu.edu
http://azclimate.asu.edu/

Nancy J. Selover, State Climatologist

The Arizona State Climate Office (ASCO) is located within the Office of Climatology of the School of Geographical Sciences & Urban Planning (SGSUP) at Arizona State University (ASU) in Tempe, AZ. The office includes the State Climatologist, Dr. Nancy J. Selover, one part-time student worker, and three affiliated faculty in SGSUP (Drs. Anthony Brazel, Randall Cerveny, and Andrew Ellis). The mission 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.

The Arizona State Climate Office is a designated ARSCO, 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

- We maintain an ASCO web page (http://azclimate.asu.edu/) to provide real-time weather data with a climate context, and provide climate products online. The website includes general climate and real-time weather information, statewide monthly temperature and precipitation maps used in the drought status report, the monthly Arizona Climate Summary, daily rainfall and evaporation tables for the Phoenix area, daily North American Monsoon updates (in summer), and links to climate education information and other climate data resources. The Moisture Balance Drought Index is available on our website, based on:
  Ellis, A.W., Goodrich, G.B., and G. M. Garfin. 2010. "A hydroclimate index for examining patterns of drought in the Colorado River Basin", *International Journal of Climatology*, **30(2):**236-255. We also have contact links on the website for data, presentation, interview requests, or questions.
- 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. Most data requests come through the phone or e-mail, generated by the forms available on the website. The data are served back through the phone, fax, e-mail, postal service, or the Internet. We are establishing a Facebook presence.

Information Services

- In 2011 (relative to 2010), we filled 147 (-26%) e-mail requests for data or information, and 171 (+84%) voicemail requests for data. We also had 1,452 (-19%) downloads on our website in 2011. The most popular product downloads continue to be the Arizona Climate Extremes, Phoenix rain day table, Monthly Climate Summaries, and the monthly climate calendars for six Arizona cities, plus the Winter 2011& 2010 Rainfall Comparison. Eight percent of our users made their request by voice mail, 9% by e-mail, and 83% by Internet (downloads). Users, other than the web hits, include university researchers (46%), government agencies (12%), the public (19%), commercial (16%), the media (2%), and legal communities (2%). We did 17 media interviews (up 41% from 2010), including 2 TV, 5 radio, 8 magazine/newspaper, and 2 researchers, and we were involved in 4 legal cases as consultants or expert witnesses. The trend this year is a decrease in e-mail, an increase in phone data requests, and a decrease in web downloads of data or products. Topics included dust storms, drought, monsoon, excessive heat, extreme weather, the new normal, and climate change. This year we will need to be more innovative in creating products and services for our stakeholders.

Research

Looking at precipitation variability effects on water resources:

- Ellis AW, Klei K, Murphy KW 2011: Analysis of the Historical Importance of Precipitation as Snow to Surface Water Supply from two Semi-Arid Watersheds in the Southwestern United States. *Journal of Arid Environments*. Submitted.
- Ellis AW, Barton NP 2011: Characterizing the North Pacific Jet Stream for Understanding Historical Variability in Western United States Winter Precipitation. *Physical Geography*. In Revision.

Climate data monitoring:

- Bohumil Svoma and Randall S. Cerveny. 2011. Analyzing Bias in Prominent Climatic Datasets, *Progress in Physical Geography*. In press.

Re-Analysis and Extension of Namias's Climatological Isentropic Analysis:

- Kimberly DeBiasse Matthew B. Pace, Andrew W. Ellis, Robert C. Balling, Jr. 2011. Detection and Evaluation of Monsoonal, Severe Storm, Drought, and Flood Events, Randall S. Cerveny, *Annals of the Association of American Geographers, 101*:6, 1204-1220**.**
- Monthly Lunar Declination Extremes' Influence on Tropospheric Circulation Patterns, D.M. Krahenbuhl, Matthew B. Pace, Randall S. Cerveny, Robert C. Balling, Jr., *Journal of Geophysical Research – Atmospheres*, VOL. 116, D23121, doi:10.1029/2011JD016598, 2011.

Remote sensing – tornado damage assessment:

- Melissa Wagner, Soe Myint and Randall S. Cerveny.2011 Geospatial Assessment of Reconstruction Rates Following a Tornado Disaster, *IEEE Transactions on Geoscience and Remote Sensing*. In Press.

Urban Heat Island:

- Winston T. L. Chow & Ronald L. Pope & Chris A. Martin & Anthony J. Brazel. Observing and modeling the nocturnal park cool island of an arid city: horizontal and vertical impacts, *Theoretical and Applied Climatology***,** DOI 10.1007/s00704-0.
- Ariane Middel, Anthony Brazel, Bjoern Hagen, and Soe Myint 2011 Land Cover Modification Scenarios and Their Effects on Daytime Heating in the Inner Core Residential Neighborhoods of Phoenix, Arizona *Journal of Urban Technology*, Vol. 18, No. 4, October 2011, 61–79.
- Winston T.L. Chow, Anthony J. Brazel. 2012. Assessing xeriscaping as a sustainable heat island mitigation approach for a desert city, *Building and Environment* 47 (2012) 170e181.
- Ariane Middel, Anthony J. Brazel, Shai Kaplan, Soe W. Myint. 2012. Daytime cooling efficiency and diurnal energy balance in Phoenix, AZ, *Climate Research*. In Press.

Outreach & Service

- Co-hosted the 6th Southwest HydroMeteorological Symposium at Arizona State University along with the National Weather Service Phoenix Forecast Office.
- Presentations included "Arizona Drought Monitoring" and "Arizona State Climate Services" presented at the 6th Southwest HydroMeteorological Symposium, "Arizona Climate Variability" presented at the Global Climate Change in the Southwest Academy, "Arizona Monsoon and Safety", presented to the Arizona Public Service Field Technicians, CoCoRaHS training for two community groups in central Arizona, a Desert Mountain middle school science fair, "Central Arizona Water Resources" presentation at the Science Café, and "Arizona Climate" presented to the Jewish Community Center and to the Arizona Hydrologic Society.
- Edited the March 2012 issue of FACES – People, Places, Cultures magazine – the Perfect Storm issue on Climate.
- Reviewed the Nevada State Climate Plan.
- Teacher mentor in the AMS DataStreme Climate program in both spring and fall semesters.
- Interviews for feature stories in local newspaper, radio, and television on dust storms (haboobs), the current drought, the North American monsoon, heat stress, record-setting hail, climate change, the new normals, water resources, urban heat island, and the seasonal and annual outlooks for temperature and precipitation.
- Service on the Arizona Flood Warning System, Drought (co-chair) and State Hazard Mitigation Plan Task Forces. Member of the AMS Applied Climate Committee.

Monitoring and Impact Assessments

- Reviewer for the National Climate Assessment Chapter 6, "Regional Climate Vulnerabilities in the Southwest".
- Reviewer for Probable Maximum Precipitation Study (2009-12) funded by Arizona Department of Water Resources. This project is not yet completed due to an 8-month delay due to budget issues.

- Prepare 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, Flood Control District of Maricopa County, and the Phoenix first-order weather station, and the AZMet network for Arizona.
- Statewide coordinator for CoCoRaHS precipitation monitoring in Arizona (728 observers).

Office of the California State Climatologist

Office of the State Climatologist
California Department of Water Resources
Division of Flood Management
3310 El Camino Ave Rm 200
Sacramento, CA 95821
Tel: 916-574-2830
http://www.climate.water.ca.gov

Michael Anderson, State Climatologist

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), Western Regional Climate Center (WRCC), and the California Nevada Applications RISA, the OSC provides expertise and a growing range of climate services for California.

Work continued on many fronts over the past year. NOAA released its update to the rainfall frequency product for California and is currently available online. California's Bulletin 195, a compilation of depth duration frequency curves, continues to be updated with the help of retired State Climatologist, Jim Goodridge. Efforts continue to bring the Jim's computational methods into an automated structure within DWR and examine ways to address climate change in the Bulletin 195. 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.

Collaboration with NOAA and Scripps Institute of Oceanography continues 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. The final configuration of the initial investment of the network is shown in Figure 1. This effort was presented at a Western States Water Council Meeting on extremes and interest was expressed in determining the feasibility of creating a west-wide network. NOAA's Earth Systems Research Laboratory was asked to develop a concept of such a network with input from the California State Climatologist and Scripps Institute of Oceanography.

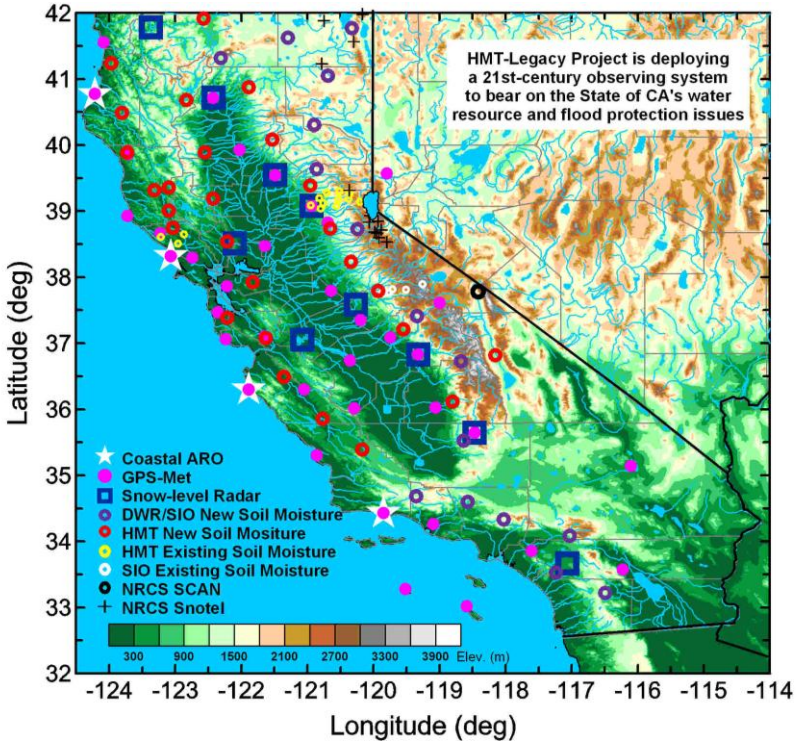


Figure 1. Final build out plan for 21st Century Observing Network project with NOAA ESRL and Scripps.

The California State Climatologist is also partnering with the California Nevada Applications (CNAP) RISA and NOAA for a National Interagency Drought Information System (NIDIS) pilot project in California. Four activities are beginning focusing on different geographic areas of California: south-coastal urban, Klamath basin, Russian basin, and Central Valley. Anne Steinemann of the CNAP RISA is acting as the State coordinator of the projects. The projects will run for two years and look to develop new data serving methods tailored to each region's specific needs.

California is now in year 4 of CoCoRaHS. Over 850 volunteers have signed up with NWS Weather Forecast Offices taking the lead as regional coordinators with help from some DWR personnel. Observers are located in 53 of California's 58 counties. Approximately 9000 reports are submitted per month from California's CoCoRaHS volunteers. A summary of activity is provided in the State Climatologist monthly summaries.

Data serving for California climate data improved this past year with the help of a collaborative project between DWR and Western Region Climate Center. Data analysis tools such as histograms and wind rose graphics have been developed for the California Climate Data Archive located at Western Region Climate Center. Further collaborations are being explored including precipitation data archiving associated with the Bulletin 195. Data serving continues via the web, phone and email. A new interface for spatial depictions of data in the California Data Exchange Center is now operational internally. No release date has been set for external use.

Travel and presentations were prominent again this past year. Presentations and/or session moderating duties included meetings for the California Water and Environment Modeling Forum, California Cooperative Snow Surveys Annual Meeting, invited talks at different locations within California including the Nevada County Master Gardeners. Out-of-state travel was limited this past year due to budget problems and will continue to be a challenge in the coming year.

The annual WERA-102 Committee meeting, a meeting of western State Climatologists, the Western Region Climate Center, and federal resource agency partners was hosted by the OSC and the John Muir Institute for the Environment at the University of California at Davis. Discussions were held on data collection, state of the National Climate Service, and climate change work being carried out in different states. Next year's meeting will be in Corvallis, OR, to discuss the crossroads of historical data and climate projection data that is used in resource management studies.

The State Climatologist has also been involved in the Department's climate change matrix team, the Climate Change Technical Advisory Group, the FloodSafe's Central Valley Hydrology Study and Central Valley Flood Protection Plan, and has recently joined the national Hydrologic Frequency Analysis Work Group. The climate change matrix team meets quarterly to discuss all things climate change related to the Department. The Climate Change Technical Advisory Group is a collection of 15 agencies, academic, and private practice personnel with expertise in climate change. The California State Climatologist is a permanent member on the committee while other seats are 3-year commitments. The group will provide input and feedback on climate change issues relevant to the Department. The Central Valley Hydrology Study is developing new design hydrology data to help the Department's floodplain mapping and flood project studies activities. This effort will include a climate change component in which the State Climatologist will be taking a lead role. The Central Valley Flood Protection Plan (CVFPP) is a 5-year plan that lays out the flood protection project activities that need to be carried out for the State. The climate change working group developed a threshold method to account for climate change in flood management planning. The document is available on the CVFPP website. The national Hydrologic Frequency Analysis Workgroup is a collection of agency, academic and private practice personnel who are investigating the possibility of updating the national flood frequency analysis guidelines.

The California State Climatologist also serves on the American Society of Civil Engineers Environmental Water Resources Institute's Hydroclimate Committee which works to raise awareness of links between climate and water management and associated research.

Work continues through the University of California Office of the President Climate Services Contract. Activity ranges from water year outlook workshops to modeling studies for flood management to field monitoring installation programs. The contract greatly expands the capabilities of project execution for the State Climate Office.

Looking ahead to the coming year, the California OSC plans to continue coordination of activities with the WRCC and the California Climate Data Archive, and continue development of the website and its capabilities to improve data serving. The State Climatologist will also continue efforts to engage climate researchers active in the State and continue collaborative efforts with NOAA personnel and others. Efforts will likely focus on extremes due to the NIDIS pilot activities and continued investment in the FloodSAFE program.

Colorado Climate Center (CCC)

Atmospheric Science Department
Colorado State University
Fort Collins, CO 80523-1371
Tel: 970-491-8545
Fax: 970-491-3314
nolan@atmos.colostate.edu
wendy@atmos.colostate.edu
nnewman@atmos.colostate.edu
http://ccc.atmos.colostate.edu/

Nolan J. Doesken, State Climatologist
Wendy Ryan, Assistant State Climatologist
Noah Newman, Staff
Zach Schwalbe, Staff

Introduction and background

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 Research, and Climate Services, the Center responds to many climate-related questions and challenges. The Center monitors climatic conditions on both broad, regional scales, and very local scales using data gathered by public sources (National Weather Service, USDA, etc.) but also by monitoring networks deployed by the Center. Data resources are then combined to provide the greatest possible granularity. 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 2011 were:

1) Conduct and coordinate climate monitoring and research specific to practical needs and applications. This includes operating the historic Fort Collins weather station which completed the 123rd year of uninterrupted climate monitoring. 2011 was a remarkable year in Colorado with northern parts of the state experiencing near-record snow accumulation and abundant spring and summer water supplies while southern Colorado dealt with severe to exceptional drought. Moving into 2012 the drought conditions have now spread northward.
2) Provide drought early warning for citizens of Colorado and the Upper Colorado River Basin. Through involvement with the National Integrated Drought Information System (NIDIS) the Colorado Climate Center is aggressively monitoring climate conditions related to drought and providing timely weekly updates to a growing community of stakeholders.
3) 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.

4) Support, coordinate, and promote the Colorado Agricultural Meteorological Network (COAGMET; http://climate.colostate.edu/~coagmet/) to provide timely local weather and climate information to support the Colorado agricultural industry.
5) Engage the citizens of Colorado in backyard climate monitoring through the Community Collaborative Rain, Hail and Snow network (CoCoRaHS; http://www.cocorahs.org) and related activities.
6) Broadly disseminate climatic information, expertise and applications, and assist others in applied climate research. This year, special emphasis was placed on planning, preparation, and promotion of "Water 2012" -- a statewide celebration of water resources and water education.

Publications

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

ARSCO Qualifications

The Colorado Climate Center is designated by the AASC as the official state climate office for Colorado. The following section describes ways in which CCC addressed the ARSCO qualification requirements during the past year:

Communication Capabilities

Communication and outreach are high priorities for the Colorado Climate Center. The CCC website and links are a critical part but not our only communications capability. Webinars (live and archived) have become a routine means of communication during the past years. A YouTube channel has been launched as an alternative means of communication along with Facebook and Twitter. Through a partnership with the Colorado State University Public Relations Department, CCC has direct access to print, broadcast, and e-media in Colorado. Many interviews and press releases are conducted or issued each year. The CCC benefits from good relations and strong communications with NOAA's National Weather Service, National Climatic Data Center, and other state and federal agencies that are providers and/or users of climate information. The Colorado Climate Center works closely with the Colorado Water Institute (CWI) and publishes climate updates through the CWI newsletter throughout the year. CCC is one of the primary data providers to the Colorado Water Availability Task Force and State Flood Review Task Force providing year-round updates on water supplies and flood potential to state agencies.

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 is only modest as most services are provided online. However, personalized request answering continues, generally free of charge. The CCC website http://ccc.atmos.colostate.edu serves tens of thousands of users and provides access to both real-time data, historic data, products, narrative climate descriptions, and publications. Unique examples include water year precipitation summaries and Colorado-specific

drought index information. CCC also features access to the CoAgMet (Colorado Agricultural Meteorological) automated weather network with near real time and historic data gathered specifically for agricultural applications. CoAgMet is the primary source in Colorado for computed estimates of reference, crop, and turf evapotranspiration using classic Kimberly Penman ET computation methodologies and the Standardized ASCE Penman-Monteith method.

The Community Collaborative Rain, Hail and Snow network (CoCoRaHS), which was initiated in 1998 by the CCC, now provides access to daily precipitation data (including snow, hail, and freezing rain) across all 50 states. CoCoRaHS was introduced into Canada in December 2011. Several new features were deployed in the past year including measurements of evapotranspiration, water balance estimates for particular locations, and graphical water year summary reports for over 14,000 locations.

Research:

Current and ongoing research at the Colorado Climate Center is focused in these areas:

1) Detection, interpretation and communication of the variability and trends observed in climate time series. Work on "Best practices" in trend detection and communication is ongoing.

2) Drought monitoring and drought early warning. We lead a weekly intensive coordinated process (including webinars during late winter and spring) that provides guidance to the U.S. Drought Monitor author – supported through the National Intergrated Drought Information System.

3) Precipitation characteristics and statistical properties. The CoCoRaHS network is affording a remarkable data set for exploring precipitation characteristics. Current emphasis is in determining how much can be learned from a short-period high-density network compared to a low-density long-term network in terms of precipitation frequencies and extreme events.

4) High elevation evapotranspiration, sublimation, and water balance.

   a) Comparing ET from CoAgMet weather stations in the North Platte and Yampa basins with lysimeter readings to refine estimates of crop water use by irrigated hay meadows.

   b) Modeling snow sublimation over the headwaters of the Upper Colorado River to better determine what role that component of the water cycle contributes related to drought and water supply projections.

   c) Overall water balance investigations supporting the NIDIS Upper Colorado River Basin pilot project.

5) Weather Instrument intercomparison. New and ongoing studies include snow sensors, rain gauges, and temperature measurement systems including comparisons of precipitation and temperature between NWS COOP stations and NOAA Climate Reference network stations

Outreach

The Colorado Climate Center maintains an outreach focus. We participate, to the extent possible within our limits of staffing and budgets, in as many outreach efforts as possible. These range from children's water festivals, school programs, field trips to the CSU Weather Station, and guest

lectures at various Colorado universities. In the past year, the CCC was involved in the AMS and NWS WeatherFests, the Colorado Water Congress, the Colorado Foundation for Water Education, the Colorado Science Convention, the Colorado Farm Show, the South Platte Forum, the Arkansas Basin Water Forum, and other smaller venues. Research and monitoring products and stories of interest are shared by listservs, press releases, and through our recent partnership with the Denver Post weather blog.

CoCoRaHS continues as a very large outreach effort through informal partnerships with other state climatologists and the National Weather Service. Approximately 15,000 participants from all 50 states are actively engaged measuring and reporting precipitation from across the country. This past year we began producing a series of animations and webinars to more effectively communicate to broader audiences (http://www.youtube.com/cocorahs/).

We have ramped up our outreach to schools as we move into "Water 2012" – our long-planned year of water education and water celebration. Rain gauges and special teacher training are being provided for any of Colorado's 1800 schools who express an interest.

Connecticut State Climate Center (CSCC)

Natural Resources Management and Engineering
University of Connecticut
1376 Storrs Road
Storrs, CT 06269-4087
Tel: 860-486-0135
http://www.canr.uconn.edu/nrme/cscc/

Xiusheng (Harrison) Yang, Professor and State Climatologist
Richard Anyah, Associate State Climatologist, Associate Director

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Associate State Climatologist and Associate Director

Approved by AASC at the 2011 annual meeting, Dr. Richard Anyah has resumed the position of the Associate State Climatologist of Connecticut, and the Associate Director of the Connecticut State Climate Center.

The Advisory Board

Due to the increasing demand for climatic data from scientists, government agencies, and the general public, an advisory board has been established since 2011 to initiate discussions for CSCC to improve its service and broaden its mission. The board consists of the following faculty members from various academic units:

Dr. Michael Willig, Center for Environmental Sciences and Engineering,
Dr. John Volins, Department of Natural Resources and the Environment,
Dr. Glenn Warner, Department of Natural Resources and the Environment,
Dr. Anji Seth, Department of Geography, and
Dr. Guiling Wang, Department of Civil and Environmental Engineering

The CSCC advisory board met on May 4, 2012. Drs. John Volin, Michael Willig, Glenn Warner, Richard Anyah, and Xiusheng Yang attended the meeting, with Drs. Guiling Wang and Anji Seth absent due to time conflicts. The advisory board has broadly discussed the history, function, challenges, and action plans for sustainable development. The following recommendations were made for CSCC to focus on in the next two years:

1) The Connecticut State Climate Center should be an integral part of all the Climate science and Climate Change mitigation and adaptation initiatives at the UConn.
2) The State Climate Center is an important data repository, climate information gatekeeper, and clearing house for any climate-related research and applications, and thus, deserves to receive University and State recognition as an important resource to the State, especially in light of potential climate impacts on various sectors of the State's economy.
3) CCSC should be promoted and enhanced as a center piece of the President's Initiative of Climate Change Mitigation and Adaptation. The center can play the role of advising the University as well as other State agencies such as DEEP that are in need of specific

climate information and services that cannot be directly provided by NOAA, but needs local infrastructure for tailoring such information (e.g., for air quality modeling and monitoring in the State).

4) There should be direct engagement between the University and the relevant State Government Agencies on how to anchor the CCSC within the broader State government structure so that CCSC can be able to enhance its services within the state, regarding provision of tailored climate information to various state agencies and institutions, especially with respect to climate change mitigation and adaptation programs.
5) Profs. Yang and Anyah have agreed to continue volunteering their time to sustain the basic services of the center, partly by working with some of their undergraduate and graduate students assistants to keep an updated climate data records and perform necessary quality control of data obtained either from the local observation stations or from the NCDC archives. However, the CCSC advisory committee strongly recommended that a partnership between UConn and relevant State agencies be explored to provide some primary support to ensure sustainability of this important mission of the center.

Support

The CSCC has been running with support to satisfy the minimum NCDC requirement for the program. The Department of Natural Resources and the Environment has provided secretarial support to the Center for day-to-day needs. A graduate student has been working on website maintenance, data transmission, processing, and dissemination. The graduate support has been provided by the University of Connecticut College of Agriculture and Natural Resources. Due to budget issues, CSCC was unable to obtain any travel funds for the annual AASC meeting.

Past and current CSCC activities

During the past year, CSCC has committed a substantial amount of time and effort in making the Center a valuable asset to the research, education and outreach communities at University of Connecticut, state and local government agencies, and the general public in the State of Connecticut.

Research

- CSCC has supported UConn researchers by providing NCDC quality-insured data, mainly in the fields of climate change, air pollution, environmental engineering, and agriculture for several projects.
- CSCC has actively participated in the establishment of the University of Connecticut Atmospheric Science Group, which has brought in the recognition of UConn as a UCAR (University Corporation for Atmospheric Research) university.
- CSCC has been actively participating in the application for the DOI Climate Science Center. The effort is coordinated by the University of Connecticut Center for Environmental Science and Engineering (CESE).

Education

- CSCC has provided up-to-date climatic data and live images for several courses taught at the University of Connecticut, including NRE 3145 Meteorology and NRE 3146 Climatology. The latter is a newly developed course focusing on the current issues of global climate change.
- CSCC is working with other faculty members to develop more structured educational and training programs at the University of Connecticut. In the past year, we have submitted two large collaborative proposals (such as IGERT or NASA global climate change programs) for establishing integrated training programs related to climate change.

Outreach

- CSCC has updated its website data pages for public to access climatic data for the State of Connecticut. The web site now provides processed climatic data for more stations across the State. The climatic data have been updated to 2010, with normal computed for the most recent past 30 years (1981-2010). For the majority stations, data includes statistics for the past 100 years, 30 years, and 10 years for various purposes.
- 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.
- CSCC has delivered over a 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.
- CSCC has provided a few of 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. Recommended by the Dean of CANR and the NRE Department Head, CSCC also has served on the Governor's working group on climate change. Our services have been widely accepted and appraised. Recently, a group of UConn students has sent Yang a letter of appreciation with many signatures.

Future planning

CSCC is currently under major updating and expansion. A graduate student has been working on a project to organize, process, analyze, and report the spatial variation and temporal change of the climate data for the State of Connecticut and neighboring states. With that, CSCC plans to:

- Following the recommendations of the advisory board to establish collaborative relationships with UConn programs and state agencies. We will try to organize and finalize our products so that others can adopt into their research, teaching or management projects. In particular, we will propose collaborative projects with state agencies for sustainable support and development.
- Re-construct 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.

- Finish and publish a new edition of the source book "The Climate of Connecticut," which was originally published in 1965.
- 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.
- 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.
- Actively participate in the AASC organized activities of research, education, and outreach, and take full advantages of the climate initiatives at the federal, state, and local governments.

Office of the Delaware State Climatologist (ODSC)

213 Pearson Hall
University of Delaware
Newark, DE 19716
Tel: 302-831-8764
http://climate.udel.edu

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

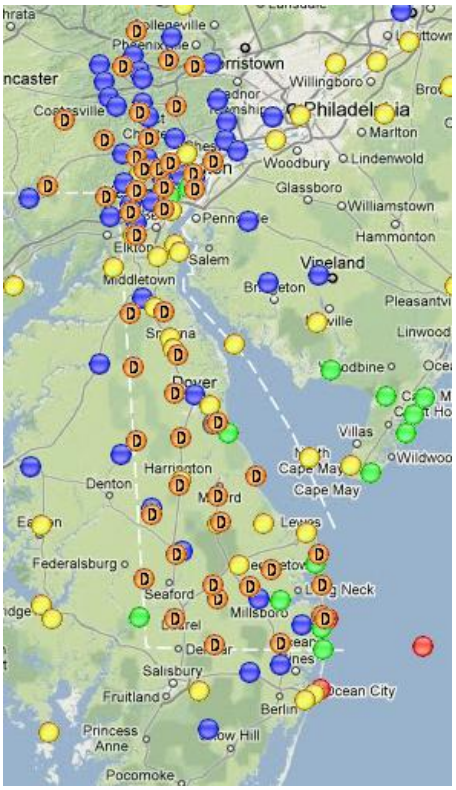
The Office of the Delaware State Climatologist (ODSC) is located within the College of Earth, Ocean, and Environment at the University of Delaware. The ODSC works in conjunction with the Delaware Environmental Observing System (DEOS). The ODSC provides diverse climate support services to the State of Delaware.

The ODSC 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 and give many public lectures. The ODSC also serves in the Technical Assistance Center of the Delaware Emergency Management Agency during critical weather events. The State Climatologist is also a statutory member of the Water Supply Coordinating Council (WSCC), and presents water-related climate information at quarterly meetings. The following represent current initiatives of the ODSC.

The Delaware Environmental Observing System (DEOS)

A major ongoing effort is the continued development and enhancement 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. Further, DEOS provides a source of high quality real-time and historical data for dissemination by the ODSC (http://www.deos.udel.edu).

Our core meteorological network has now grown to a total of 50 stations (45 installed and maintained by DEOS) located in the three counties of Delaware, Chester County in Pennsylvania (in cooperation with Chester County Emergency Management), and Cecil County in Maryland. Data from the core network and approximately 340 additional observing platforms are collected, visualized, disseminated, and archived by DEOS. The data collected by the core meteorological stations include air temperature, dew point temperature, wind speed and direction, solar radiation receipt, atmospheric pressure, precipitation, and in many cases soil temperature and soil moisture. More than 28 of the core stations also measure snow depth (described more below). The additional 340 observing platforms observe other environmental variables including stream flow, tidal water level, water quality, well level, and ocean and bay characteristics (from buoy data).



The DEOS GeoBrowser displays the spatial distribution of stations (by type) on the Delmarva Peninsula. The orange symbols with a 'D' in the center are stations maintained by DEOS. http://www.deos.udel.edu/geobrowser.html.

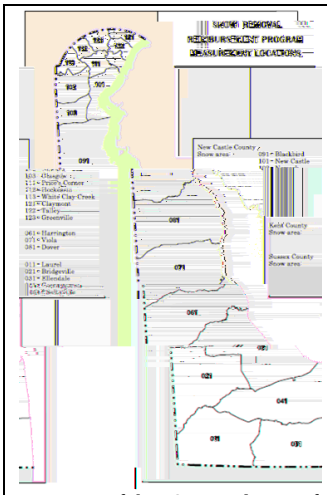
The Delaware Coastal Flood Monitoring Project

Surrounded by the Delaware Bay, the Delaware River, and the Chesapeake Bay, the Delmarva Peninsula is very vulnerable to coastal storms. Much of the damage during tropical and extra-tropical weather events is associated with severe coastal flooding. The Delaware coastline is extremely susceptible to such events, examples being the great March, 1962 storm and the recent coastal flooding incident of May 12, 2008. A GAP Analysis of pertinent coastal data needs and a comprehensive survey of inland inundation levels during previous coastal flooding events was completed as part of a cooperative effort between the ODSC/DEOS and several Delaware State Agencies. A prototype coastal flood monitoring system (CFMS) for Kent County in Delaware has been developed and was used during the passage of Hurricane Irene in August 2011 and during several nor'easters in 2011 and 2012. The system sends a warning of forecast tidal levels to users via the DEOS ALERTS System, directs them to the CFMS web site where all information on the coming event is available, and provides the user with a map showing the potential coastal inundation from the upcoming storm.

Work has begun siting sensors to better interpret model output for the Delaware Bay as a part of the CFMS expansion project. The expansion project will extend the warning area north to New Castle, DE and south to Lewes, DE. Following this expansion, the CFMS will be extended to the Inland Bays of Sussex County, DE. In order to ensure that first responders statewide utilize the Coastal Flood Monitoring System, the ODSC and DEOS has conducted training sessions for diverse constituencies across Delaware.

The DEOS Snow Monitoring Network

DEOS supports the Delaware Department of Transportation (DelDOT) Snow Removal Reimbursement Program with at least one snow depth measurement in each of the 12 transportation districts statewide. The three northernmost areas each have three snow depth measurements and all other areas have one measurement for a total of 18 operational snow monitoring stations (additional snow research sites are also contained within the network). Sonic ranging depth sensors are installed at each location during October through April. The 1-, 6-, and 24-hour totals as well as storm total snow depth are available in real-time on the DEOS snow depth monitoring website.



Locations of the 18 snow districts for which DEOS measures snowfall in conjunction with DelDOT's snow removal reimbursement program.

The measurement algorithm has two distinct characteristics which separate the DEOS snow depth data from NWS snowfall totals. First, measurements are fully automated and reported real-time in the same manner as other DEOS data streams. Second, since snow is never cleared from the pad during the snow event, allowing for the natural compaction of snow with time, a "snowfall algorithm" has been developed to allow for direct comparison with NWS official and spotter snowfall totals.

The Delaware Irrigation Management System (DIMS)

DIMS serves as an irrigation scheduling tool for the agricultural community of Delaware. It uses daily meteorological data from the DEOS network to calculate reference evapotranspiration and rainfall which are used to calculate crop water requirements for user-defined farm fields. DIMS provides a user interface where growers can enter their field specific information (i.e., crop type, field location, planting date, etc.) and using that information, DIMS automatically determines the NRCS soil texture classification and nearest DEOS meteorological station for each field. Crop water requirements are updated daily and allow users to enter their own irrigation and rainfall data to make the system provide more accurate results. DIMS was launched in Spring 2012 for use with corn and soybean and is currently in use for over 80 center pivot irrigation systems statewide.

The Delaware Community Collaborative Rain, Hail, and Snow (CoCoRaHS) Network

The State of Delaware transitioned from the DEOS Environmental Monitors Program (DEMs), joining CoCoRaHS on September 1, 2009. Mr. Kevin Brinson, Assistant State Climatologist, serves as the CoCoRaHS coordinator for the state. Presently, the state is homogeneously covered by about 20 active observers, but additional observers are being sought.

Florida Climate Center

Center for Ocean-Atmospheric Prediction Studies
Florida State University
Tallahassee, FL 32306-2840
Tel: 850-644-3417
http://www.coaps.fsu.edu/climate_center/index.shtml

David Zierden, State Climatologist
James J. O'Brien, Emeritus State Climatologist
Melissa Griffin, Assistant State Climatologist

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 Tallahassee's Innovation Park. Though physically located off-campus, COAPS and the Florida Climate Center are part of the Department of Earth, Oceans, and Atmospheric Sciences at the Florida State University (FSU). The Florida Climate Center is a 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, State Climatologist, and Melissa Griffin, Assistant State Climatologist. Dr. Mort Winsberg, author of *Florida's Weather* and professor emeritus of geography at FSU, collaborates with the Florida Climate Center staff on relevant projects, and Dr. James. J. O'Brien, former State Climatologist and Professor Emeritus, remains actively involved and provides welcome insight 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 (NCDC), 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 week 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:

- Maintain and provide access to historical data archives
- Listen to and respond to the needs of our customers

- Look beyond traditions weather variables, using derived quantities and other products
- Charge for services, where applicable
- Certify data, legal services
- Provide education/outreach on weather and climate issues across the state

The Florida Climate Center is currently making a strong effort to expand our data and product serving capabilities. We have created an interactive historic climate database and developed tools to allow both the display and downloading of small or larger subsets of the data themselves. These data display and downloading tools will be accessed through both the Florida Climate Center and Florida Climate Institute websites. We are also working with Olmo Zavala on a GIS display tool for viewing and accessing climate information across the Southeast U.S. Preston Leftwich and Steven Armstrong have developed a Google map-based to display probabilities associated with heavy rainfall events across the Southeast U.S. We will continue to expand the suite of tools and products with the ultimate goal of being the clearinghouse for climate data in Florida.

Research and Applications

The Florida Climate Center is a leading authority on climate variability in Florida, particularly as related to El Niño Southern Oscillation (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.

The Florida Climate Center is also a partner in a new climate extension program, Climate Variability to Climate Change: Extension Challenges and Opportunities in the Southeast US. The goal of this project is to build an effective Climate Extension program in the Southeast US that will contribute to the existence of a vibrant and sustainable agricultural industry in the region that is capable of adapting to and mitigating risks associated with climate variability and change. By using participatory approaches and taking advantage of established partnerships with the agricultural industry already engaged in our existing climate extension program, we aim to find and develop climate adaptation and mitigation strategies with increased chance of adoption by producers in the southeastern US.

Community Outreach and Education

In October 2007 Florida became the 23rd state to join the Community Collaborative Rain Hail and Snow (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 all 50 states where more than 10,000 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. As a non-profit organization, CoCoRaHS 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 to support K-12 participation.

In addition to the CoCoRaHS activities, members of the climate office staff have taken part in numerous outreach events across portions of the state, including weather and climate classrooms at elementary and middle schools, university open houses, and summer camps.

The State Climatologist has also become active in education and community outreach on the subject of climate change in the State of Florida. David Zierden is now an 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.

State and Regional Climate Issues

The Florida Climate Center had teamed up with the University of Florida and plays an important and active role in the formation and development of the Florida Climate Institute (http://www.floridaclimateinstitute.org). Through this partnership, top biological, social and agricultural scientists work with climatologists in order to bring together the best science expertise in the state to address the complex issues associated with climate change and societal response. In addition to providing expert knowledge and understand of the climate of Florida, the center has been tasked with providing high-quality datasets for a variety of climate scenarios for the institute.

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 ACF (Apalachicola-Chattahoochee-Flint) basin and has hosted a series of stakeholder workshops since 2009. The pilot presents a bi-weekly webinar on current drought status and the drought outlook for the basin, where David Zierden is the climate lead.

The State Climatologist has organized a group of National Weather Service personnel, Water Management District, and other interested parties in providing input to the weekly *U.S. Drought Monitor*. Each week there is a free exchange of emails and phone calls assessing the severity and impacts of drought across the state, then providing input to the *U.S. Drought Monitor* in a unified voice.

Monitoring and Impact Assessment

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 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.

Networking

In 2011, the Florida Climate Center began issuing monthly newsletters informing our customers and current climate topics, new products, and activities of the center. We have also redesigned our website for easier navigation, expanded data products and tools, and have added current and dynamically updated content and features. The Florida Climate Center is also taking advantage of social networking and has an active Facebook page.

The Florida Climate Center is also proud to be hosting the 2012 AASC Annual Meeting in Destin, Florida, on July 9-12.

Office of the Georgia State Climatologist

Georgia Environmental Protection Division
Georgia Department of Natural Resources
2 Martin Luther King Jr. Drive, Suite 1152 East Tower
Atlanta, GA 30334
Tel: 404-363-7079
http://www.gaepd.org/Documents/stateclimatology.html

Bill Murphey, State Climatologist
Nyasha Dunkley, Deputy State Climatologist

The Office of the Georgia State Climatologist within the Environmental Protection Division functions to collect, disseminate, and interpret climatological and meteorological data. It daily serves the State in responding to public and private entities on issues related to Georgia's climate, as well as offering correspondence with educational institutions as it relates to atmospheric science. An important role of the climate office is to stay apprised of current atmospheric conditions as it relates to (but not limited to) droughts, the ENSO (El Nino-Southern Oscillation) forecast, and the short, middle, and long-term seasonal outlooks. In addition, the office internally produces composite maps containing climatological information, such as precipitation and temperature. The climatology office is led by State Climatologist, Dr. Bill Murphey, whose background includes air quality forecasting for the state of Georgia, as well as analysis of synoptic and mesosynoptic scale systems in mid-latitude and Polar Regions. Nyasha Dunkley, Deputy State Climatologist, also has a background in air quality forecasting, as well as research into the correlation between ENSO and tropospheric ozone.

Hawaii State Climate Office (HSCO)

Department of Meteorology
School of Ocean and Earth Science and Technology
University of Hawaii
Honolulu, HI 96822
Tel: 808-956-2324
http://www.soest.hawaii.edu/MET/Hsco/

Pao-Shin Chu, State Climatologist
Chris O'Connor, Graduate Research Assistant
Chase Norton, Meteorology Research Assistant

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

This year the HSCO has added a new member to the team, Chris O'Connor, a graduate of the University of California Santa Barbara. In the fall of 2012, Chris will begin participation as a graduate student in the Meteorology Department here at the University of Hawaii. Along with his educational endeavors, Chris will be a graduate research assistant for Dr. Pao-Shin Chu.

It is our goal here at the HSCO to be active contributors in our community. On 02/29/12, Dr. Pao-Shin Chu and the HSCO took part in a monthly lecture series put on by the Hawaii Conservation Alliance at the ING Cafe in Waikiki, Hawaii. Titled "Precipitation Extremes in the Hawaiian Islands Under a Changing Climate", the purpose of this lecture was to educate the public on the recent precipitation findings by the HSCO.

One of our focuses at the HSCO is to assist others with various weather data requests. The requests that we handled this year came from a wide variety of fields; from professionals in the community to professors to students. Recently, we even offered aid to a high school student in need of our climate expertise. This year our most common endeavor was to supply precipitation data sets in Microsoft Excel document format. On the other hand, we also gave assistance to a few people in need of trend data. For example, we investigated the average monthly wind speed and direction in Honolulu for the past 10 years.

During the past year, we have published a paper, focusing on projecting future changes in heavy rainfall events for Oahu using a statistical neural network downscaling approach (Norton et al., 2011). Our results indicate that the frequency of heavy rainfall events on Oahu will increase in the next 30-yr (2011-2040) relative to the present-day climate. However, heavy rainfall intensity is projected to decrease in the future. A BCa bootstrap resampling method is used to provide 95% confidence intervals of the storm frequency and intensity.

One of the main thrusts of our current activity is to perform dynamical downscaling for projecting future rainfall variations for the Island of Kauai. This project is funded by the Kauai Department of Water. Because global climate models have a coarse horizontal resolution and the island is small and terrain complex, simulations from climate models cannot be used directly for Hawaii. Dynamical downscaling is achieved by using a high resolution regional model (WRF) that is

initialized with the output from global climate models. We are downloading and processing a suite of the latest CMIP5 climate models for projection of future climate in the North Pacific. We are also currently configuring the WRF model for initial conditions and running the regional model with multiple-nested domains in very fine resolutions (down to 1 km for Kauai).

There have been a few unusual weather events the State of Hawaii has experienced in the past year. Hawaii has been affected by a few heavy rainstorms. There are two in particular which were exceptionally memorable. The first storm occurred between 05/01/11-05/03/11, where there were reports of dual water spouts (Image 1) just off the coast of Waikiki and unusually large amounts of lightning. Around 60,000 customers in east Oahu lost electrical power after lightning struck two major transmission lines. On top of that, heavy rainfall occurred resulting in numerous flash flooding events, although no injuries were reported. The second major storm occurred between 03/05/12-03/09/12. Along with a tornado touching ground in Kaneohe, Hawaii's largest hailstone ever recorded dropped on the eastern side of Oahu (Image 2). Additionally, incredibly heavy rainfall along with flash flooding took place in all parts of the state.

Image 1: Dual water spouts off the southern coast of Oahu on 05/02/12.

Image 2: Hailstone the size of a lemon dropped along eastern Oahu on 03/09/12.

Massive swell events pounded the northern shores of the islands during winter, this year topping out at 35 foot faces on 01/15/11 along the northern and western facing shores of Kauai. Aside from the excitement drawn from these magnificent swell events, drought has been a hot topic of discussion this year in Hawaii. Persistent drought conditions have been present throughout the state. Fortunately, the latest storm in March 2012 brought significant amounts of rainfall to the state, bringing some regions out of drought. Nevertheless, there are still parts of the state under serious drought conditions, including the western parts of the Hawaiian Islands, Maui, and Molokai.

The most infamous event was the devastating tsunami in Japan, which was heard about and felt around the world on 03/11/11. The Pacific-wide tsunami certainly affected the Hawaiian Islands, with the west side of the Big Island experiencing the greatest impact. Three hotels experienced extensive damage, while one of the resorts had to close permanently due to the severity of the inundation. The other islands received lesser effects from the tsunami, though damages were experienced on Oahu, Molokai, and Maui. The good news is there were no reports of serious injuries.

References

Norton, C.W., P.-S. Chu, and T.A. Schroeder, 2011: Projecting changes in future heavy rainfall events for Oahu, Hawaii: A statistical downscaling approach. J. Geophys. Res., 116, D17110.

Record Size Hail Picture. Honolulu NWS. Accessed 3/25/12.

Storm Events Database, NOAA National Climatic Data Center, http://www.ncdc.noaa.gov/stormevents.

Twin Water Spouts Picture. http://www.flickr.com/photos/rubbah_slippahs/5683016610. Accessed 04/15/12.

Idaho State Climate Services (ISCS)

Department of Biological and Agricultural Engineering
P.O. Box 440904
University of Idaho
Moscow, ID 83844-0904
Tel: 208-885-7004
Fax: 208-885-7908
rqualls@uidaho.edu
http://snow.ag.uidaho.edu/

Russell J. Qualls, Associate Professor and State Climatologist
Ayodeji Arogundade, Graduate Student
Yohannes G/Eyesus Getahun, Graduate Student

Climatic information is essential to every citizen of Idaho. To help people obtain the climatic and water data and information necessary for planning and every day work, the State Climatologist Program strives to acquire, archive, process and disseminate, in the most cost effect manner possible, 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 a website and 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 159 observers.
- Responded to numerous e-mail requests for climate data/information/services.
- Addressed telephone requests for information, services and research.
- Interviewed by local, state and national newspapers, radio stations, and other media outlets.
- Maintain three automated weather stations, a Cooperative Observer Station with over 110 years of data, a CoCoRaHS non-recording precipitation gage, and a recording precipitation gage, and partially fund a SNOTEL site.
- ISCS provides numerous reports including Intensity-Duration-Frequency spreadsheets for many cities in Idaho.

Research

- Develop hybrid remote sensing-ground sensor method to quantify watershed snow-covered area.
- 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 change scenarios to evapotranspiration on irrigation water demand and the resulting economic impact on agricultural revenues.
- Analyzing historical temperature trends at climate stations across Idaho.
- Developing algorithms and models to assimilate remotely sensed data for use in spatially distributed land surface-atmosphere exchange models.
- Maintain a 130 foot tall eddy covariance forest research tower to study water and carbon exchange in complex mountainous, forested topography.
- 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:

- Presentations to Idaho State Legislative committees on climate and climate change issues in the state.
- Climate products made available through ISCS website, and the printed volume, *Climates of Idaho* (Abramovich, R., M. Molnau, and K. Craine, University of Idaho, College of Agricultural and Life Sciences).
- Participate in discussion and meetings regarding formation of National Climate Services.
- Climate Presentations to local elementary schools.
- Interviewed by print, radio, and television media contacts.
- 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 and Weather.

Monitoring and Impact Assessment

- ISCS helps monitor current and historical precipitation through the CoCoRaHS network (http://www.cocorahs.org/) and QA/QC analyses of the Idaho network.
- ISCS is conducting studies of the impact of climate scenarios on state climate, water supply, agricultural water demand, and agricultural revenue for the Snake River Plain of southern Idaho. These are related to historical observations from the Cooperative Observer Network, SNOTEL (http://www.wcc.nrcs.usda.gov/snow/), and an agricultural meteorology network (AgriMet, http://www.usbr.gov/pn/agrimet/).

Illinois State Climatologist Office

Illinois State Water Survey
Prairie Research Institute
University of Illinois Urbana-Champaign
2204 Griffith Drive
Champaign, IL 61820-7495
Tel: 217-333-0729
Fax: 217-244-0220
jimangel@illinois.edu
http://www.isws.illinois.edu/atmos/statecli/

Jim Angel, State Climatologist

The State Climatologist Office (SCO) for Illinois is located at the Illinois State Water Survey (ISWS) in Champaign, Illinois, under the Prairie Research Institute on the campus of the University of Illinois. 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 SC maintains a web site (http://www.isws.illinois.edu/atmos/statecli/) and blog (http://climateillinois.wordpress.com/) devoted to climate data and information on a wide variety of climate topics.

Information Services

The Illinois SC is actively engaged in providing information services within Illinois through interviews, lectures, and responding to calls and emails. In addition, regular monthly press releases on conditions of the last month are used widely throughout the state. Each year the state climatologist gives 18 to 24 talks around the state to a wide range of audiences.

Research

The Illinois SC maintains an active research program, with applied research focused on Illinois and the Midwest. He is currently involved in the USDA funded project called "Useful to Usable (U2U): Transforming Climate Variability and Change Information for Cereal Crop Producers."

He has an adjunct appointment with the Department of Atmospheric Science at the University of Illinois and sponsored several students for senior-level Capstone Projects involving the relationship between ENSO and Illinois monthly temperatures and precipitation, the effects of the Corn Belt on summer-time humidity, and the analysis of early 19th century temperature records at Fort Armstrong.

Outreach

The Illinois SC engages in a number of outreach activities. He writes regular contributions to the monthly ISWS Water and Climate Summary. He has 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. He has worked closely with University of Illinois Extension on a number of issues that included: a) training of CoCoRaHS weather observers, b) teaching a section on climate to Master Naturalists in Champaign and Madison Counties, c) speaking at University of Illinois Extension Seminars around the state, d) speaking to other groups that are either part of or hosted by Extension such as marketing clubs, and e) occasional guest on the Illinois Gardener program on WILL-TV. He was a guest lecturer for an environmental science class on the campus of the University of Illinois.

The Illinois SC has worked closely with the National Weather Service on a variety of issues that included: a) training of CoCoRaHS weather observers, b) supporting the cooperative weather observer network through contributions to newsletters, letters of appreciation, attending award ceremonies, etc., and c) coordinating climate services needs in Illinois amongst the five NWS offices that serve Illinois.

Angel is a member of the American Meteorological Society, Illinois State Academy of Science, and the American Association of State Climatologists.

Monitoring and Impact Assessment

The Illinois SC regularly monitors the climate conditions within the state. The noteworthy events of 2011 were the wet springs that hampered planting, followed by a flash drought in July and August in central Illinois. This was followed by an extremely mild winter with little snow and record high temperatures in the spring. He provides input on drought and their impacts to both the state drought task force and the U.S. Drought Monitor.

The Illinois SC finished his term as the interim manager of the Water and Atmospheric Monitoring program (http://www.isws.illinois.edu/warm/) at the Illinois State Water Survey in August 2011. This program coordinates the data collection and monitoring programs conducted at the Water Survey. The program includes observations of soil temperature and moisture, solar radiation, surface water and groundwater levels, and in-stream sediment.

Indiana State Climate Office (IClimate)

Department of Agronomy– *Crops, Soil, Environmental Sciences*
Purdue University
West Lafayette, IN 47907
Tel: 765-494-6574
Fax: 765-496-2926
iclimate@purdue.edu
http://www.iclimate.org

Dev Niyogi, State Climatologist
Ken Scheeringa, Associate State Climatologist

IClimate is an American Association of State Climatologists (AASC) Recognized State Climate Office (ARSCO). In addition to permanent staff, the office provides work opportunities to graduate and undergraduate students in research projects and customer service interactions. This office fulfills the ARSCO requirements in the following ways:

Research

IClimate continues to be involved in several research projects primarily supported through NSF, NASA, DOE, USDA, and other federal agencies. An assessment of the role of land use and land cover including urbanization on the regional hydro-climatology continues.

The development of a regional drought information portal and an environmental cyber-infrastructure prototype for heterogeneous data access and processing is in progress. The 2011 Data-Driven Approaches to Drought Symposium (DDAD) was hosted by Purdue in June for researchers and stakeholders to exchange techniques for drought characterization, explore cyber-infrastructure for data collection, and share visualization methods leading to improved practical applications.

Through improved decision support tools, training, and resource materials *IClimate* partners in the *Useful to Usable (U2U)* project which seeks to improve the resilience and profitability of farms in the Midwest amid variable climate change. Other *IClimate* projects involve the role of land use change on surface temperature datasets and rainfall trends across the continental or eastern US.

Projects are underway related to the design framework of land use planning as a tool for climate change adaptation in greener cities with particular focus on Indianapolis, Indiana. A series of projects are also underway related to climate literacy and education for middle schools and informal educators. Details regarding these projects and resulting publications can be found at http://landsurface.org.

Outreach

A Climate Services and Drought Workshop was held in Indianapolis in June. The workshop was attended by staff of *IClimate*, NWS, MRCC, NDMC, Purdue staff, and potential climate partners such as Indiana government, Silver Jackets, and local weather broadcasters. Topics were aimed to

explore existing and proposed operational climate applications and their delivery systems relevant to Indiana.

An important outcome of this workshop was the formation of an Indiana Climate Services Team. A goal of the team is to integrate existing and planned climate activities among the various partners and sectors into practical operational climate applications of benefit to Indiana residents. Discussions along these lines continued at the CoCoRaHS state coordinators meeting in December. The first official meeting of the new Climate Services Team took place as a conference call in March 2012.

In response to the Indiana State Fair tragedy an *IClimate* web page was created as a compilation of the various local meteorological data collected on that date (http://iclimate.org/2011aug13.asp). *IClimate* staff responded to requests for data summaries from the Governor's General Counsel and other investigators in the days and weeks following the incident.

Ruth Everhart of Seymour was honored as the longest serving cooperative observer in Indiana history at a community celebration in her honor on 16 October 2011. Staff of NWS and *IClimate* presented Ruth with award certificates. She later received an award from the State of Indiana in recognition of her 64 years of service.

Media interviews, outreach venues, and press releases continued through *IClimate*. A booth was hosted at the Indiana State Fair featuring exhibits on climate education and the CoCoRaHS program. Invited talks included an audience of seed salesmen at Beck Hybrid Days at the Purdue Diagnostic Training Center where Ken's talk "What's Wrong with our Weather?" was presented.

IClimate continues as the state co-manager of CoCoRaHS Indiana. At the end of our sixth year in 2011 more than 1660 volunteers have joined CoCoRaHS Indiana with more than 400 actively reporting each day. The *Counting Drops* newsletter was again sent to all Indiana CoCoRaHS volunteers, both active and inactive. A state coordinators meeting was held at Purdue on 5 Dec 2011. An important policy change at this meeting was to end the free rain gauge incentive program at the end of the year and direct those funds into development of applications making use of the CoCoRaHS data collected. Weekly and monthly Indiana total precipitation GIS maps based on CoCoRaHS observations continue to be posted to our web site: http://www.iclimate.org/precip/images/precip.asp.

Monitoring and Impact assessment

Though the AASC SCEP grant has ended, *IClimate* continues to compile current weather statistics and impacts into weekly and monthly state climate narratives. An abbreviated highlights version of the monthly summary continues to be sent to MRCC at the end of each month. The full monthly report is posted to our *IClimate* web site (http://www.iclimate.org/summary.asp) and to the AASC web site (http://www.stateclimate.org/state.php?state_id=IN).

Reference evapotranspiration monitoring with ETgages continued in 2011 at 7 Purdue research farm automated weather stations and at 2 non-automated Purdue farms. The automated measurements are updated hourly into the *IClimate* web database. Two new manual ETgage sites will be added in 2012 at the NWS offices in Indianapolis (IND) and Northern Indiana (IWX).

Collaboration with our NWS and RCC partners continues. Ken represented *IClimate* as a member of the Indiana State Extremes Committee in February 2011. The event debated was a new 24 hour snowfall record at South Bend on 8 January 2011. After input from all members the committee accepted the event as a new state record but with comment to further investigate why the former record was accepted with incomplete documentation.

In another instance a cooperative station was closed whose data was deemed critical to Purdue researchers. A novel solution was discovered during a meeting between the NWS and *IClimate* staff that enabled the station to be reopened a few months later.

For years local NWS offices have forwarded copies of the recent month cooperative observer forms to the *IClimate* office. In 2011 the IND office provided *IClimate* with access to data retrieval from the WxCoder web page, thus eliminating the monthly ritual of mailing us forms. This may be a solution for other state climate offices weary of storing paper copies of cooperative station forms for recent months.

IClimate routinely accesses climate data from the MRCC MACS system when compiling the weekly and monthly weather impact summaries and in response to some client data requests.

Ken continues as the observer at the IN41 station of the National Atmospheric Deposition Program (NADP), which monitors precipitation chemistry at over 200 locations nationwide.

State agencies, Purdue researchers, students, and scores of others consult *IClimate* staff routinely for assistance in specific projects. In 2011 the Indiana Departments of Natural Resources, Fire Marshall, and Environmental Management are a few examples. All such contacts are far too numerous to itemize here.

Education

Through separate NSF and NOAA grants, *IClimate* continues working with a network of teachers and educators in developing and delivering a curriculum and professional development material on climate science with a focus on the Midwest. The website http://iclimate.org/ccc continues to be used by teachers to access climate change curriculum modules that can be integrated into middle school activities. *IClimate* hosted an exhibit on climate change education at the Indiana State Fair regarding climate and the role of oceans (as part of COSIA-UC Berkeley) during Purdue Day when 500,000 visitors typically attend. Talks were given to teachers at NSTA and to various extension groups.

Iowa State Climatologist Office

Iowa Dept. of Agriculture & Land Stewardship
Wallace State Office Bldg.
Des Moines, IA 50319
Tel: 515-281-8981
Fax: 515-281-8025
harry.hillaker@iowaagriculture.gov
http://www.iowaagriculture.gov/climatology.asp

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 is also maintained. With 136 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).

Work has continued in developing a monthly database of historical Iowa precipitation records with just over 20,000 station-years compiled. Preliminary work in developing statewide averages of various weather statistics beyond average monthly temperature, precipitation, and snowfall is also in progress. These new averages include the number of days per year reaching or exceeding maximum temperatures of 90º or 100ºF 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. The first version of these historical metrics has been

completed with plans for expanding the number of locations used in these statistics underway in 2012.

Outreach

The office maintains very open communication with the news media with a total of 307 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 1,940 inquiries were answered during the past year. Most inquiries were received from government agencies (37%), the news media (16%), attorneys (13%), and insurance (6%). Virtually every major branch of State government utilizes the Iowa SC Office data on a regular basis. Total contacts, and especially news media contacts, were down considerably from recent years, probably owing to less eventful weather in 2011.

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 Asheville, NC in July 2011 and served as the Secretary-Treasurer of the AASC in 2009 and 2010. In January 2012 the Iowa SC became co-chair of the NOAA Data Stewardship Team.

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. Special weather summaries and analyses are also prepared the USDA and U.S. Geological Survey and the office is a regular contributor to the U.S. Drought Monitor. As always, there were notable extremes of the weather in Iowa in 2011. The most significant was a return to much drier weather in 2011, bringing an end to a period of four very wet years (2007-2010). Dry weather was particularly acute in late summer and into the fall with drought conditions developing over much of northwest Iowa and a small corner of southeast Iowa. The state experienced its

shortest growing season since 1989, but with minimal impact thanks to the hottest summer since 1988 providing plenty of heat units. The tornado season got off to a very active start with large outbreaks on March 22 and April 9, but then came to its earliest conclusion since 1962.

Kentucky Climate Center (KCC)

Department of Geography & Geology
Western Kentucky University
1906 College Heights Boulevard
Bowling Green, KY 42101
Tel: 270-745-5983
Fax: 270-745-6410
stuart.foster@wku.edu
http://www.kyclimate.org

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

The Kentucky Climate Center (KCC) observed its 34th year of operation in 2011. 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, and mathematics.

The KCC is recognized by the AASC as the State Climate Office for Kentucky in the National Climate Services Partnership. Therein, the KCC had developed strong relationships with the five National Weather Service forecast offices that serve portions of Kentucky, which include Jackson, KY, Louisville, KY, Paducah, KY, Wilmington, OH, and Charleston, WV. The KCC also enjoys supportive relationships with the Midwestern Regional Climate Center and the National Climatic Data Center.

In addition to housing the Office of the State Climatologist, the Kentucky Climate Center is home to the Kentucky Mesonet and the Climate Research Laboratory. The Kentucky Mesonet is a statewide network of automated weather and climate stations that is recognized as the official source of climatological observations for the Commonwealth of Kentucky. The Climate Research Laboratory houses several Linux workstations running WRF, WRF-Chem, MM5, and RAMS and supports atmospheric and atmospheric chemistry modeling focusing on impacts of land-use and land-cover change.

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. The KCC website was recently transitioned to a new URL, (http://www.kyclimate.org/). Transition to a new e-mail address is anticipated. In addition, the KCC maintains the Kentucky Mesonet website (http://www.kymesonet.org/).

Research

Faculty and students associated with the Kentucky Climate Center are involved in a variety of applied research projects. A current focus is on the analysis of data from the Kentucky Mesonet, including temperature bias due to station exposure and instrumentation and assimilation of Kentucky Mesonet data in forecasting. Modeling research continues to assess impacts of model physics parameterization scheme selection on forecasts, impacts of model initialization dataset on forecasts, impacts of land-use/land-cover change and soil moisture on planetary boundary layer, precipitation, and air quality dispersion. Papers on these topics were published in Journal of Hydrometeorology, Tellus A, Global and Planetary Change, Applied Geography, Water, Air, and Soil Pollution, and WIREs: Climate Change.

Faculty, staff, and students affiliated with the Kentucky Climate Center presented research papers at the annual meetings of the American Meteorological Society, Association of American Geographers, the Kentucky Academy of Sciences, and the Southeast Division Association of American Geographers. They have also presented papers at number of state and regional professional meetings and workshops.

Outreach

The KCC provides outreach via the media, including interviews through the television, radio, and newspaper media addressing significant weather events, climate change, and the Kentucky Mesonet.

The state climatologist plays an active role on the Kentucky Drought Mitigation Team organized through the Kentucky Division of Water within the Kentucky Cabinet for Energy and Environment.

KCC representatives were featured speakers at events held or sponsored by the Kentucky Emergency Response Commission, the Kentucky Division of Emergency Management, the Kentucky Small Grain Growers' Association and University of Kentucky, and the Kentucky Cabinet of Transportation/Federal Highway Administration. The KCC also maintained an active working relationship with NOAA National Weather Service forecast offices throughout Kentucky.

Monitoring and Impact Assessments

Expansion of the Kentucky Mesonet (KM) continued. Sixty-two research-grade automated weather and climate monitoring stations are currently operational throughout the state. One of the mesonet stations also serves as an eddy-covariance flux measuring site.

Mesonet staff maintains strong relationships with NWS forecast offices serving Kentucky, media, and various public and private entities. Data from the KM are freely available to the public via the KM website.

Louisiana Office of State Climatology (LOSC)

Department of Geography and Anthropology
Louisiana State University
Baton Rouge, LA 70803
Tel: 225-578-6870
http://www.losc.lsu.edu

Barry Keim, State Climatologist
Kyle Brehe, User Services Coordinator
Malcolm Moe Moreau, NWS Liason
Amanda Billiot, Graduate Student
Robert Gautreaux, Graduate Student
Laura Becker, Graduate Student

Mission

The mission of the Louisiana Office of State Climatology (LOSC) and the Louisiana 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 Louisiana State University (LSU), the National Weather Service (NWS), Southern Regional Headquarters of the NWS, the Southern Regional Climate Center (SRCC), and the National Climatic Data Center (NCDC).

Need and Relevance

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. Hundreds of requests are still handled annually. We also collaborate with the Louisiana Office of USDA's National Agricultural Statistics Service, where data are shared. 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 (www.losc.lsu.edu). This report is also e-mailed to over 100 recipients across Louisiana, including most television weathercasters in the state, concerned State Office Officials, as well as the National Weather Service Offices that serve Louisiana. The LOSC 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 are 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*. 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.

Outreach

The LOSC conducts frequent interviews with radio, newspaper, and magazine media. Several hundred media contacts were logged in 2011. In 2011, I was quoted in the following newspapers *The Advocate* – 11 (Baton Rouge), *Times-Picayune* – 4, *The Reveille* – 3, *The Advertiser* – 4 (Lafeyette), DIG Magazine – 1, Currents Magazine – 1. I was interviewed at least 77 times for radio by *Louisiana Network* on a variety of weather topics involving Louisiana (LA Network has 75 radio station affiliates in Louisiana). I was a Guest on *Sunday Journal* with John Pastorek twice on WBRZ, Channel 2 – first on May 18, 2011 to discuss the opening of hurricane season. Interviewed by WBRZ-Channel 2 live 2 times on August 8, 2011 about the Hot Air Balloon Championships, and on June 1, 2011 about the opening of hurricane season. In 2011, I was interviewed by KMAR Radio 25 times, by WJBO Radio 5 times, and by the Associated Press 5 times.

Research

Keim, B.D., R. Fontenot, C. Tebaldi, and D. Shankman. 2011. Hydroclimatology of the U.S. Gulf Coast under Global Climate Change Scenarios. *Physical Geography* 32**(**6):561–582. http://dx.doi.org/10.2747/0272-3646.32.6.561.

Nogueira, R., and B.D. Keim. 2011. Contributions of Atlantic Tropical Cyclones to Monthly and Seasonal Rainfall in the Eastern United States 1960–2007. *Theoretical and Applied Climatology* 103(1-2):213-227, DOI: 10.1007/s00704-010-0292-9.

Needham, H., and B. D. Keim. 2011. Storm Surge: Physical Processes and an Impact Scale. Chapter 20, pp. 385-406, In: *Recent Hurricane Research – Climate, Dynamics, and Societal Impacts*, E. Lupo (Ed.). Intech Open Access Publisher: Croatia.

Maryland State Climatologist Office

University of Maryland
Department of Atmospheric and Oceanic Sciences
College Park, MD 20742
Tel: 301-405-7223
climate@atmos.umd.edu
http://www.atmos.umd.edu/~climate

Konstantin Vinnikov, Acting State Climatologist
Russell R. Dickerson, Professor

Abstract

This year's activity by the State climatologist office for Maryland included routine climate service coupled with monitoring and interpretation of observed regional climate change. We showed that century-scale change of MD climate follows the classic greenhouse global warming scenario with cold season amplification of temperature and a noticeable increase in annual precipitation. We found that summer time precipitation has a tendency to decrease in all eight climate divisions of MD. Potential consequences of this decrease in summer precipitation together with increase in temperature should be evaluated. More surprising preliminary results show that there is no noticeable or statistically significant increasing trend in the annual number of days with temperatures above 100 F.

Climate Service: Summary of Activities in 2011

The office of the State Climatologist of Maryland is the center for analysis, interpretation, and distribution of climactic information for the State of Maryland. Climate data are provided to governmental agencies, businesses, students, researchers, and citizens of Maryland. We maintain links with many cooperative meteorological stations in the state, as well as the National Climactic Data Center, the National Weather Service Forecasting Office, and the National Oceanic and Atmospheric Administration.

The office of the State Climatologist of Maryland received more than 100 data requests in 2011. Nearly all data requests were handled by accessing the data from the National Climatic Data Center, and forwarding the data to the recipient in accordance to the requesters' preferences. The majority of data requests were of precipitation or temperature data for a specific location and timeframe. Specifically, lawyer and attorney offices would request weather reports for a certain day and time for a specific location (i.e. street or intersection) as the nature of their claims needed that type of detail. Many other requests were received from students, researchers, and employees of governmental agencies such as wind histories (gusts and direction), seasonal outlooks (spring and summer climate outlook), or hydrological outlooks (drought conditions). This past year, we have been contacted with requests from students attending the University of Maryland, Hood College, the United States Naval Academy, and Pennsylvania State University. Some government agencies that have requested data include the Maryland Department of the Environment, National Plant Materials Center, Naval Research Lab, USEPA Office of Research and Development - National Risk Management and Research Laboratory, Maryland Department of Natural Resources,

and the Department of the Army as part of the Critical Infrastructure Risk Management (CIRM) program. Businesses have contacted the office for climate data for projects they are working on. In general, most requests are handled with data from the National Climactic Data Center. Data from Maryland COOP stations has been used in data requests along with data from the National Weather Service Forecasting Office. One other main type of request we have received has been from local media outlets, such as radio stations, local newspapers, etc. asking for an interview or statement about climate conditions. To mention a few: WBAL Radio News, Midday with Dan Rodricks 88.1 WYPR, The Baltimore Sun, and The Queen Anne's Chronicle. The Office of the State Climatologist also works with Maryland COOP stations. We receive and archive monthly climate data records from approximately thirty sites from all over the state of Maryland. These COOP stations are managed and operated by private citizens. Some of the data requests require special research. They are mostly related to information on regional climate change for monitoring and managing natural resources and climate dependent entrepreneurial activities. Few examples are below.

Observed century scale climatic trends in temperature and precipitation

Recent revolution in the NCDC/NOAA approach to homogenization of historical long-term climatic records created many problems for climate services. New data, that should be used, are often not yet officially released. Old data, which should not be recommended for use anymore, is still available from the official NCDC web site. Obtaining the proper version of data is currently possible through direct contact with NCDC scientists only. The time series of state and climate division averages of monthly temperatures are most often used to evaluate regional climatic trends. As an example Figures 1-5 display a map of MD climate divisions, seasonal variations of means, standard deviations, and linear trends of temperature and precipitation for the period of observation from 1895.

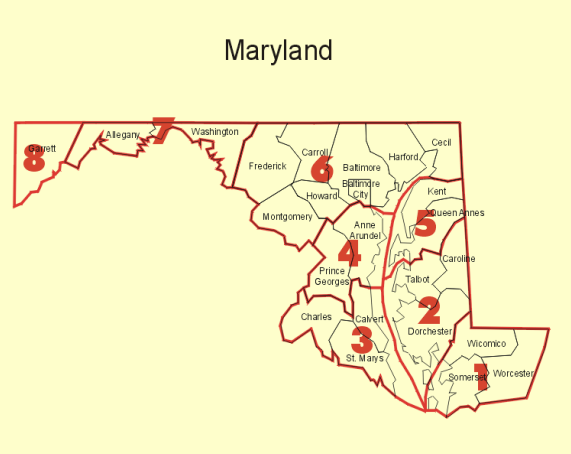


Figure 1. Schematic map of the NOAA climate divisions for Maryland: 1-Southeastern Shore; 2-Central Eastern Shore; 3-Lower Southern; 4-Upper Southern; 5-Northeastern Shore; 6-North Central; 7-Appalachian Mountains; 8-Allegheny Plateau.

These estimates are based on the US Historical Climate Network v.2 monthly temperature and precipitation data set. Averages for MD Climate Divisions are obtained by Dr. Russell Vose (NCDC/NOAA). The estimates show that climate of MD is warming and follows the winter

amplification scenario. Cold season temperature is rising faster compared to warm season temperature. Summer warming is rather weak almost everywhere in MD and is about 1°F/100 yr. Such a low rate of seasonal warming is not really detectable or statistically significant in regional climatic records. Nevertheless, this almost negligible warming is accompanied by a decrease in summer precipitation. This decrease is compensated by increased precipitation in other seasons (spring and autumn) and may cause many environmental and economical consequences for citizens of MD. These include decrease of summer water resources, increase in occurrences of severe droughts, increase in accumulation of dry biomass in the not well-managed forests.

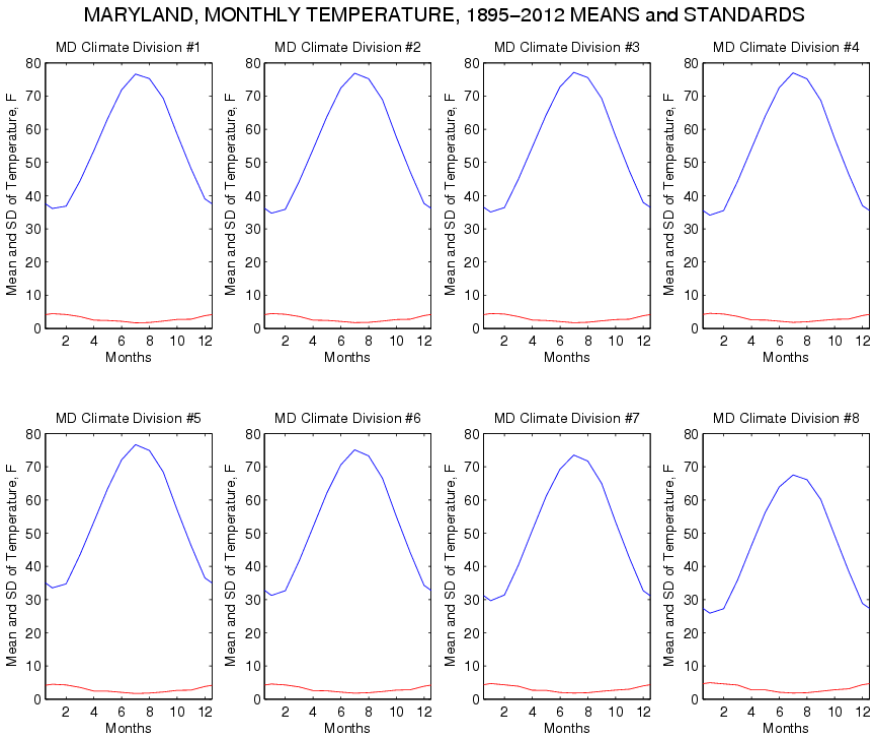


Figure 2. Seasonal variations of 1895-2012 means and standard deviations of monthly temperature in the MD climate divisions.

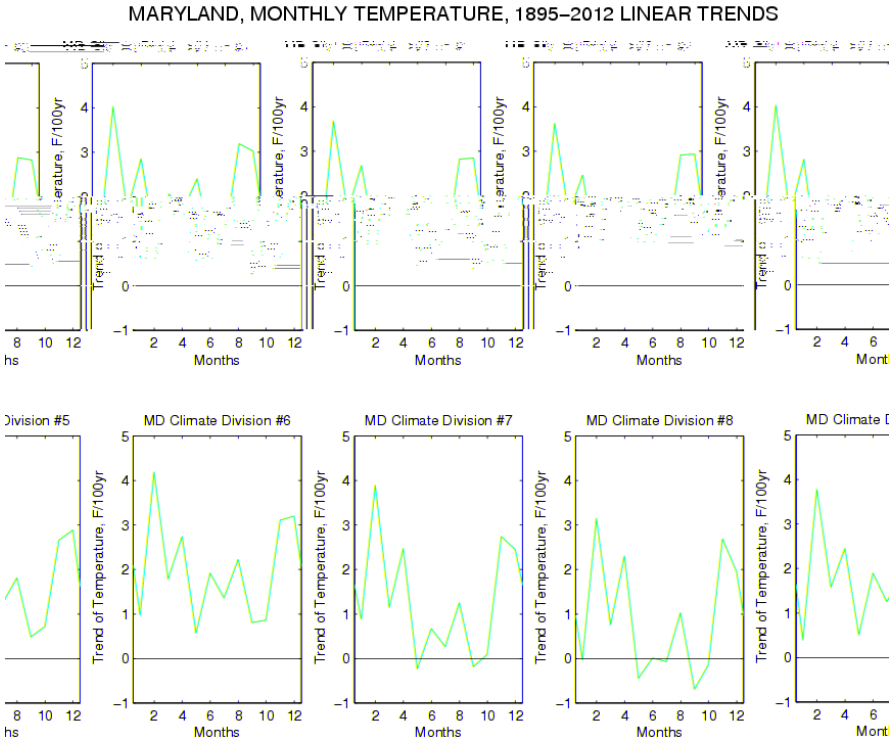


Figure 3. Seasonal variations of 1895-2012 linear trends of temperature in the MD climate divisions.

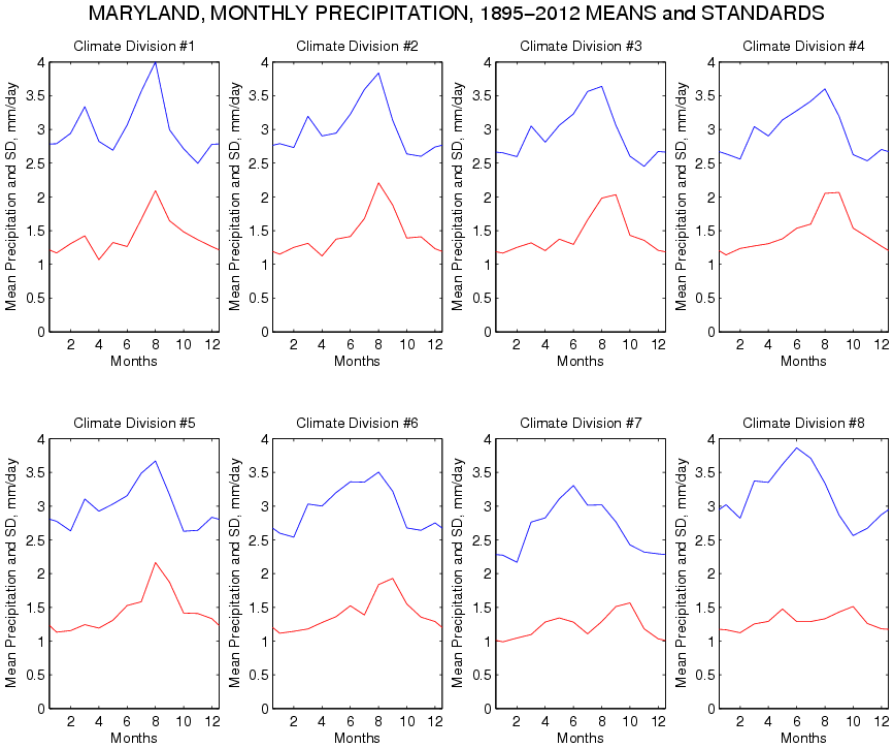


Figure 4. Seasonal variations of 1895-2012 means and standard deviations of monthly precipitation in the MD climate divisions.

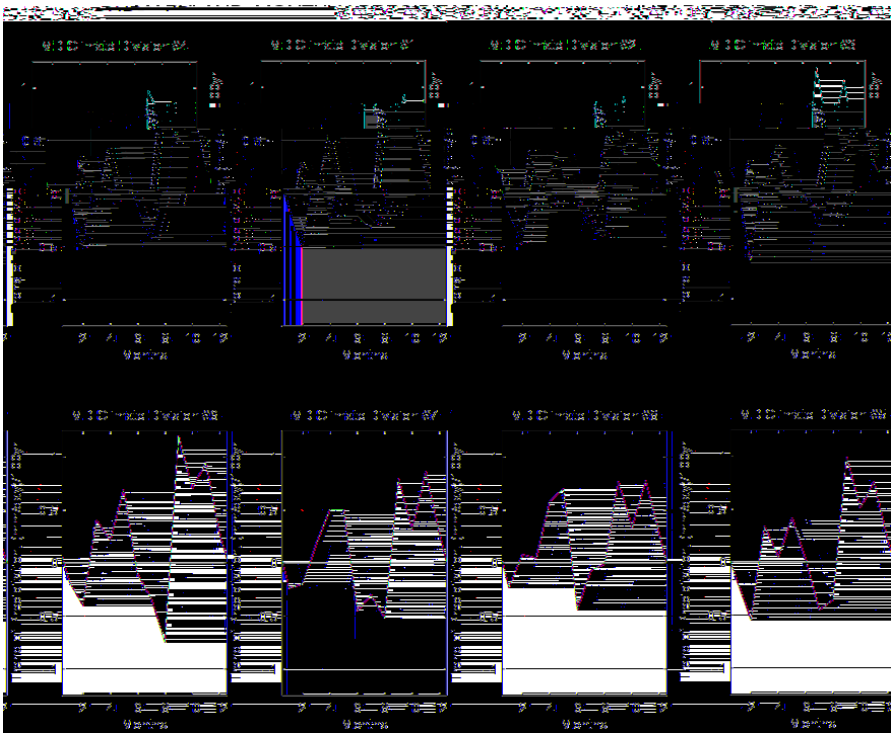


Figure 5. Seasonal variations of 1895-2012 linear trends of precipitation in the MD climate divisions.

Observed century-scale climatic trend in occurrence of heat waves

The more complicated question is about climatic trends in occurrence of heat waves. The problem is that century-scale climatic records in Maryland do not provide the full information needed for recognition of heat waves. In addition, available records are not homogeneous. Practically, only the daily maximum temperature observations can be used for heat wave recognition. Let us simplify heat wave definition and assume that a day with $T_{max} \geq 100°F$ is a heat wave day. Figure 6 displays preliminary results just for one station, Laurel, MD. Raw, but quality controlled daily data on T_{max} has been used to compute a time series of the annual number of days with T_{max} above the thresholds 90, 95, and 100°F. We then used ordinary least squares technique to obtain linear trend estimates.

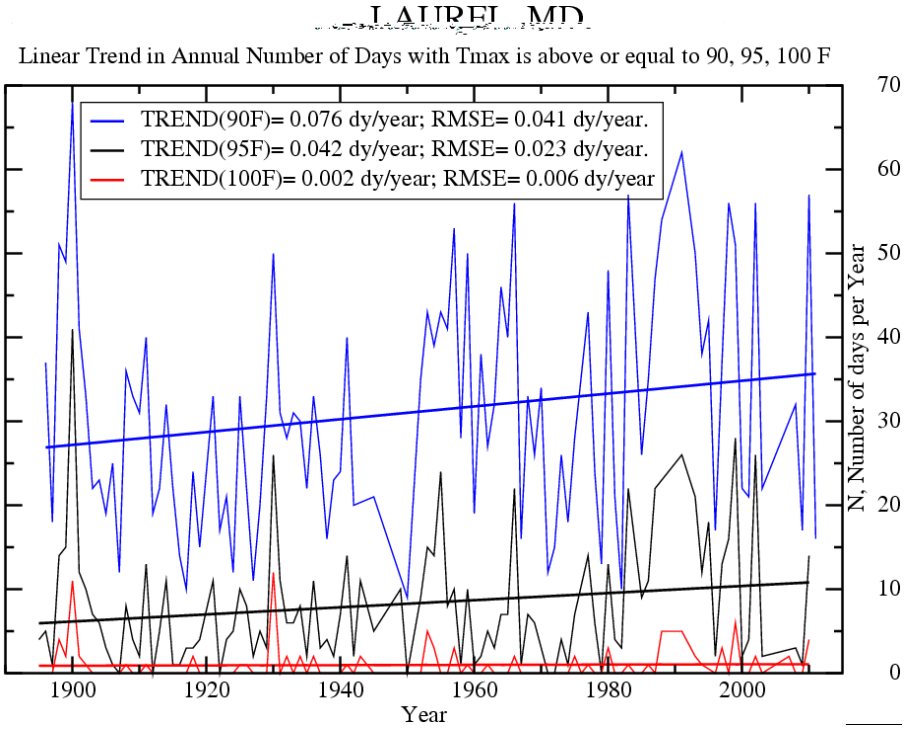


Figure 6. Laurel, MD. Time series of annual number of days with Tmax≥90, 95, 100 F/year and their linear trends.

These preliminary estimates show that the number of days with maximum temperature exceeding 90 and 95°F have been increasing with rate 7.6 ±4.2 and 4.2 ±2.3 days per century. This is quite consistent with summer warming trend in the MD Upper Southern climate division, which is about 2°F/century (Figure 3). More surprising is that there is no noticeable and statistically significant trend in the number of days with temperature above 100°F. This means that increase in mean temperature at this station is accompanied by decrease of its variability. At this stage of study we see no observational evidence of increase in the occurrence of heat waves in this climatic record. This work should be continued.

Michigan State Climatological Resources Program (MCRP)

Room 236 Geography Building
Department of Geography
Michigan State University
East Lansing, MI 48824
Tel: 517-432-4756
Fax: 517-432-1076
andresen@msu.edu
http://climate.geo.msu.edu/

Jeff Andresen, State Climatologist

The Michigan Climatological Resources Program (MCRP), home of the Office of the Michigan State Climatologist within MSU's Dept. of Geography, is the archival and service center for climatological data and related information for Michigan. Leadership of MCRP is the responsibility of the State Climatologist, 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. During 2011, the only personnel change was a reduction in Peter Kurtz's annual appointment from 100% to 60%.

ARSCO Qualifications

The MCRP is an American Association of State Climatologists (AASC) Recognized State Climate Office (ARSCO) and fulfills a number of qualifications as outlined below. Major objectives of the MCRP are consistent with the AASC-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 the applied use of climatological information.

Communication Capabilities

The majority of public requests for climate data and information are placed via telephone and email exchanges. While a fraction of requests are still filled through conventional mail service, a growing proportion of responses are through email. MCRP also provides information through dedicated worldwide web sites (see below). Climate data are collected operationally in the program via internet (Unidata's Internet Data Distribution system) and dedicated satellite receiver connections, and via internet and telephone through the program's Enviro-Weather information access system.

Information Services

The total number of public requests for climate-related data and information in 2011 was 858, 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 total number of formal billable requests during the year was 103, which is down 11 requests from 2010. The average amount of payment received per billable request was $47.71. These numbers suggest continuing long term declines in the number of formal data requests. In contrast, use and data access from our internet sites, climate.geo.msu.edu, www.agweather.geo.msu.edu/mawn, and www.enviro-weather.msu.edu, continued to expand steadily, with collectively more than 5500 hits per day on average in 2011.

Outreach Activities

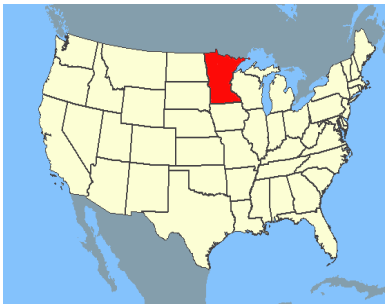
The MCRP in conjunction with MSUE (through the SC's formal appointment) also maintains an active outreach program through traditional venues, providing climate-related information in formats ranging from public speaking engagements to regular columns in the popular press. During 2011, the MCRP staff provided 23 interviews to print, radio, and television media and 16 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 2011, 38 columns were written. MCRP continues to serve as state-level coordinator of Michigan's Community Collaborative Rain, Hail, and Snow (CoCoRaHS) network.

Research

MCRP maintains an active research program addressing climate-related issues in the state and region. Current projects involve investigation of past and projected future climate changes in the region and potential 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 2011, staff at MCRP authored or co-authored 2 book chapters and 3 non-refereed articles and technical reports. MCRP was associated with 4 new external grants during 2011 (totaling $806,726), 7 grants in force from previous years, and 12 new grant proposals that were submitted for review.

Minnesota State Climatology Office (MN_SCO)

Minnesota Department of Natural Resources
439 Borlaug Hall, University of Minnesota
1991 Upper Buford Circle
St. Paul, MN 55108-6028
Tel: 651-296-4214
Fax: 612-625-2208
climate@umn.edu
http://climate.umn.edu



Greg Spoden, 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 Ecological and Water Resources, 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 millions of data points. The database features data collected by Minnesota's high spatial density precipitation monitoring program, formed in the early 1970s. 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, email, telephone, office visits, meetings, and public appearances.

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 email inquiries

Information Services

- Web site – the MN_SCO Web site hosts approximately 3000 users per day. The Web site offers free access to nearly all of Minnesota's digitized climate data, as well as a number 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 email – the MN_SCO answers dozens of phone calls and emails per week from customers with climate questions.

Research

- In 2011, the MN_SCO participated in the establishment of a micrometeorological network of temperature sensors designed to describe the depth and breadth of the Twin Cities heat island.
- The State Climatology Office is a principle member of two advisory committees tasked to provide guidance concerning climate change adaptation research and outreach. Office staff participated in the creation of an agency primer on climate change and renewable energy.

Outreach

- Staff give frequent interviews to electronic and print media.
- Staff are commonly requested to attend multi-agency, multi-disciplinary meetings where a climatological perspective is required.
- Staff make public appearances addressing matters of weather and climate.

Monitoring and Impact Assessments

- The MN_SCO works with the National Weather Service to coordinate Minnesota's role in the *CoCoRaHS* program.
- 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.
- The MN_SCO is in frequent communication with authors of the U.S. Drought Monitor.

Office of the Mississippi State Climatologist

Department of Geosciences
Mississippi State University
PO Box 5448
Mississippi State, MS 39762-5448
Tel: 662-325-3915
http://www.msstate.edu/dept/geosciences/stateclimatologist.htm

Charles Wax, State Climatologist (outgoing)
Michael Brown, State Climatologist (incoming)

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. After serving for 29 years, Dr. Wax retired as State Climatologist this spring, and a new Memorandum of Agreement between AASC and Mississippi State University recognizes Dr. Michael E. Brown as the new Mississippi SC.

Service activities of the SC this past year included 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. An estimated 25 email requests are handled daily in the SC office. The SC also serves as a member of Mississippi State University's Crisis Action Team with the responsibility of providing weather updates and advisories for potential severe weather events and school closings.

This past year the SC was again co-principal investigator for a geoscience education project sponsored by the Mississippi Department of Education called TANS—Teacher Academy in Natural Sciences. This involved a two-week summer workshop for 60 teachers, three weekend workshops through the year, and co-teaching visits to 10 school districts in Mississippi. The SC's contribution was instruction on using weather and climate material in middle school science classes.

Outreach activities this past year have continued to be heavily focused on the perceptions and possible effects of climate change, and on severe weather threats in Mississippi. The SC office continues to be overwhelmed with requests for information and for presentations about potentially

changing weather characteristics to groups throughout the state and region. The Mississippi public is also manifesting a heightened awareness of the impacts of weather and climate on all types of activities, especially severe weather, due to several violent outbreaks of severe weather this past year and to increased media coverage of weather and climate in general. Dr. Brown conducted several speaking sessions to survivors of the Smithville F5 tornado of April 27, 2011.

Research activities this past year included continued modeling of the physical and cultural impacts on groundwater resources from the shallow alluvial aquifer of the Mississippi Delta region; distribution of tornadoes, thunderstorms, and lightning strikes in Mississippi; effectiveness of holding surface water in field impoundments for use in irrigation in place of groundwater; evaluating spatial rainfall distribution for use in the Mississippi Irrigation Scheduling Tool (MIST) project; and assessing the feasibility of climate supporting a reservoir capable of providing over 100,000,000 gallons of water per day for use by the Pascagoula ship yard. A book, Weather and Climate of Mississippi, was published by the University Press of Mississippi.

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

- Served as co-state coordinator for the CoCoRAHS network. Over 250 observers are enlisted across the state at present, and the State Climate Office has used a little over $3000 of grant money to buy rain gauges and pamphlets for recruitment.
- Presented a guest lecture to the Broadcast Meteorology Program Summer Workshop at Mississippi State University.
- Interview for Starkville Daily News, Starkville, MS, on tornadoes in Mississippi.
- Interview for Daily Corinthian, Corinth, MS, on La Nina's effects in Mississippi.
- Interview for WCBI-TV, Smithville, MS, EF5 Tornado - one year later.
- Presentations on weather to six 4-H Clubs in east-central Mississippi.
- "Severe Weather." Presentation to First Baptist Church, Maben, MS Senior Citizens group.
- "Weather Processes and Stability Classes in Mississippi." Short course for Southern Region Foresters on Prescribed Burning, Mississippi Cooperative Extensive Service, Mississippi State University, Mississippi State University.
- Presentation on jobs in climatology to Christian Women's Job Corps.
- "Climate Change." Guest lecture presented to the Environmental Science class at Jackson Preparatory School, Jackson, MS.
- "Severe Weather." Presentation to 400 students at Park Place Christian Academy, Jackson, MS as a part of Science Month activities.
- "Global Climate Change." Presentation to Friends of the Library annual membership meeting, Dothan Public Library, Dothan, AL.

Invited Conference presentations:

"Modeling the potential for replacing groundwater with surface water for irrigation by using on-farm storage reservoirs in the Mississippi Delta." Mississippi Water Resources Conference, Jackson, MS.

"Teacher Academy in the Natural Sciences (TANS): Geosciences Share-a-thon for middle school

science teachers. " Mississippi Science Teachers Association Annual Conference, Jackson, MS.

"Smithville, MS, EF5 Tornado--Societal Impacts." National Weather Association, Birmingham, AL.

"The Warning System and the Role of the National Weather Service During an EF5 Tornado as Described by the Residents of Smithville, MS." Presented to the Southern Region of the National Weather Service via Go-To-Meeting, Memphis, TN.

"Developing a University Disaster Mitigation Plan." Webinar for Progressive Training Publications.

"Warning Confirmation and Response in the 2011 Smithville, MS, Tornado." 106th Annual Association of American Geographers, New York.

"Long-Term Analysis and Future Forecasting of Climate Factors Influencing Autumn-Winter Distributions of Mallard in the Atlantic, Central, and Mississippi Flyways." National Fish and Wildlife Congress, Ottawa, Canada.

"Experiences of Smithville, MS Residents with the April 27 Tornado." 66th annual meeting of the Southeastern Division of the Association of American Geographers, Savannah, GA.

"Using CG Lightning as a Forecasting Tool for Severe Hail." National Weather Association 36th Annual Meeting, Birmingham, Alabama.

"Teaching and Learning about Geoscience: A Survey of Mississippi Science Teachers." 105th annual meeting of AAG, Seattle, WA.

Grants funded:

- USDA National Institute for Food and Agriculture, Agriculture and Food Research Initiative Competitive Grants Program: "Downstream water quality and quantity impacts of water storage systems in Porter Bayou watershed." $455,000. (Co-PI)

Contracts funded:

- Pickering Engineering Firm, Inc. "George County lake climate variability analysis". $85,000. (Co-PI)

***Publications*:**

In Press. C. Wax. "Mississippi's Climate." The Mississippi Encyclopedia, Ed. Charles R. Wilson. University Press of Mississippi, Jackson, MS.

2012. Brown, M.E. and C. L. Wax. "Thunderstorms, Lightning Strikes, and Tornadoes in

Mississippi." MAFES Bulletin 1198. Mississippi Agricultural and Forestry Experiment Station, Mississippi State University.

2012. Sherman-Morris, K., C. Wax and M. Brown. Weather and Climate in Mississippi. University Press Of Mississippi, Jackson, MS.

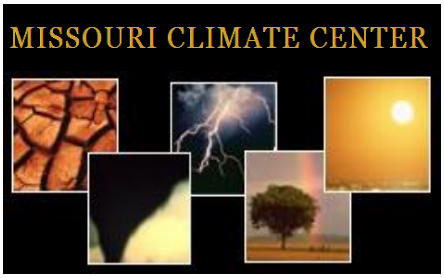
2012. Thornton, R., C. Wax, and J. Pote. "Modeling the potential for replacing groundwater with surface water for irrigation by using on-farm storage reservoirs in the Mississippi Delta." Proceedings, Mississippi Water Resources Conference, Jackson, MS. Mississippi Water Resources Research Institute, Mississippi State, MS.

2012. Sherman-Morris, K., Brown, M.E., Dyer, J.L., McNeal, K.S., Rodgers, J.C. "Teachers' Geoscience Career Knowledge and Implications for Enhancing Diversity in the Geosciences." Journal of Geoscience Education.

2012. Sherman-Morris, K., Rodgers,J.C., McNeal, K.S., Brown, M.E., Dyer, J.L. "Professional Development Strategies to Enhance Diversity in the Geosciences." The Science Educator.

Missouri Climate Center (MCC)

Soil, Environmental and Atmospheric Sciences
302 ABNR, University of Missouri-Columbia
Tel: 573-882-5908
Fax: 573-884-5133
GuinanP@missouri.edu
http://climate.missouri.edu



Patrick Guinan, State Climatologist
Evan Kutta, Undergraduate Assistant
Jen Power, Undergraduate Assistant

The 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 2011 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. The Missouri Climate Center continues to participate in the State Climatologist Exchange Program and is posting monthly weather and climate impact reports for the state of Missouri.
- The Missouri Climate Center continues to actively participate with the media. The state climatologist has established recurring relationships with newspaper journalists and radio and television reporters and Dr. Guinan submitted several news releases through the University's Cooperative Media Group.
- An agricultural weather forecast is developed and submitted online every morning by the undergraduate assistants.
- Over 4000 lines of data arrays are collected daily from a network of 30 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 18 real-time weather stations in Missouri associated with the Extension Commercial Agriculture Automated Weather Station Network.
- We continue to publicize and recruit Missouri citizens to enroll in 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 500 Missouri agricultural producers and others 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;
- Fulfilled hundreds of requests for climate information and provided climatological expertise to numerous individuals, groups, and agencies;
- Submit 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/weabcws.asp;
- Run the rice model program to predict rice growth stages: http://agebb.missouri.edu/weather/reports/ricedds.asp;
- Provide weather data from the automated network to be used in a risk assessment tool for wheat scab prediction: http://www.wheatscab.psu.edu/;
- 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;
- Campus weather station linked to main MU web site: http://www.missouri.edu/;
- Campus weather station and forecast linked to College of Agriculture web site: http://cafnr.missouri.edu/;
- The real-time stations are providing 5-minute weather conditions to the Meteorological Assimilation Data Ingest System (MADIS);
- Developed a crop water use calculator using automated weather stations maintained by the Missouri Climate Center: http://agebb.missouri.edu/weather/reports/cwu/;
- Submitted more the 170,000 Horizon Point reports in 2011, based on weekly activity from more than 600 active e-mail addresses: http://agebb.missouri.edu/horizonpoint/;

Research

- Providing real-time weather status to 18 weather stations in the Commercial Agriculture Automated Weather Station Network for Integrated Pest Management;
- Provide climate data for graduate students and faculty research projects.
- One of the participants in a multi-state 5-year USDA/NIFA grant awarded in 2010. Grant title: Useful to Usable (U2U): Transforming Climate Variability and Change Information for Cereal Crop Producers.
- Submitted and presented an online abstract titled *Horizon Point Weather Advisory Program* at the 19th Conference on Applied Climatology. July 18 – 20, 2011, Asheville, NC.

Outreach (Education, Awareness, and Contact Activities)

- Guest instructor for *Soils and Environment*. Peter Motavalli, Instructor. University of Missouri, Columbia. Topic: Automated weather monitoring;
- Guest instructor *Ag Systems Management*. Allen Thompson, Instructor. University of

Missouri, Columbia. Topic: Automated weather application in agriculture;

- Guest instructor for *Hydrologic Measurement Techniques*. Jason Hubbart, Instructor. University of Missouri, Columbia. Topic: Measuring climate and automated weather station monitoring at Sanborn Field;
- Gave weather presentations to numerous field days across the state;
- Gave more than two dozen weather and climate presentations in Missouri;
- Weather updates for MU Extension Quarterly Ag-Marketing Teleconferences;
- Gave weekly weather updates for MU's IPM Agronomy and Horticulture Teleconferences (April-August);
- State Co-Coordinator of the Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) in Missouri;
- 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;
- Member of the WERA 1012 Regional Coordinating Committee: Managing and Utilizing Precipitation Observations from Volunteer Networks;
- Stakeholder Advisory Team member for USDA research project: "Predictability and Prediction of Decadal Climate and its Societal Impacts in the Missouri River Basin: A Regional Study Integrating Earth System, Hydrologic, Agricultural, Economic and Land Use Models";
- Participated in several NOAA Climate Service webinars hosted by the National Weather Service Central Region.

Nevada State Climate Office (NSCO)

Department of Geography
University of Nevada
Reno, NV 89557-0048
Tel: 775-784-1723
climate@unr.edu
http://www.climate.unr.edu

Kate Berry, Acting State Climatologist
Jeffrey Thompson, Assistant State Climatologist

The Nevada State Climate Office (NSCO) was established under Nevada Revised Statute 396.595. Our mission statement is:

> The Nevada State Climate Office serves the people of Nevada by maintaining descriptions of, reporting on, and providing access to information on the climate in the state, including atmospheric conditions and levels of precipitation. The Office collaborates with, advises, and promotes climate data collection, interpretation, and research in conjunction with local, state, and federal agencies and the governor's office and is responsible for drought planning in the state. The Office participates within and serves as a member of the national and regional network of state climatologists.

This year the NSCO has been overseen by Dr. Kate Berry, Acting State Climatologist and Director of NSCO. Jeff Thompson, Assistant Nevada State Climatologist, continues in his role to maintain office operations and work on various NSCO projects. Decisions are currently being made about future NSCO leadership and structure as Dr. Berry will leave this position on 1 July 2012.

A year ago, eight current projects were identified for the NSCO:

1. Compile and distribute quarterly state climate summaries

2. Refine and update the NSCO website

3. Develop a record of requests for information and responses from NSCO

4. Develop and enhance the network of weather observers and storage gauges, in coordination with NWS Reno

5. Enhance relationships with other organizations (NWS, WRCC, State Engineer's Office, other agencies within the Nevada Department of Conservation & Natural Resources, USDA, NRCS)

6. Develop an on-campus weather station for educational purposes

7. Solidify membership within the American Association of State Climatologists and the western regional network of climatologists

8. Update the Nevada State Drought Plan in conjunction with state agencies and the governor's office

Progress has been made on each of these projects. Of particular note are:

1. Web portal project put into operation- Started with storage gauge data (NSCO)/DWR gauge data collection and preparation for the project- another faculty member was hired and an undergraduate Geography student intern worked on the project in the spring semester 2012.

2. Storage gauge network expanded to 24 sites across 11 counties in Nevada.

3. Automated weather stations and standard rain gauges were purchased for placement to support long-time cooperative observers as well as new observers. As of spring 2012, stations were activated in 7 Nevada counties. Existing contacts were made to confirm potential sites and articles were written to find interested new observers/sites across Nevada.

4. Campus weather station was put into operation again. This station started reporting in the fall semester 2011.

5. Articles were written for newspapers in five counties, which focused on weather/climate issues, informed the public of office personnel changes, and gauged community interest in expansion of the cooperative observers. A presentation was made at the inaugural Great Basin Climate Forum. In addition, several press releases and media interviews were done associated with the release of the State Drought Response Plan and drought conditions in the state.

6. Quarterly Nevada Climate Summaries were distributed electronically to more than 300 subscribers, physically mailed to 30 observers, archivists, and state officials.

7. Office personnel taught courses in atmospheric science and gave lectures on office activities and data collection/field operations.

8. NSCO assumed the leadership in revising the State Drought Response Plan, which had not been revised since 2003 and had not been used by state agencies or the Governor's office in a number of years. In conjunction with the State Department of Water Resources and the State Division of Emergency Management, the Office initiated an expert review of the former plan for initial suggestions in the fall of 2011, after which a revised plan was drafted in the winter. This was followed by a public review period and the Plan was finalized in April 2012. The final Nevada Drought Response Plan can be found at NSCO's website (http://www.climate.unr.edu/).

9. With the completion of the State Drought Response Plan, it was immediately put into effect as conditions have become increasingly drier throughout much of the state since the beginning of calendar year 2012. In this situation, NSCO has been taking the lead in the State Drought Response Committee working with the State Department of Water Resources and the State Division of Emergency Management. As of 4 June, 2012, 4 counties are in

"Stage 1 – Drought Watch "and all other counties in the state are in "Stage 2 – Drought Alert". Three Drought Task Forces have been established in different parts of the state, one in Northwestern Nevada, one in Central Eastern Nevada, and one in Southern Nevada. These Task Forces have members associated with local, state, and federal agencies. A meeting with the Drought Response Committee and members from the Task Forces was held in late May at which time the Task Forces were asked to gather and assess information about local needs, vulnerabilities, plans, and resources associated with the drought in their respective areas. This information is due in mid-June and it should facilitate systematic decision-making about designating counties as "Stage 3 – Drought Emergency".

New Hampshire State Climate Office (NHSCO)

University of New Hampshire
Department of Geography
73 Main Street
Durham, NH 03824
Tel: 603-862-3136
Fax: 603-862-4362
mary.stampone@unh.edu
http://www.unh.edu/stateclimatologist/

Mary D. Stampone, State Climatologist

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 NHSCO has focused on providing the public with quality and timely information on weather and climate though research, outreach, and educational activities. The NH State Climatologist participates in AASC activities, including attending the 36th Annual Meeting of the American Association of State Climatologists in July of 2011.

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

Communication Capabilities

The NHSCO regularly provides information on weather and climate to a wide variety of users including state agencies, local businesses, law enforcement, concerned citizens, K-12, and university faculty and students. Data and analyses are disseminated via the internet, email, telephone, regular mail, and in person through interviews and presentations. The NHSCO has continued to maintain a website that allows users, with various interests and skill levels, direct access to climate data from a variety of data repositories. This website is also used to publish weather and climate summaries and analyses for New Hampshire weather events as well as more formal reports on weather conditions and events for public outreach purposes. The NHSCO also hosts a Twitter page (@nh_sco) followed by national and state government offices and officials, local news organizations and weather enthusiasts.

Information Services

The NHSCO has responded to data requests from New Hampshire citizens, businesses, schools, and organizations and maintained a regular presence in local print, radio, and television media. The NH State Climatologist regularly works with UNH Media Services to produce and disseminate information on significant weather and climate events. This work includes compiling and analyzing data for and writing press releases, conducting media interviews via the UNH Skype connection as well as in person and telephone interviews with television, radio, and print news journalists. Throughout the year, the NH State Climatologist provided weather and climate information and seasonal outlooks to statewide media outlets and was quoted in local and regional news media. The NHSCO also serves as a resource for UNH journalism students and student reporters, providing

information on a wide variety of scientific topics including weather, climate and natural hazards. Popular media topics included: the summer 2011 heat and drought conditions, Hurricane/Tropical Storm Irene, fall foliage, "snowtober," lack of winter snowfall, Spring 2012 drought impacts, and local climate change impacts.

Research

NHSCO presented results of ongoing research co-authored with NWS personnel at the AMS 19th Conference on Applied Climatology in July 2011.

- Stampone, M.D. and D.A. Glenn (2011). Northeast United States heat index climatology: 1981-2010. 19th Conference on Applied Climatology/36th Annual Meeting of the American Association of State Climatologists and Practical Solutions for a Warming World: AMS Conference on Climate Adaptation. July 18-20, 2011.
- Glenn, D.A., B. Korzeniewski, L.J. Mueller, and **M.D. Stampone** (2011). Quality assurance and quality control of NWS Historical Cooperative Observations. Conference on Applied Climatology/36th Annual Meeting of the American Association of State Climatologists and Practical Solutions for a Warming World: AMS Conference on Climate Adaptation. July 18-20, 2011. Asheville, North Carolina.

The State Climatologist is also a Co-PI with UNH faculty and Cooperative Extension personnel on a New Hampshire Department of Environmental Services (NHDES) funded project to revise the State Drought Management Plan. Work on New Hampshire drought analysis and management plan revisions is in progress and will be completed in the fall of 2012.

- 2011-2012, *Analysis of New Hampshire Droughts and Revision of the State Drought Management Plan*, NHDES ($153,323) PI's: Davis, M (UNH, Department of Earth Sciences), **M.D. Stampone** (UNH, Department of Geography) and M. Craig (UNH Cooperative Extension).

Outreach

The state climatologist is a co-coordinator for NH CoCoRaHS and participated in funded community outreach projects including:

- UNH-EOS for the "Albedo Climate Regulation" project proposed as part of the NSF EPSCoR RII Track-1 project entitled "Climate Change Science, Ecosystem Impacts and Mitigation through Efficiency and Alternative Energy."
- NHSTA 2012 Spring Conference Workshop, Keene State University, March 12, 2012 "A National Network of Teachers and Students Measuring Important Precipitation and Snow Events" with Stephen Hale, UNH – Leitzel Center

Speaking engagements are also part of the NHSCO public outreach program and the state climatologist was invited to participate in the following outreach events:

- Women in Science and Technology – NH Space Grant Consortium, Berlin, NH, April 6, 2012 (*Keynote Speaker*).
- New Hampshire Professional Landscapers Conference - UNH Cooperative Extension, Concord, NH, March 14, 2012. "New England Climate Trends." (*Invited*

Speaker).

- Science Café New Hampshire, Concord, NH, May 24, 2011. (*Invited Speaker*).

The NH State Climatologist serves on the Mount Washington Observatory (MWO) Board of Trustees. As a trustee, the State Climatologist serves as a member of the Scientific Advisory Committee and was a member of the search committee for the Director of Research position, a joint academic position between Plymouth State University and the MWO.

Monitoring and impact assessment

The state climatologist serves as member of the NH Drought Management Team working with state officials to assess statewide drought conditions and drought impacts. The Drought Management Team was called into service in April 2012 to address the ongoing drought and identify drought impacts on statewide resource management sectors. The state climatologist serves on this team to advise state resource managers on present and possible future drought conditions. The team met twice during April and remains on-call as drought conditions persist.

The NHSCO continues to work closely with the NWS Forecast Offices in Gray, ME, and Taunton, MA, as well as the Mount Washington Observatory, Plymouth State University faculty, and UNH/NOAA National Ocean Service research faculty to coordinate the NH CoCoRaHS network. In addition to leading and participating in regular CoCoRaHS training sessions, the State Climatologist worked with K-12 teachers and UNH faculty to develop coursework and classroom activities around precipitation monitoring. In addition to hosting a CoCoRaHS station, the State Climatologist is also a NWS COOP observer. Daily observations are recorded by NHSCO staff and reported to the NWS by the State Climatologist. Additionally, the NHSCO continues to be the point of contact for the two NOAA Climate Reference Network (CRN) stations located in southern New Hampshire and provides regular station maintenance.

Office of the New Jersey State Climatologist (ONJSC)

Center for Environmental Prediction
NJ Agricultural Experiment Station
School of Environmental and Biological Sciences
c/o Department of Geography
Rutgers University
54 Joyce Kilmer Ave.
Piscataway, NJ 08854
Tel: 848-445-4741
Fax: 732-445-0006
david.robinson@rutgers.edu
http://njclimate.org

David A. Robinson, State Climatologist
Mathieu Gerbush, Assistant State Climatologist/Climate Services
Keith Arnesen, Assistant State Climatologist/Agricultural
Chad Shmukler, Technical Director
John Read, Technical Assistant
Daniel Zarrow, Technical Assistant/Meteorologist
David Fittante, Field Technician
Erik Namendorf, Assistant Field Technician

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://njwx.org) 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. of 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 34 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 further upgrades of our various servers. Major Mesonet activities included the addition of the former 19 station RISE network into the Mesonet fold. This has included major upgrades of the RISE stations. Also, in cooperation with the Delaware DEOS network, we have improved metadata and begun a major upgrade of network quality control. We are also on the verge of launching a new database and communications program that will include polling of our stations every 5 minutes. Over the past year, support for these activities has come from the NJDEP, US Forest Service, and Global Science and Technology Inc. (via a National Weather Service grant). Using network data, we have been working with NJ agriculture extension

colleagues to develop indices for blueberries and apples, and with these individuals and others at Cornell, a grape growth index. We continue to partner with the US Forest Service on data gathering and display associated with fire danger monitoring.

New Jersey's fourth year in the Community Collaborative Rain, Hail and Snow Network saw more than 250 observers actively participating and submitting vital observations. Our color-filled state and regional maps of precipitation, snowfall, snow cover and snow water equivalent continue to be popular (http://climate.rutgers.edu/stateclim/?section=menu&%20target=CoCoRaHS). In addition to the NJWxNet and NJ CoCoRaHS, the ONJSC maintains a comprehensive archive of historical data, metadata, and climatologies from NWS primary and cooperative stations. This is supplemented with data submitted by ONJSC volunteer observers. This information is manually processed and displayed in event, monthly, and annual maps and tables. One of the most popular pages includes snowfall observations for any event depositing 2" or more snow at any location in the state (http://climate.rutgers.edu/stateclim/?section=menu&%20target=wint1112snowtotals). This included 7 events this past winter, half of the number from the much snowier winter of 2010/11, thus fewer than 10,000 site visits occurred (half of last year's total).

Research endeavors within the ONJSC range from student projects on topics such as climatologies of major rainfall and snowfall events to collaborative efforts with Rutgers colleagues and state and federal agencies. Research regarding the utility of NWS monthly and seasonal outlooks for the Garden State will soon be posted on the ONJSC website. 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 office gave approximately 300 interviews to the media over the past year.

The ONJSC continued 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, the office's Facebook page, 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://njclimate.org).

Information Services

- More than 300 specific requests for data and products each year.
- More than 700 unique visits to ONJSC web sites each day.
- Monthly and annual climate summaries in map and tabular 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, and homeland security.
- Student research on topics such as urban heat islands, state snow cover variability, and ocean influences on state weather and climate.

Outreach

- Several hundred media interviews each year.
- Presentations to schools, civic organizations, senior centers, etc.
- Conference presentations to the 4-H Climate Change Workshop, the NJ Mosquito Control Association, the NJ Health Officers Association, the NJ Emergency Preparedness Workshop, the Passaic River Basin Flood Preparedness Workshop, the Raritan Headwaters Association, the NJ Future Redevelopment Forum, the Association of American Geographers special session on Hurricane Irene, and many others.
- The NJ State Climatologist is a member of the National Academy of Sciences Board of Atmospheric Sciences and Climate, the NOAA Climate Working Group, the NWS StormReady Community Program advisory board, the Liberty Science Center Education and Teaching Advisory Committee, and a Sustainable Jersey climate committee.

Monitoring and impact assessment

- Operation of the NJWxNet (http://njwx.org).
- State operation of NJ CoCoRaHS.
- Web site updates for significant winter events.
- Daily, monthly, and annual historical climate data (regularly updated) from dozens of long-standing NJ Cooperative Observing Stations.
- The NJ State Climatologist is a member of the NJ Drought advisory committee.

New Mexico Climate Center (NMCC)

Department of Plant and Environmental Science
New Mexico State University
MSC 3Q, P.O. Box 30003
Las Cruces, NM 88003
Tel: 505-646-2974
dwdubois@nmsu.edu
http://weather.nmsu.edu/

David DuBois, State Climatologist
Stan Engle, Database Administrator
Rebecca Armenta, Graduate Student Assistant
Elizabeth Smith, Graduate Student Assistant

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 one faculty position, a part-time staff position, and two graduate student assistants. 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 15 automated weather stations throughout the state that are used primarily for agricultural purposes. We maintain and distribute this data via the NMCC website (http://weather.nmsu.edu/). In 2011, we were in the process of designing and upgrading the NMCC website with a roll-out date in early 2012. Many other requests were also answered by phone and email. In addition, the New Mexico Climate Center provided a variety of web based tools for decision support in the areas of agriculture, hydrology, construction, health, and economic development.

Research

Our research activities in 2011 consisted of applied climate research in which climatic information was used for studies involving crop improvement, irrigation/water management, and air quality studies. The Climate Center continued to be heavily funded and involved in a four year air quality and health study covering southern New Mexico. The principal investigator, Dave DuBois, directed a five university consortium to investigate the linkages between air quality conditions and respiratory health among several communities near and along the US/Mexico border region.

We continued research in the numerical modeling analysis of air mass trajectories for use in air quality studies (Koracin et al., 2011; Chen et al., 2011). This research was in collaboration with air quality researchers at the Desert Research Institute's Division of Atmospheric Sciences. Using funds from a Unidata equipment grant, we are in the process of building experience in mesoscale modeling starting with an operational run of the WRF-ARW model for our region and offering the files on the THREDDS data node. We are also running an operational run of WRF to downscale the NOAA CFSv2 model for seasonal forecasts. Another research thread that we continue to be involved in is in the area of satellite remote sensing. This year we hosted a researcher from Hong Kong Polytechnic University to work on an aerosol optical depth model using MODIS and AVHRR imagery.

Outreach

We expanded our outreach using Twitter (@nmclimate) for providing climate and drought information to the public. We continued to maintain our Facebook page for the Climate Center and used it for sharing information about climate locally and related news. In conjunction with an air quality project a blog (http://nmborderaq.blogspot.com/) was maintained to document air quality and climatic conditions along the New Mexico/Mexico border region. So far more than 12,000 visits have been logged on this blog. We participated in numerous outreach activities in public schools and community events promoting climate awareness and CoCoRaHS.

Goals

Plans for 2012 include the roll-out of the improved Climate Center website and the new climate database interface. The Climate Center continued to work closely with the Climate Assessment of the Southwest (CLIMAS) program at the University of Arizona to continue work in the area of climate services and seasonal predictions of air quality. With the financial assistance of the AASC we have been creating metadata for a number of NWS cooperative observation stations in southern New Mexico. The results of this are in the process of being posted on the NMCC webpage.

Peer Reviewed Publications

Chen, L.-W.A., J.G. Watson, J.C. Chow, D. DuBois, and L. Herschberger. (2011). $PM_{2.5}$ Source Apportionment in Minnesota, USA: Reconciling Receptor Models for Urban and Rural Monitoring Networks. Journal of the Air & Waste Management Association, **61(11)**: 1204-1217.

Koracin, D., R. Vellore, D.H. Lowenthal, J.G. Watson, J. Koracin, T. McCord, D.W. DuBois, L.-W. Antony Chen, N. Kumar, E.M. Knipping, N.J.M. Wheeler, K. Craig, and S. Reid (2011). Regional source identification using Lagrangian stochastic particle dispersion and HYSPLIT backward-trajectory models. Journal of the Air & Waste Management Association, **61(6)**: 660-672.

Technical Reports

DuBois, D., E. Ward, R. Carr, J. Greenlee, and Z. Edwards. (2011). Study IIa: Inventory of landforms, soils, hydrology, vegetation and all types of land use for the Assessment of Land-based Sources of Air Quality Contaminants in the Binational Border Region of

Southwestern New Mexico, Northwestern Chihuahua and West Texas. Prepared for the Office of Border Health, Las Cruces, NM. September 30, 2011.

Green, M., A. Chen, D. DuBois, and J. Molenar. (2011). Lake Tahoe Visibility Impairment Source Apportionment Analysis, Final Report, August 16, 2011. Submitted to USDA Forest Service Pacific Southwest Research Station.

DuBois, D., E. Ward, Z. Edwards, R. Fitzgerald, J. Greenlee, and M. Shukla. (2011). Fiscal Year 2011 final report of the binational border air quality study. Prepared for the Office of Border Health, Las Cruces, NM. June 30, 2011.

DuBois, D., E. Ward, J. Greenlee, and Z. Edwards. (2011). Optimal network design of the binational border air quality study. Prepared for the Office of Border Health, Las Cruces, NM. April 30, 2011.

Presentations and Posters

DuBois, D., R. Tropp, I.G. Kavouras, and T. Hertel (2011). Sunland Park Low-Wind Exceedances $PM_{2.5}$ Study. Presented at the A&WMA 104th Annual Conference & Exhibition, June 23, 2011, Orlando, FL.

Green, M.C., A. Chen, J. Molenar, and D. DuBois (2011). An analysis of 20 years of aerosol and visibility data in the Lake Tahoe Basin. Presented at the A&WMA 104th Annual Conference & Exhibition, June 23, 2011, Orlando, FL.

Margez, J. P. F., Ramirez, M. A. R., Hernandez, L. J.M, Shukla, M. K., DuBois, D. W., Sanogo, S., Liess, L. (2011). Dispersion of particulate matter in urban areas in semi-arid zones of northern Mexico (pp. 6). XXXVI National Congress of Soil Science (Mexican Society of Soil Science).

Muhammed, B., M. Bleiweiss, and D. DuBois (2011). MODIS satellite sensor products used for snowmelt runoff modeling in support of water resource management. Presented at the ISNET / RJGC Workshop on Applications of Satellite Technology in Water Resources Management, Amman, Jordan.

Sammis, T. W., D.W. DuBois, S. Engle, J. Wang, D. Miller. (2011). Forecast Climate Data Use in Irrigation Scheduling. Presented at the Irrigation Association Annual meeting, San Diego , CA.

State Climate Office of North Carolina

1005 Capability Drive, Suite 100
Box 7236, NC State University
Raleigh, NC 27695-7236
Tel: 919-515-3056
Fax: 919-515-1441
sco@climate.ncsu.edu
http://www.nc-climate.ncsu.edu

Ryan Boyles, Director and State Climatologist
Ameenulla Syed, Associate Director and Manager, NC ECONet
Aaron Sims, Assistant State Climatologist
Mark Brooks, Climate Services Coordinator
Ashley Frazier, Environmental Meteorologist
Sean Heuser, Instrumentation Meteorologist
John Mc Guire, Environmental Meteorologist
Heather Dinon, Applied Climatologist
Greg Deleruyelle, Administrative Assistant

The State Climate Office of North Carolina is a public service center at NC State University. It serves 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 enhancement of web-based resources, development and delivery of tools and services for media, agriculture, forestry, natural resource, and water resource sectors. We also continued our programs to support the NOAA SE Regional Climate Center and the SE Climate Consortium. This past year we established a new extension program focused on forests and renewed efforts to engage broadcast and print media.

Research efforts in the past year built on partnerships with the Southeast Climate Consortium and the Carolinas Regional Integrated Sciences RISA programs with an emphasis on model development and implementation, radar-based precipitation datasets, and drought monitoring.

- 3 manuscripts were successfully published in peer-reviewed journals
- 23 presentations were given at 10 scientific conferences, and 14 staff attended 12 scientific meetings

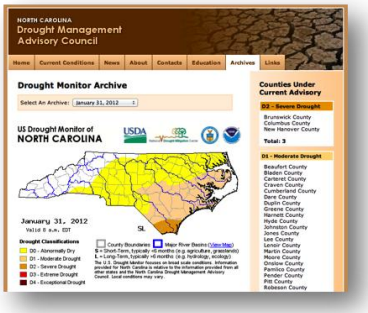
Educational outreach Educational outreach activities focused on training for NCSU students, our ongoing partnerships with The Science House and Centennial Campus Middle School, and several large outreach programs that touched thousands of students across the state. SCO supported 4 graduate students and 9 undergraduate students.

Climate Service Highlights

Requests for Services: Interest from clients during 2011-2012 resulted in a 9% decrease in time spent directly responding to requests for services from clients as compared with the previous year. A large percentage of time is devoted to supporting educational requests (52%), while remaining

effort goes largely to support government (19%) and private industry (20%). Formal public interest requests account for 9% of effort.

Monthly climate summaries: Climate summary reports are prepared each month to review climate patterns, their causes, and impacts 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), through the Southeast Climate Consortium (SECC), and via the SCO's new Twitter feed. The SCO uses the newsletters to also highlight SCO products and services. Currently, monthly climate summaries and news are distributed to hundreds of users via science teacher and agriculture extension email listserves. In addition, 506 individuals have signed up to directly receive these products via email each month.



Drought Monitoring and Response: SCO is a member of the NC Drought Management Advisory Committee, participating in weekly drought monitoring conference calls and providing public presentations on drought in NC. SCO has provided routine updates on drought conditions and impacts through the Drought Management Advisory Committee, monthly climate summaries and newsletters, and interviews for print and broadcast news media.

Environmental Modeling: SCO continues to produce experimental numerical weather forecast guidance using the Weather Research Forecast model. These simulations are available for use by the public, and are distributed to partners including DENR and National Weather Service. Moreover, these simulations provide guidance to support a series of agricultural projects, including peanut disease guidance, the ipmPIPE for cucurbits, and new efforts with smoke dispersion.

Late Blight for Potatoes and Tomatoes: In collaboration with Dr. Jean Ristaino (NCSU Plant Pathology), NCSU in 2010 joined a team of plant pathologists to successfully propose development of a national monitoring and alert tool for Late Blight that affects tomatoes and potatoes. SCO is responsible for providing weather information and technology support based on effort and experience with the Cucurbit Downy Mildew project. This is a 5-year project funded by USDA National Institute for Food and Agriculture.

PINEMAP(Pine Integrated Network: Education, Mitigation, & Adaptation Project): Climate Support for Southern Conifer Management: In collaboration with 42 other investigators from across NC State University and the southern US, SCO successfully proposed in 2010 a 5-year project to USDA for research, extension, and educational activities to improve the management of pine trees in the southern US. SCO will specifically serve as the conduit to the other State Climatologists, developers for a decision support system based on AgroClimate.org, and the climate extension resource for all partners.

Fire Weather Guidance: After nearly a decade of discussions with DENR Forest Resources, SCO was awarded a contract to improve the use of weather and climate observations for fire danger monitoring and risk assessment. As part of this effort over the next year, SCO will develop tabular- and map-based web tools to visualize fire risk measurements using the National Fire Danger Rating System and inputs from all CRONOS observations and MPE.

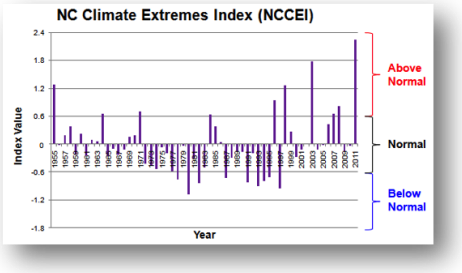
Experimental Inflow Forecasts: In collaboration with Dr. Sankar Arumugam (NCSU Civil,

Construction, and Environmental Engineering), SCO developed a web portal to visualize experimental seasonal inflow forecasts using methods developed by Sankar Arumugam. With funding from the NC Water Resources Research Institute and the Urban Water Consortium, SCO focused this past year on monthly operational implementation of seasonal forecasts for reservoir inflow and storage.

Research Highlights

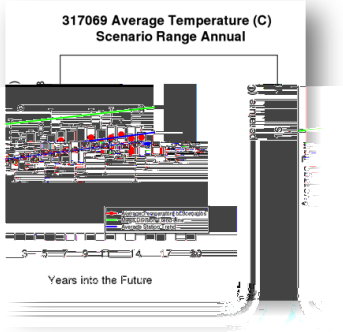
USDA High-Resolution Drought Triggers: SCO was awarded a project with partners at TAMU and Purdue University to produce a routine SPI product based on MPE. Over the past year, software routines have been developed and we expect beta-testing with partners during the summer of 2012. In 2013, we plan to work with Cooperative Extension to link local estimates of SPI generated by this effort to field impacts in corn, soybeans, and pastures. Collaborators are John Nielsen-Gammon (TAMU) and Dev Niyogi (Purdue).

Model Reanalysis / Model Climatology: As numerical weather models improve they may be able to better estimate current and historical climate conditions. SCO is testing several data assimilation schemes to see how well the WRF model can initialize and simulate temperature, moisture, and winds near the surface in complex terrain as compared to surface observations from sensors. If successful, this effort could allow for a very high-resolution (1km) estimate of past climate conditions and model-based climatologies.



Localized Climate Extremes Index: The National Climatic Data Center produces a Climate Extremes Index for the United States that describes the impact of temperature and precipitation extremes on the U.S. from year to year. The goal of this project is to develop a localized version of the Climate Extremes Index that also includes severe weather events, winter weather events, and tropical activity. Currently the index methodology has been calculated and evaluated for North Carolina and currently is being evaluated for Florida by the Florida Climate Center. A second goal of this project is to allow for an objective comparison between years given that multiple extremes may impact the state in a given year, such as in 2011. Collaborators are Melissa Griffin and David Zierden at the Florida Climate Center.

Evaluation / Implementation of Geospatial Downscaling of Precipitation in the Southeast US: Working with Dr. Guillermo Baigorria at the University of Florida, SCO is implementing and evaluating a technique to provide advanced geospatial downscaling for seasonal and climate change forecasts over the southeastern US. A web tool is currently in development for the visualization of experimental seasonal forecasts produced using the downscaling techniques previously tested.



Development of Historical Climate Analog Scenarios: Working with Dr. John Christy (University of Alabama – Huntsville), the SCO is developing historical climate analog scenarios to represent the possible future scenarios of temperature and precipitation at local scales in the next 20 years given prescribed larger scale trends in

temperature and precipitation based on climate change projections. This method has been built into a prototype web tool that provides historical climate analog scenario information for actively recording stations with at least 50 years of records in the Southeast US.

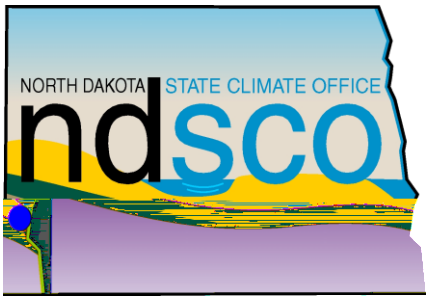
Educational Outreach Highlights

Invited Presentations and Visitor Programs: SCO staff provided 6 presentations by invitation, including large group presentations to a local middle school, StormFest, and the opening of the Nature Research Center. SCO provided tours and programs for 10 visitor groups. Total Direct Contact Hours= 50,895

Centennial Campus Magnet Middle School Internship: SCO hosted four 8th grade student interns from a local middle school from mid-October 2011 through early April 2012. This is the 9th year of the internship program, where students spend an afternoon every week in the SCO to learn about NC climate and develop their own research projects.

North Dakota State Climate Office (NDSCO)

North Dakota State University
231 Walster Hall
P.O. Box 6050
Fargo, NC 58105-6050
Tel: 701-231-6577
Fax: 701-231-7861
Adnan.Akyuz@ndsu.edu
http://www.ndsu.edu/ndsco



Adnan Akyüz, Assistant Professor of Climatology and State Climatologist

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Mission Statement

The mission of the North Dakota State Climate Office (NDSCO) 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:

Observation Capabilities

The State Climate Office operates an Automated Weather Monitoring Network called The North Dakota Agricultural Weather Network (NDAWN) which consists of 72 stations distributed across North Dakota, the Red River Valley, and border regions of surrounding states.

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

Conference Proceedings and Abstracts

Badh, A., and F. A. Akyuz. 2011. Impact of Climate Change on the Growing Degree Days (GDD) for corn in the Northern Plains, USA, ND Academy of Science. May 2011.

Stooksbury, D, J. N. Gammon, A. Akyüz, K. G. Hubbard, L. Dupigny-Giroux, M. Timofeyeva, 2011. AASC Recommendations for the Education of an Applied Climatologist. AGU Fall Meeting. 5-9 December 2011, at the Moscone Convention Center, San Francisco, California.

Popular Extension Publications

Akyüz, F. A. 2011: Weekly Weather. Crop and Pest Report. Weekly from May 4, 2011 through August 24, 2011.

Kandel, H., Akyüz, F. A. 2011: Soybean Growing Degree Days Model. Crop and Pest Report. July 7, 2011. NDSU Extension Services.

Akyüz, F. A. 2011: Economic Benefits of NDAWN to Regional Agriculture. Water Spouts. No 259 September 2011. NDSU Extension Service, North Dakota State University.

Akyüz, F. A., H. Kandel. 2011: 2011 Growing Season Climate Summary for North Dakota. Canola Variety Trial Booklet. 2011.

Akyüz, F. A., and B. Mullins, 2011. North Dakota Quarterly Climate Bulletin. Winter 2010-2011. V.5, No. 1. Electronic: http://www.ndsu.edu/ndsco/publication/ndsco/bulletin/winter11.pdf.

Akyüz, F. A., and B. Mullins, 2011. North Dakota Quarterly Climate Bulletin. Spring 2010-2011. V.5, No. 2. Electronic: http://www.ndsu.edu/ndsco/publication/ndsco/bulletin/spring11.pdf.

Akyüz, F. A., and B. Mullins, 2011. North Dakota Quarterly Climate Bulletin. Summer 2010-2011. V.5, No. 3. Electronic: http://www.ndsu.edu/ndsco/publication/ndsco/bulletin/summer11.pdf.

Akyüz, F. A., and B. Mullins, 2011. North Dakota Quarterly Climate Bulletin. Winter 2010-2011. V.5, No. 4. Electronic: http://www.ndsu.edu/ndsco/publication/ndsco/bulletin/fall11.pdf.

Akyüz, F. A., and B. Mullins, 2011. 2011 Growing Season Weather Summary for North Dakota. Electronic: http://www.ndsu.edu/ndsco/publication/gss/2011.pdf.

Invited Presentations

- Akyüz, F. A.: 2011 Growing Season Forecast. Garrison Farmers Union Elevator-Garrison State Bank. February 1, 2011. Garrison, ND
- Akyüz, F. A.: Meteorological Misconceptions. SNR Seminar. February, 2, 2011. NDSU.
- Akyüz, F. A.: Is the climate changing in the region? Best of the Best in Wheat and Soybean. February 8, 2011. Alerus Center, Grand Forks, ND.
- Akyüz, F. A.: Climate Change and its Local Implications. Best of the Best in Wheat and Soybean. February 9, 2011. Moorhead, MN.
- Akyüz, F. A.: Global Climate Change and Agricultural Implications in ND. Extension Spring Conference. March 29, 2011. Fargo, ND.
- Akyüz, F. A.: Climate Change and its Implications in ND. Agassiz Club. April 7, 2011. Fargo, ND.
- Akyüz, F.A.: Hail Climatology for Hail Insurance Adjusters. Hail Meeting. NDSU, Fargo, ND.
- Akyuz, F.A.: North Dakota Agricultural Weather Network and its Economic Impact in ND. American Meteorological Society Local Chapter Meeting. September 28, 2011. UND. Grand Forks, ND.
- Akyuz, F.A.: NRM 150 Guest Lecture. Climate Change Perspective. September 26, 2011. NDSU, Fargo, ND.
- Akyüz, F. A.: Climate Change and its Regional Agricultural Implications. Barnes County Township Officers Annual Meeting. December 8, 2011. Valley City, ND.

K-12 Activities

- Akyuz, F.A.: Boy Scouts Club Presentation: Pressure, wind, and tornadoes. January 11, 2011. NDSU, Fargo, ND.
- Akyuz, F.A.: Tornado Safety for K-12. May 17, 2011. Kennedy Elementary School, Fargo, ND.
- Akyuz, F.A.: Pressure, Wind and Tornadoes. K-12 ELL (English as Second Language Learners). Lewis and Clark Elementary School. June 23, 2011. Fargo, ND.

Radio and TV Presentations and Spots Made

There were total of 35 media appearances made in 2011

Oklahoma Climatological Survey (OCS)

University of Oklahoma
120 David L. Boren Blvd., Suite 2900
Norman, OK 73072
Tel: 405-325-2541
Fax: 405-325-2550
ocs@ou.edu
http://climate.ok.gov/

Renee McPherson, State Climatologist & Director of Research for the South Central Climate Science Center
Gary McManus, Associate State Climatologist
Mark Shafer, Climatologist & Director of the Southern Climate Impacts Planning Program

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In 2011, Oklahoma Climatological Survey (OCS) scientists helped lead the submission of a $4 million proposal to the U.S. Department of the Interior for the University of Oklahoma (OU) to serve as host of the South Central Climate Science Center — a major new initiative that will bring researchers from the U.S. Geological Survey (USGS) to the OU campus. In October 2011, USGS announced the selection of OU as the host for the Center, in collaboration with its consortium partners: Oklahoma State University, Chickasaw Nation, Choctaw Nation of Oklahoma, Texas Tech University, Louisiana State University, and NOAA's Geophysical Fluid Dynamics Laboratory. The Center will focus on research related to the impacts of climate on natural and cultural resources management across the south-central U.S., including climate impacts on water resources and ecosystem services.

Nationally, OCS participated in the American Association of State Climatologists conference, Open Science Conference of the World Climate Research Programme, Annual Meeting of the American Meteorological Society (AMS), AMS Conference on Climate Adaptation, and Climate Prediction Application Sciences Workshop, among other meetings. McPherson served as Chair of the Metadata Working Group of the AMS's Ad Hoc Committee for a Nationwide Network of Networks, Member of the AMS Weather and Climate Enterprise Commission, Member of the AASC Review Committee for the Dissertation Medal for Applied Climatology, and Subject Matter Expert for OFCM's Committee for Integrated Observing Systems.

New research funding in 2011 included *Water Decisions for Sustainability in the Arbuckle-Simpson Aquifer* through NOAA and *Developing Standard Procedures for Filling Climatic Data Gaps for Use in Building Performance Monitoring and Analysis* through the American Society of Heating, Refrigerating and Air-Conditioning Engineers. At the end of 2011, OCS employed 32 professional staff, 6 graduate students, and 10 undergraduates. We administered 35 financial accounts with a fiscal year (July 1, 2009 to June 30, 2010) budget totaling $4.5 million.

Information Services

In 2011, OCS customers requested 36.3 Terabytes of information from 2 billion hits to our web pages. OCS's Southern Climate Impact Planning Program (SCIPP) began producing monthly newsletters called the *Southern Climate Monitor* in January 2011. We also fulfilled several hundred information requests from phone or email, generating $40,000 in revenue.

OCS renovated its web pages (see image below), both visually and technically. The climate product section of the site incorporates historical and current data with weekly to seasonal outlooks to help decision makers. We also launched a new version of our K-12 outreach website and developed new, web-based tools, including the Grape Black Rot Advisor and an enhanced Cattle Comfort Index.

Research

Examples of scientific publications and reports include the following:

American Meteorological Society (R. A. McPherson, co-author), 2011: Final report of the AMS ad hoc Committee on a Nationwide Network of Networks. AMS, Boston, MA, 94 pp.

Hoekstra, S., K. Klockow, R. Riley, J. Brotzge, H. Brooks, S. Erickson, 2011: A preliminary look at the social perspective of Warn-on-Forecast: Preferred tornado warning lead time and the general public's perceptions of weather risks. *Wea. Climate Soc.*, **3**, 128–140.

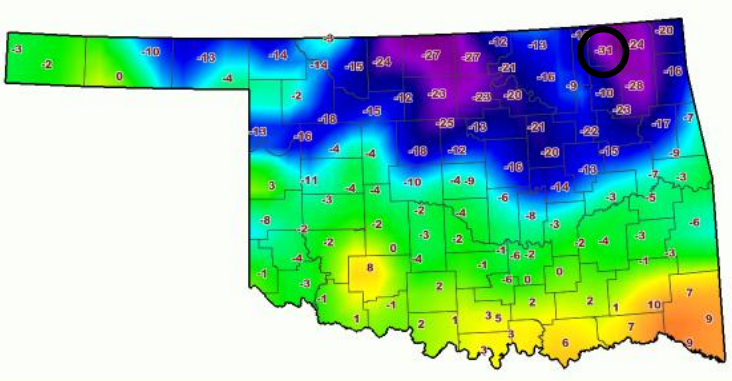
McPherson, R. A., J. D. Lane, K. C. Crawford, and W. G. McPherson Jr., 2011: A climatological analysis of heatbursts in Oklahoma (1994 – 2009). *Intl J. Clim.*, **31**, 531-544.

Monitoring & Impact Assessments

Oklahoma experienced nearly every weather calamity possible in 2011, setting all-time records for heat, cold, drought, tornadoes, hail, and snow. Damages due to weather-related disasters in Oklahoma rose into the billions of dollars. Here are some highlights:

Snowstorms– Two significant winter storms weather struck the state in late January and early February 2011. The first dumped up to 21 inches of snow in northeast Oklahoma with widespread reports of 6-12 inches over much of the state. During a second storm several days later, the state record for 24-hour snowfall was broken when 27 inches of snow fell in Spavinaw over Feb. 8-9.

Record cold– On the morning of Feb. 10, light winds, clear skies, and a fresh snowpack allowed temperatures to plummet into never-before-seen territory. The Nowata Mesonet site reached a low of 31 degrees below zero, shattering the state's previous record of 27 degrees below zero.



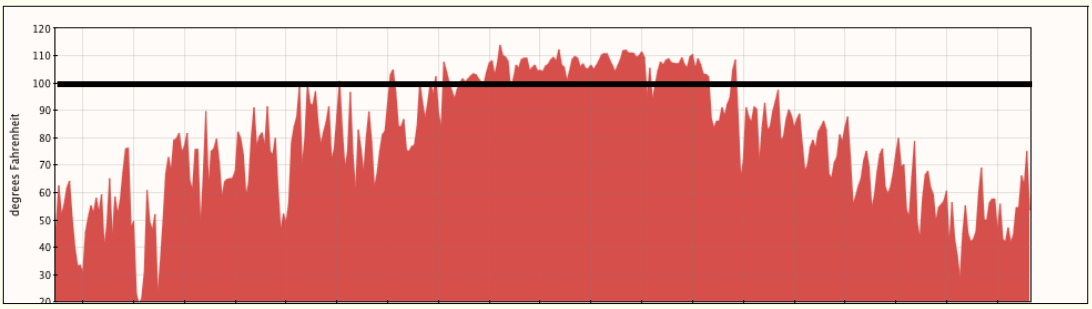
On the morning of Feb. 10, light winds, clear skies, and a fresh snowpack allowed temperatures to plummet into never-before-seen territory. The Nowata Mesonet site (circled) reached a low of 31 degrees below zero, shattering the state's previous record of 27 degrees below zero.

Drought– Fed by La Niña, the drought that began in October 2010 intensified through spring in the western half of the state before exploding statewide during summer. Crops withered and a beleaguered cattle industry saw widespread sell-offs due to lack of forage and water. For much of western Oklahoma, 2011 ranked in the top three driest years.

Summer heat– Oklahoma experienced the hottest summer of any state since records began in 1895 with a statewide average of 86.9 degrees. July's average temperature was 89.3 degrees, becoming the hottest month for any state on record.

Tornadoes– Oklahoma's 2011 tornado count finished at 119, the second highest total for the state since statistics began in 1950. April's 50 tornadoes were the most on record for that month. On May 24, an EF-5 twister gave a glancing blow to the Oklahoma Mesonet site at El Reno. That site recorded a maximum wind gust of 151 mph, setting the record for strongest surface wind ever measured (non-radar) in Oklahoma.

Hail– A supercell near Gotebo on May 23 dropped a monster 6-inch diameter hailstone, establishing a new record hailstone for the state.



The Grandfield Mesonet site recorded 101 days above 100 degrees (denoted by the thick black line), breaking the previous record of 86 days from Hollis in 1956.

On a less damaging note, OCS's Southern Climate Impacts Planning Program continued to assess the climate-related needs of local, state, tribal, and federal decision makers across Oklahoma. Representatives of 23 agencies and organizations participated in face-to-face interviews and the ensuing report was submitted for inclusion in the 2013 National Climate Assessment. In collaboration with Haskell Indian Nations University, we hosted a December meeting for Oklahoma tribal nations on climate variability and change. Representatives from 21 Oklahoma tribes and three tribal colleges participated. Breakout session findings also were submitted to be included in the 2013 National Climate Assessment.

In 2011, OCS completed 1592 laboratory calibrations of sensors. To maintain our remote sites and sensors in the field, we conducted 587 site visits to our remote stations in the Oklahoma Mesonet and ARS Micronets. We resolved 1057 trouble tickets in these networks, consisting of sensor repairs and rotations.

Outreach

Through the Southern Climate Impacts Planning Program, OCS began conducting bi-weekly webinars in September 2011 to help decision makers in the south-central U.S. manage the historic drought. On average, 76 people attended each webinar, which was sponsored jointly with the National Drought Mitigation Center and the Climate Assessment for the Southwest.

OCS hosted 3 K-12 teacher workshops, providing education to 76 teachers across Oklahoma. In cooperation with Oklahoma libraries, OCS engaged 904 students, teachers, and adults at 12 Speaker Service Talks. OCS held its first 4-day summer camp, with 19 students from Oklahoma, California, and Texas. OCS taught 256 public safety officials through 17 OK-First workshops during 2011. We also hosted field trips for over a dozen Oklahoma schools to the National Weather Center, providing tours to over 600 students.

OCS issued 22 press releases during 2011 and provided interviews to hundreds media entities. Over 80 OCS *Mesonet Ticker* emails were sent to the media, state agencies, and weather enthusiasts, and 12 Mesonet Connection electronic newsletters were provided to Mesonet customers. We participated in 43 SUNUP Mesonet Weather Report television segments.

Oregon Climate Service (OCS)

Oregon State University
College of Earth, Ocean, and Atmospheric Sciences
326 Strand Ag Hall
Corvallis, OR 97331-2209
Tel: 541-737-8927
Fax: 541-737-5710
oregon@coas.oregonstate.edu
http://www.ocs.oregonstate.edu

Philip Mote, State Climatologist
Kathie Dello, Deputy Director
Darrin Sharp, Faculty Research Assistant
Rachel Calmer, Student Assistant

The Oregon Climate Service (OCS) is the official AASC Recognized state climate office (ARSCO) for the state of Oregon. OCS staff are also a part of the Oregon Climate Change Research Institute (OCCRI) and participate in the NOAA-funded PNW Climate Impacts Research Consortium. The focus of the past year has been on strengthening research and outreach capacity, building partnerships and providing climate services to all Oregonians.

Routine activities

Staff answer about 10-15 requests per week by phone, e-mail, and personal meeting. Requests often increase in periods of active weather, or at end of season/year. Staff monitor and weigh in on drought monitor activity. The OCS website was revived a year ago and it has been well-received. OCS staff are sometimes asked to review climate pieces of documents produced by state and federal agencies.

Research

21st century climate services:

This Microsoft-funded project is a collaboration between OCS and the Department of Electrical Engineering and Computer Sciences at Oregon State University to use innovative techniques in data visualization to display climate data. A beta version was unveiled at the 2011 AASC meeting in Asheville, NC. We hope to assemble a focus group and refine the product for public release sometime this year.

Pacific Northwest heat waves:

The Office of the Washington State Climatologist and OCS joined forces to study heat waves in the Pacific Northwest. Heat waves are currently infrequent, though climate models suggest that they may increase in the future and will impact the most vulnerable populations and areas. We consider the Pacific Northwest to be a vulnerable area because of the rarity of extreme heat. This project has spurred a now informal working group with the Oregon Health Authority and the National Weather Service Western Region on examining heat criteria in Oregon and western Washington.

Submitted papers:

Bumbaco, K.A., K.D. Dello and N.A. Bond, 201x. A historical analysis of Pacific Northwest heat waves: synoptic evolution and trends. J. Appl. Meteorology and Climatology, in review

Upcoming:

OCS has teamed up with the NOAA-funded Postdoc Applying Climate Expertise (PACE) postdoc in OCCRI to examine historical extreme maximum precipitation in Pacific Northwest using observations and an OCCRI project regional climateprediction.net, which has deployed a regional climate model for the western US on tens of thousands of volunteers' personal computers.

Outreach

Outreach is a major component of OCS activity. We typically use the following venues:

- **Newsletter:** The monthly newsletter is distributed to a listserve, posted on the OCS website, on the twitter feed, and on the Oregon page of stateclimate.org.
- **Twitter:** The microblogging service has been an effective way of getting quick bits of timely climate and weather information out to interested parties. These people include local media and the general weather/climate-interested. The popularity of the OCS twitter increased and followers doubled over past year. Contextual tweets such as "Portland hit 70 ˚F today, the last time it did so was on October 19, 2011" are among the most retweeted/favorited by other users.
- **Public presentation:** Staff are asked to give presentations on Oregon climate, or Oregon climate change which includes a historical component. The audiences range from general public to decision-makers.
- **Media:** Staff gave over 50 interviews to print, TV and radio media over the past year. These interviews are either requested by media (direct phone call) or follow a press release. Press releases are crafted in partnership with the Oregon State University News and Communications office. Popular topics in the past year were the re-appearance of La Niña, a very dry December, western Oregon flooding in mid-January, and March snow. Many news outlets ran press releases in full without interview.
- **Museum activities:** OCS staff met with the Oregon Museum of Science and Industry (OMSI) in Portland to discuss climate education activities. The first activity was a weather vs. climate and greenhouse gas activity as part of the museum's Planet under Pressure event. We continue discussions with OMSI for future collaboration, including using Science on a Sphere to talk about climate.

Meeting participation of note

- Tour and discussion for all OCS and OCCRI staff at the National Weather Service Forecast Office in Pendleton, OR in September 2011.
- WERA-102 in Davis, CA at UC Davis, hosted by the California State Climatologist. (OCS is hosting next year's meeting in Corvallis, OR in conjunction with the Climate Impacts Research Consortium).
- Regional Climate Services workshop in Victoria, BC, Canada, hosted by the Pacific Climate Impacts Consortium in November, 2011. The workshop brought together people working in climate services from Canada, Europe and the United States.
- American Meteorological Society Annual Meeting, New Orleans, LA. January 2012. Kathie Dello presented a poster on the 21st century climate services project funded by Microsoft.
- Kathie Dello gave the keynote address on Oregon Climate at the High Desert Green Industry Conference in Redmond, Oregon in February 2012.
- Western Governors' Association Pacific Northwest Weather and Climate Forum in Seattle, WA on April 3-4, 2012. The Forum brought together high-level decision makers and scientists. Phil Mote served on a panel about regional climate science enterprises.
- Phil Mote addressed a crowd of 300 at the Oregon Chapter of the American Meteorological Society on April 10, 2012: The Scientific Case for Human Influence on Global Climate: What We Learn From Analyzing ALL The Evidence

Pennsylvania State Climate Office

Pennsylvania State University
606A Walker Building
University Park, PA 16802
Tel: 814-863-1842
Fax: 814-865-3663
psc@mail.meteo.psu.edu
http://climate.met.psu.edu

Paul Knight, State Climatologist

The Pennsylvania State Climate Office database continues to incorporate observations from more than a half dozen separate networks within the Commonwealth. During the last year, the database has been reorganized allowing for the incorporation of more tools to the web interface.

The vision for a Pennsylvania Mesonet remains a priority for the State Climate Office, though funding sources are scarce. 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 2011, over 500 volunteer observers had enrolled and typically, 170 faithfully report each day.

Information Technology Capabilities

- About thirty web data requests were logged each month (besides those by phone and the occasional US mail).
- Primary users are commercial, educational and government organizations.
- The entire North American Regional Reanalysis data set (approximately 4.7 terabytes) is updated routinely so that the data have been completed through 12/31/11. This constitutes a 32-year data set.

Communication Capabilities

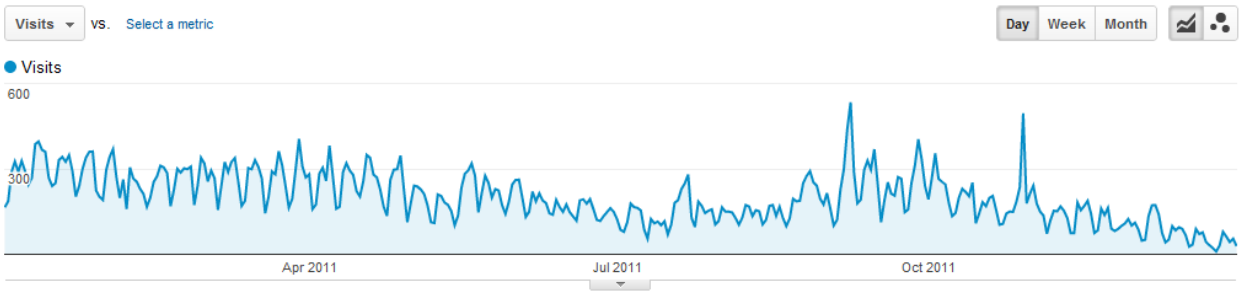
- The web server is now separate from the database host to increase the capacity of numerous web inquiries simultaneously. Development of new products has mainly focused on grant-related items, such as those connected with a data inventory.

Information Services

- The Interactive Data Archive has been expanded to include data queries for specific dates and strings of dates. 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 accessed is similar to the past year. The following charts show the 2011 user volume, domain taps and areal distribution:

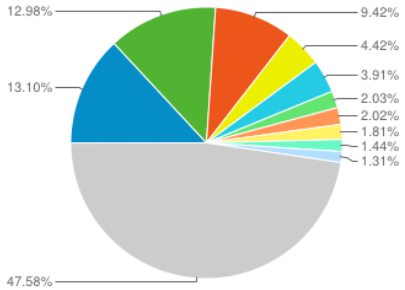


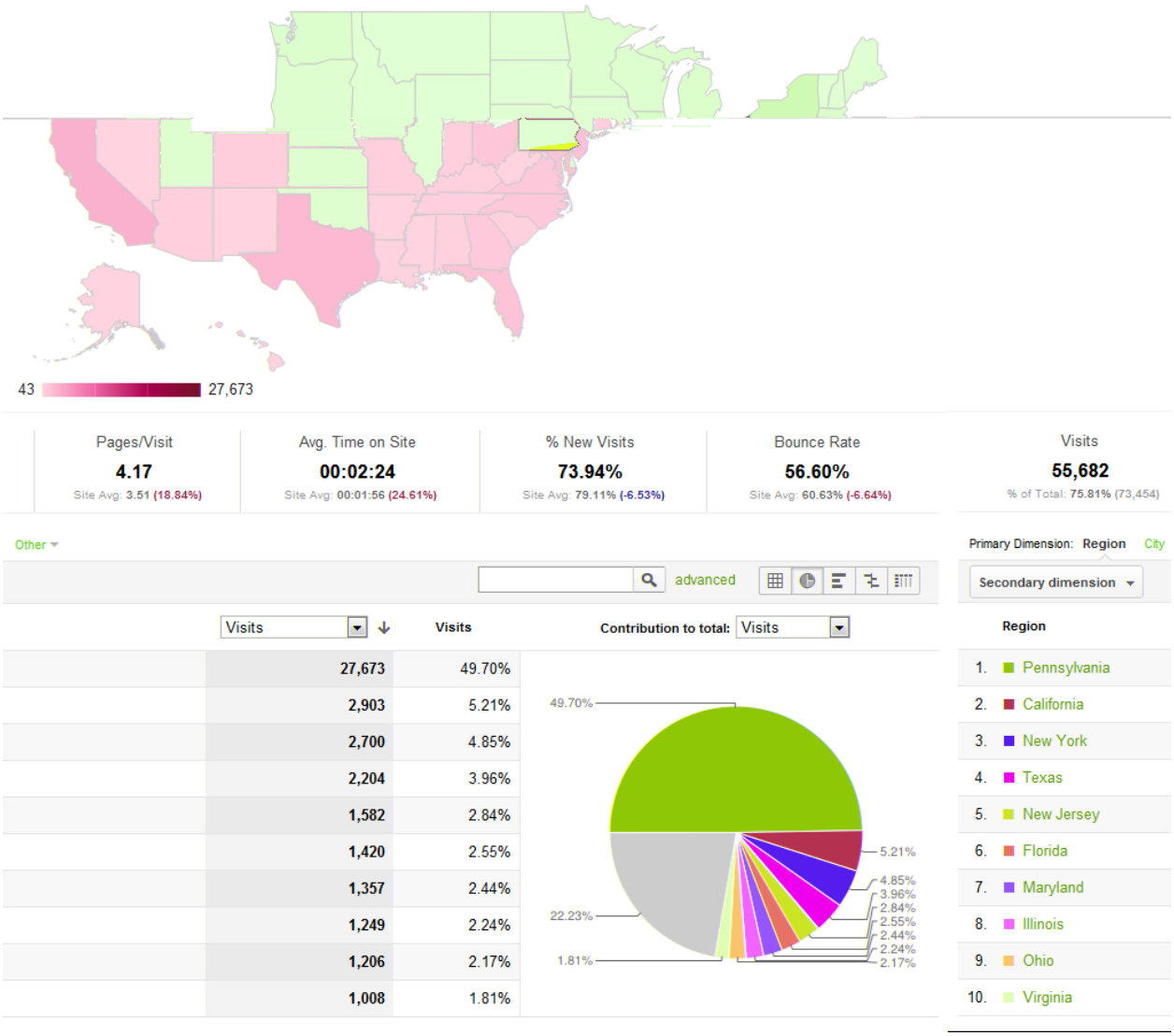
Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
73,454	**3.51**	**00:01:56**	**79.11%**	**60.63%**
% of Total: **100.00%** (73,454)	Site Avg: **3.51** (0.00%)	Site Avg: **00:01:56** (0.00%)	Site Avg: **79.11%** (0.00%)	Site Avg: **60.63%** (0.00%)

Primary Dimension: **Domain**

Secondary dimension | advanced

	Domain	Visits	Visits	Contribution to total: Visits
1.	comcast.net	9,620	13.10%	
2.	unknown.unknown	9,533	12.98%	
3.	verizon.net	6,922	9.42%	
4.	psu.edu	3,245	4.42%	
5.	rr.com	2,870	3.91%	
6.	comcastbusiness.net	1,488	2.03%	
7.	sbcglobal.net	1,484	2.02%	
8.	ptd.net	1,326	1.81%	
9.	windstream.net	1,055	1.44%	
10.	myvzw.com	963	1.31%	





Data Quality Control/Assurance

- The PA Climate office takes advantage of the sophisticated data quality control routines provided by MADIS on CWOP. Other data is manually QA with student support. A trend comparison of surface temperature and dew point (comparing FAA sites and NARR grid point data) has assured us of 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 seventh year. Annual and seasonal summaries have been designed which will have applicability to Pennsylvania climate stations (and DCNR) that are not part of this project. The interface for the National Park Service data inventory and retrieval is now compatible for both IE and Mozilla browsers.

Special Projects

- Collaboration with experts at Kansas State University continues with the refinement of environmental data monitoring systems for a Wheat Scab project.
- The development of phenology models for Organic Growers of Cucurbits and the implementation of an Apple Disease forecast systems continues with the College of Agricultural Sciences.
- A project with Pennsylvania DOT and the top forecasters from the forecasting practicum course continued to provide an early alert for hazardous winter weather for surface transportation in Pennsylvania.
- The climate office has been called on to advise Penn DOT on their anticipated upgrade of the state's RWIS in 2012.
- Collaboration continues between ZedX, Inc. and the state climate office in providing forecast charts and commentary for the Soy Bean Rust and other rust spores (corn and wheat stem) with USDA.
- A new project has been funded in collaboration with USDA-ARS and the Dept. of Soil Sciences to develop a fertilizer forecasting tool for the Pennsylvania region so that nutrient run-off can be minimized and the efficacy of the nutrient can be maximized.

SCEP

- The Pennsylvania State Climate Office contributed monthly state weather summaries including its societal impacts to the Northeast Regional Climate Center during all of 2011 as per Task 2.1 of the 2011-2012 NCDC-SCEP agreement.

South Carolina Office of Climatology

1000 Assembly Street
P.O. Box 167
Columbia, SC 29202
Tel: 803-734-9568
Fax: 803-734-9573
Mizzellh@dnr.sc.gov
http://www.dnr.sc.gov/climate/sco

Hope Mizzell, State Climatologist
Wes Tyler, Assistant State Climatologist for Service
Mark Malsick, Severe Weather Program Liaison

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 date back to the late 1800s. 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 2011:

Communication Capabilities

- The office expanded the SCO website (http://www.dnr.sc.gov/climate/sco). Highlights include the addition of the South Carolina Temperature and Precipitation Trends 1901-2010 (annually and seasonally) and reformatting the South Carolina County Atlas.
- The office expanded the email notification system focused on severe weather notification and tropical advisories. The address list increased from 978 in 2010 to 1,302 in 2011. The breakdown of subscribers is Agriculture 2%, Commercial 13%, Education 7%, Government 48%, Health 3%,Media 1%, Personal Interest 25% , and Utility 1%.

Information Services

- During 2011, the SCO averaged 42 monthly phone and email requests for climate data and 31,000 information retrievals from the SCO web site.
- Staff assisted SCD NR Law Enforcement and SC Highway Patrol with 39 accident investigations.

- Media inquiries averaged 15 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*.
- SCO provided 29 special weather event summaries during 2011. Examples include the heavy snowfall of January 10, heavy rainfall and freeze event of March 26-31, damaging high winds on April 5, July 13 record heat index values, and July 27 coastal rain event.
- 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 2011, the SC Drought Response Committee was convened seven times to review the drought conditions and issue declarations. Monthly 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.

Research

- 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.
- SCO completed a research project extending the State's trend analysis through 2010 for 70 USHCN Southeast temperature and precipitation stations.
- SCO continued to utilize an online application to systematically identify and document the nature and scope of requests received. Customers were surveyed to determine how they integrate climate information into their day-to-day operations as well as their long-term plans. This project was initiated in 2010 in conjunction with a broader effort by State Climatologists in the Southeast region and the Southeast Regional Climate Center to conduct client assessments.

Outreach

- The SCO provided approximately 40 annual presentations to various governmental, private sector, and civic organizations.
- Staff attended state and national conferences such as the Southeast Regional Climate Center's Technical Advisory Committee's Annual Meeting and the American Association of State Climatologists Annual Meeting. Staff serves on the Water Resources Committee for the S.C. American Water Works Association and the Palmetto Chapter of the American Meteorological Society.

- The Assistant State Climatologist serves as commissioned law enforcement officer to assist SCDNR during weather emergencies.
- The State Climatologist serves as chair of the SCDNR Climate Change Technical Working Group (SCDNR-TWG). She worked with the SCDNR_TWG and agency staff to complete a report addressing "Climate Change Impacts to Natural Resources in South Carolina."

Monitoring and Impact Assessment

- 129 volunteers provided daily observations for the COCORAHS network reporting at least 300 or more days. Seventeen observers reported observations 365 days during 2011.
- 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, the Hurricane Season annual exercise, the Governor's Hurricane Roundtable Exercise, and training. The Severe Weather Liaison issued 9 weather outlooks, 15 severe thunderstorm/tornado advisories, 52 tropical advisories/updates, and 15 winter weather advisories. He issued customized forecast information for all DNR Governor's Cup Billfish Tournaments. Staff participate in 6 SC Emergency Management Conference Calls related to Tropical Systems Earl and Nicole, 15 for the January 10 snow event and Inauguration, and 24 for Hurricane Irene. Even though the State Emergency Operations Center (SEOC) wasn't fully activated for Hurricane Irene staff worked 10-12 hour shifts at the SEOC to answer questions about the forecast and pending impacts to the State.

South Dakota Office of Climate and Weather (SDOCW)

Agricultural and Biosystems Engineering
SAE 213 Box 2120
South Dakota State University
Brookings, SD 57007
Tel: 605-688-5678
Fax: 605-688-6764
dennis.todey@sdstate.edu
http://climate.sdstate.edu

Dennis Todey, State/Extension Climatologist
Laura Edwards, Extension Climate Field Specialist
Nathan Edwards, Network Engineer
Ba Ngyuen, Web Application Programmer

The South Dakota Office of Climate and Weather is part of the South Dakota Extension Service at South Dakota State University. The mission of the state climate office overlaps well with the mission of extension to provide science-based data and information and education to the people of the state to support the economy, livelihood, and wellbeing of people in the state. As part of the SDSU Extension, the state climate office has connections across the state to communicate with people of the state providing for a direct set of users as well as contacts to transfer information back to the climate office on state impacts and needs. The South Dakota Office of Weather and Climate (SDOCW) was granted ARSCO status in 2005.

Personnel

Dr. Dennis Todey continued as state climatologist and director of the climate office completing his ninth year in this position. Dr. Todey also served as the American Association of State Climatologists' president.

Because of severe budget cuts, SDSU extension executed a huge reorganization in 2011. As part of that reorganization, Laura Edwards was hired as extension climate field specialist in the Aberdeen Regional Office, the first in the state. She has collaborated with the state climate office particularly with interaction with extension and the agricultural community. She has also become co-state coordinator for CoCoRaHS.

Nathan Edwards also joined the office in 2011 as the network engineer. His responsibilities are overseeing the SDSU climate and weather station network maintenance and data collection. He has also taken some responsibility in revamping data management in the office.

Several undergraduate students and one recent graduate (mainly with computing background) filled non-permanent positions in maintaining and processing data from weather stations, fixing computer issues and developing some new products.

The office is in various states of hiring for one computer position and another climate position.

Reporting

The state climate office continues to supply data and create reports through a contract with South Dakota Agricultural Statistics Service. These data are used for official reports weekly during the growing season and monthly during the off-season.

During the year the SCO completed monthly climate impact reports as funded through a SCEP funded climate reporting project. These reports were compiled and posted on the SD state climate site, the AASC site, and forwarded to HPRCC for use in their monthly report.

The SCO also reported on climate information weekly during the summer fire season. In cooperation with the South Dakota School of Mines and Technology (state fire meteorologist) and South Dakota Wildland Fire Suppression, we published a weekly discussion of fire conditions, and weather and climate impacts on potential fire issues.

The state climate office manages, archives, and supplies data from a 42 station automated weather station network across the state. In 2011 the main activities were trying to maintain station viability during staffing transitions among various students.

Drought conditions resurged for the first time in several years. The SCO continued to engage in discussions on the USDM list and interact with people at local levels monitoring drought information.

Media

As part of the SDSU extension reorganization extension created a network called iGROW radio to deliver daily information via radio across the state. Dennis Todey and Laura Edward collaborated on weekly weather/climate updates for iGROW radio.

The SCO did over 50 media interviews ranging from record precipitation to winter conditions and usual outlooks for farmer/producers in state and regional print, radio, TV, and other media.

Extreme Events Reporting

Wet conditions pervaded the state during the year from winter through summer leading to various amounts and scales of flooding. The SCO reported on record precipitation amounts throughout the year and about annual totals (where nearly 10 stations set annual precipitation records).

Research

The SCO contracted with USDA Risk Management Agency to develop a web tool in response to the wet conditions across the northern Plains. Because of the recent wet period over the last 20 years many crop insurance claims have occurred because of excessive wetness. The web tool is designed to display summarized data for RMA, crop insurance companies and producers how precipitation compares to historical levels.

Dr. Todey was part of two other ongoing USDA-funded projects during 2011. These were funded to do work on climate change issues and the corn system across the Midwest. The projects will collect data on greenhouse gas emissions from crops, assess people's understanding of climate and climate needs for their operations, develop tools to help producers use climate information and do climate education at multiple levels. Both are 5-year funded projects, one through Iowa State and one through Purdue. Both of these projects conducted surveys of state climatologists and agricultural advisers during 2011. Data from these will be reported at the annual meeting and subsequent publications. The U2U project through Purdue included four other state climatologists (IN, MI, IL, and MO) and two regional center directors (MRCC and HPRCC).

Outreach

The state climate web site has maintained its central access point for various data in the state including federal and non-federal data. The site serves the general public, other researchers and a variety of clientele across the state. A new version of the site is close to being deployed.

The web site and individual responses continue to supply data for various users in the state and outside the state. Over 100 individual data request and several legal data requests have been supplied by the SCO during the last year.

Dr. Todey continues to be a source for climate information locally, regionally and nationally. Planting conditions, outlooks, and reports on records continue to be a popular media need. He has been invited to over 50 talks in the state and region including talks in MN, WI, and IL during the year. The addition of Laura Edwards has allowed coordination to present at more agricultural and teacher events since her arrival. The SCO did four Master Gardener trainings through SD Extension.

The SCO continues as the state coordinator for CoCoRaHS – Laura Edwards has become state co-coordinator. The three National Weather Service Offices are regional coordinators.

Education

As AASC representative, Dr. Todey was part of a climate education project through George Mason University seeking to work with TV meteorologists as climate educators. Dr. Todey also was working on climate education planning teacher education activities as part of one of the USDA projects (CSCAP) through Iowa State.

AASC Presidency

Dr. Todey served as AASC president in 2011. In addition to conducting usual AASC business, including the SCEP program, coordinating with new states and other various issues, he has become involved regularly in the discussion of the new climate service in NOAA and interactions between AASC, USDA, and other federal agencies.

Office of the Texas State Climatologist

College of Geosciences
Department of Atmospheric Sciences
Texas A&M University
3150 TAMUS
College Station, TX 77843-3150
Tel: 979-845-5044
stateclimatologist@tamu.edu
http://climatexas.tamu.edu/

John Nielsen-Gammon, State Climatologist
Brent McRoberts, Graduate Research Associate
Marissa Pazos, Undergraduate Assistant
Justin Womack, Undergraduate Assistant

Physical Location and Funding

The Office of the State Climatologist (OSC) is housed in the Department of Atmospheric Sciences, Texas A&M University. During 2011, the OSC team included:

John Nielsen-Gammon	Texas State Climatologist
Brent McRoberts	Graduate Research Assistant
Marissa Pazos	Undergraduate Assistant
Justin Womack	Undergraduate Assistant

Don Conlee and Steven Quiring, faculty members in the Atmospheric Sciences and Geography Departments, respectively, also assisted with OSC activities. Operating funds are provided by Texas A&M University, with additional external grant funding for particular research projects. Cost recovery is available for large data requests.

Communication and Information Services

In 2011, the OSC received and fulfilled over 400 individual requests for climate data and information. Requests are fielded by telephone or email.

We have completely replaced our web site with a new, more user-friendly one (http://climatexas.tamu.edu/), which went live in May 2012. We also replaced our logo!

On the Office website, monthly climate summaries for the state and the Bryan/College Station area are posted. 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. Also on the web site is an online library of climate resources that includes OSC publications, publications from the State of Texas, and links to other climatic resources.

Research

Three peer-reviewed articles from the OSC were published this year.

McRoberts, D. B., and J. W. Nielsen-Gammon, 2011: A new homogenized United States climate division precipitation data for analysis of climate variability and change. J. Appl. Meteor. Clim., 50, 1187-1199, doi:10.1175/2010JAMC2626.1.

This paper describes a data set we have produced that, unlike the conventional climate division precipitation data set, is homogeneous to first order in the face of network configuration changes. The new data set also uses consistent methodology from 1895 to the present, thereby avoiding the 1930 discontinuity in the NCDC data set. The homogenized data show a substantial and significant increase in precipitation through the central United States.

Fall, S., A. Watts, J. Nielsen-Gammon, E. Jones, D. Niyogi, J. R. Christy, and R. A. Pielke Sr., 2011: Analysis of the impacts of station exposure on the U.S. Historical Climatology Network temperatures and temperature trends. J. Geophys. Res., 116, D14120, doi:10.1029/2010JD015146.

This paper, including two other current State Climatologists and one former State Climatologist as coauthors, applies a simple siting rating scheme to the USHCN stations and evaluates the dependence of recent temperature trend magnitudes on siting quality. We found that siting quality affects both maximum and minimum temperature trend estimates, but in opposite directions, with the poorest sites tending toward the smallest diurnal temperature ranges.

McRoberts, D. B., and J. W. Nielsen-Gammon, 2012: The use of a high-resolution SPI for drought monitoring and assessment. J. Appl. Meteor. Clim., 51, 68-83, doi:10.1175/JAMC-D-10-05015.1.

This paper describes the high-resolution standardized precipitation index (SPI) products produced on a weekly basis by the OSC that encapsulate the state of drought and/or wetness in Texas. These products utilize the Advanced Hydrologic Prediction System (AHPS) daily, 4 km precipitation analyses available at http://water.weather.gov. The products are utilized for drought severity assessments in the US Drought Monitor.

We presently have three externally-funded research programs, all supported by the USDA. The first is designed to improve and expand our high-resolution SPI products for use throughout the central and eastern United States. Teaming up on this project with us are state climatologists R. Boyles and D. Niyogi. The second is designed to produce probabilistic soil moisture and streamflow forecasts for agricultural planning purposes, and includes collaborators in the College of AgriLife Sciences. The third will investigate the dependence of year-to-year tick population variations on climate variations, and includes collaborators in the College of AgriLife Sciences and the College of Science.

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, including a radio interview with the Australian Broadcasting Corporation while on a trip to Australia.

During the Drought of 2011, the number of requests for outside speeches increased rapidly. By the end of 2011, the State Climatologist was averaging almost two talks per week, including a briefing on extreme events hosted by C2ES, AASC, and AGU. The State Climatologist was also the first to testify at a series of hearings in Austin on legislative initiatives in response to the drought. The OSC prepared a status report on the drought in support of the testimony, and this report presently serves as the primary reference for the Drought of 2011.

A newer form of outreach is the blog ClimateAbyss, hosted by the Houston Chronicle (http://blog.chron.com/climateabyss). The blog focuses on climate change, with some discussion of current weather events as well. The blog is written by the State Climatologist and is updated about twice a week. The blog has proven to be a useful mechanism for distributing informal or time-sensitive information related to drought and other climate events.

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 United States Drought Monitor mailing list.

Since December 2008, with partial assistance from 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 the diversity of climate impacts in Texas, reports include more than a hundred impact reports. Reports are gathered from newspapers and other sources throughout the state with links to the original source material. The reports are posted on our own web site at http://climatexas.tamu.edu/societal-impacts/impacts-of-climate as well as on http://www.stateclimate.org.

Utah Climate Center (UCC)

Utah State University
4825 Old Main Hill
Logan, UT 84322-4825
Tel: 435-797-2664
http://climate.usurf.usu.edu/

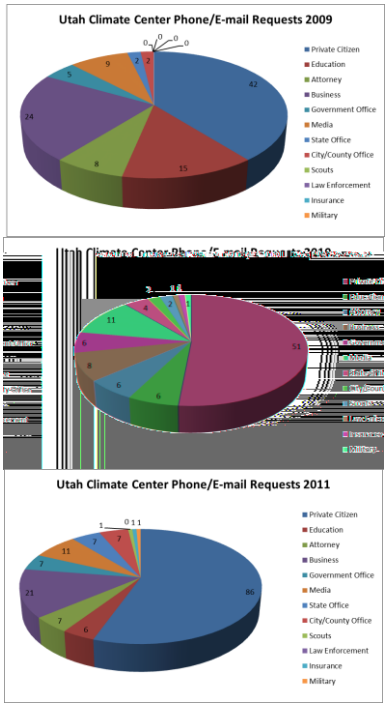
Robert Gillies, Director/State Climatologist
Esmaiel Malek, Associate Director
Robert Davies, Program Coordinator
Jonathan Carlisle, Research Technician
Marty Booth, Meteorologist
Shih-Yu Wang, Assistant Professor of Climate

The climate center continued service for the State of Utah during 2011.

Dr. Wang represented the Utah Climate Center at the American Association of State Climatologists (AASC). Dr. Davies represented the UCC at two Western Extension and Research Administrative (WERA) committees – WERA 102 & WERA 1012. As in the past, Dr. Gillies represented the Utah Climate Center at the National Weather Service, as well as the Western Regional Climate and Colorado Basin River Forecast Centers – all based in Salt Lake City.

Utah Climate Center Call Log Statistics

	2009	*2010*	*2011*
Private Citizen	42	51	86
Education	15	6	6
Attorney	8	6	7
Business	24	8	21
Government Office	5	6	7
Media	9	11	11
State Office	2	4	7
City/County Office	2	2	7
Scouts	0	2	1
Law Enforcement	0	1	0
Insurance	0	1	1
Military	0	1	1
Total	107	99	155



The number of telephone and e-mail data requests in 2011 increased as compared to 2009 & 2010 and are shown above. As has been the case in the past, calls originated from a variety of sources with general inquiries from private citizens being the most dominant source.

This phone call report is restricted to types of calls in which a climate/data/service related request or question was made to the Climate Center. It does not, for example, include "in house" calls like the admin office asking about a particular meeting or financial document.

As was mentioned in previous years' reports, the website continues to be the major source that clients are using as a resource to retrieve their data/information as was intended at the outset. As per last year, the statistics of use is monitored by Google analytics. The statistics indicates that the level of activity is generally comparable between the two years. A new map interface is being developed; this will also include access to several more data streams. Release is scheduled for early summer 2012.

Dr. Gillies was put forward for promotion to full professor in 2011. Part of the review process involved external review from which the following clip below commented upon re: the Utah Climate Center:

> *"...the Utah Climate Center is one the best in the United States. Through its balance of State and other sources of financial support, its state-of-the-art data services, and its regionally-and sectorally-focused customer services, the Center delivers high-quality, timely, and relevant climate services to the citizens of Utah".*

Dr. Gillies presented (all **invited**) at various venues on the subject of climate and climate change:

- **Robert R. Gillies**. 2011. Multiple-scale interactions." @ Seasonal to Year-Two Colorado River Streamflow Prediction Workshop (UCAR sponsored), Salt Lake City, Utah, March 21-22, 2011.
- **Robert R. Gillies**. 2011. Research of the Utah Climate Center." @ NOAA Climate Program Office/NOAA Headquaters, Silver Springs, Maryland, March 16, 2011.
- **Robert R. Gillies**. 2011. Climate in the Intermountain West." @ NOAA Climate Prediction Center, Camp Springs, Maryland, March 14, 2011.
- **Robert R. Gillies**. 2011. Science of Climate Change. *Global Academy, the Office of Global Engagement*. June 28, 2011, Utah State University, Logan, Utah
- **Robert R. Gillies**. 2011. Unique Climate Regimes of the Intermountain West. P*resentation to Ted Wilson (Senior Advisor on Environmental Matters to the Governor of Utah)*. May 4th, 2011, Utah Capital Building, Salt Lake City, Utah.
- **Robert R. Gillies**. 2011. Climate Change in the Intermountain West. *Intermountain Section of the Society of American Foresters*. April 29th, 2011, Utah State University. Logan, Utah
- **Robert R. Gillies**. 2011. Scale Interactions and Forecasts of Wintertime Inversions in the Intermountain West. Rotary Club (Logan), March 10, Coppermill, Logan.
- **2011** August 18-20, I represented Utah State University (Opening Ceremony and Speaker) at the International Conference on Agricultural Water Efficient Use in Arid Regions, Yangling, Shaanxi, P. R. China.

- **2011** River Streamflow Prediction Workshop (UCAR sponsored), Salt Lake City, Utah, March 21-22, 2011.

A summary of other activities are as follows:

Service/Outreach

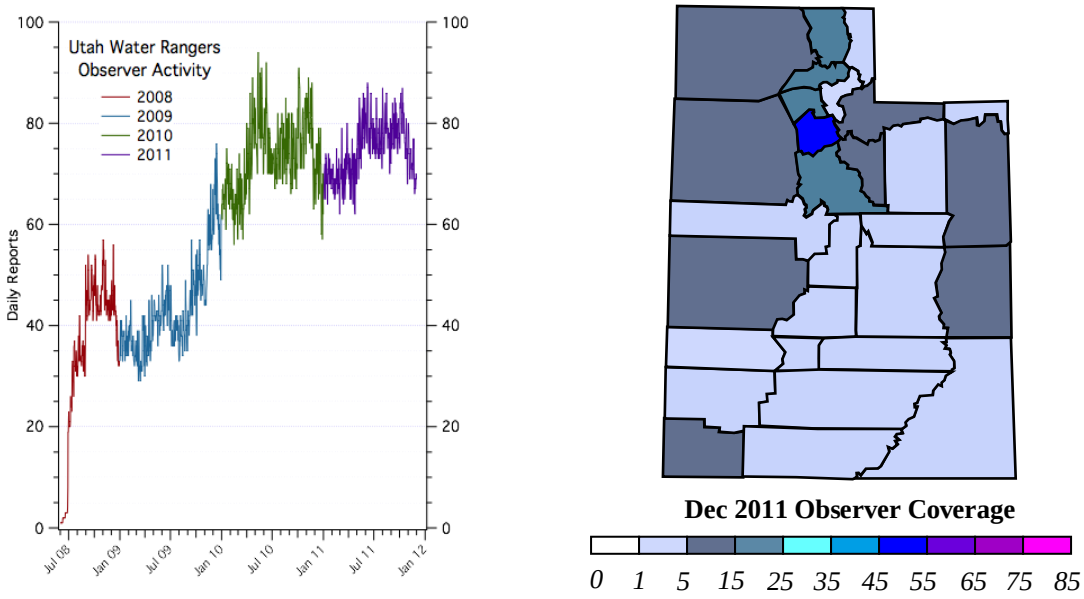
Service- and outreach-oriented work moves research results into the community. It includes community education, product development and implementation, and assistance to various stakeholder groups.

The UCC Newsletter has matured in 2011.

Monthly Newsletter — 2011 saw significant evolution of this product, with monthly feature articles, monthly products, seasonal products and national and global climate notes of interest. Distribution has recently increased via advertisement through Extension and the CoCoRaHS observer network.

2011 Issues of *Utah Climate Update*

CoCoRaHS — Daily reports have remained steady over the year, averaging about 75 per day. Most significantly in 2011, we now have reporting observers in every county in the state.



CoCoRaHS daily observations and observer coverage in 2011.

Climate Advisor to Utah Transit Authority — UTA is applying for federal grants to study the impacts of climate change on public transportation in Utah. UCC is partnering with UTA in this proposal.

Climate Advisor to Utah Department of Health — Utah DOH is currently working on a document regarding climate change and public health. Dr. Davies spent time directing them to the work that has already been done on the subject (which is considerable) and helping them understand the notion of regional climate modeling and what to look for in terms of climate-related variables in public health (e.g., temperature regimes for malarial mosquitoes).

New Products / Visualizations

The unusually warm summer combined with an abnormally wet spring in 2011 resulted in some serious concerns for Cache Valley farm managers regarding the first fall frost that might prohibit corn ear from maturing in time and lead to inadequate silage. At the request of the Utah Agricultural Experiment Station (UAES), the UCC conducted a quick, proof-of-concept analysis to identify the feasibility of seasonal prediction for 2011's first freeze day; this was done one month before the climatological first freeze day. Analyzing the climatic linkage between first fall freeze and ambient temperature at several stations, the UCC team adopted operational prediction output of the Climate Forecast System version 1 model (CFSv1), the first of its kind developed by the National Centers for Environmental Prediction (NCEP). The result was that for Cache Valley and four other sites in Utah, the preliminary – yet effective – forecast module successfully predicted the 1-1.5 month delay of first fall freeze, which was later validated (Ref., Fig. 1). Farm managers, having postponed harvesting following the forecast, were able to produce sufficient corn

silage and hay with efficient management of corn types, saving USU considerable money since prices were extremely high due to the late and rainy spring.

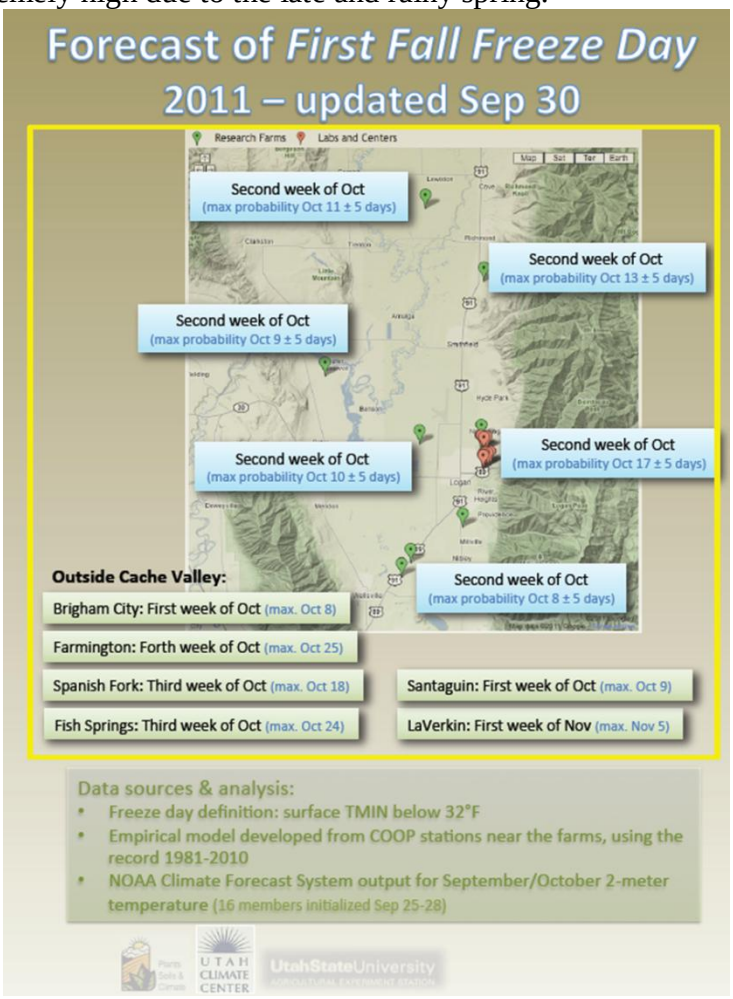


Figure 1. Forecast of First Fall Freeze Day

On-going Research

Utah Temperature Trends —Work on Utah temperature trends continues. The National Climate Data Center's (NCDC) conversion to the Global Historical Climate Network (GHCN) daily data has complicated matters a bit, but that is being worked. In putting together climatic temperature summaries for various Utah locations, the issue of missing data arose. Therefore we have been exploring strategies for estimating these missing values using various flavors of correlation analyses (Fig. 2).

Filling the Gap in the Utah Temperature Record

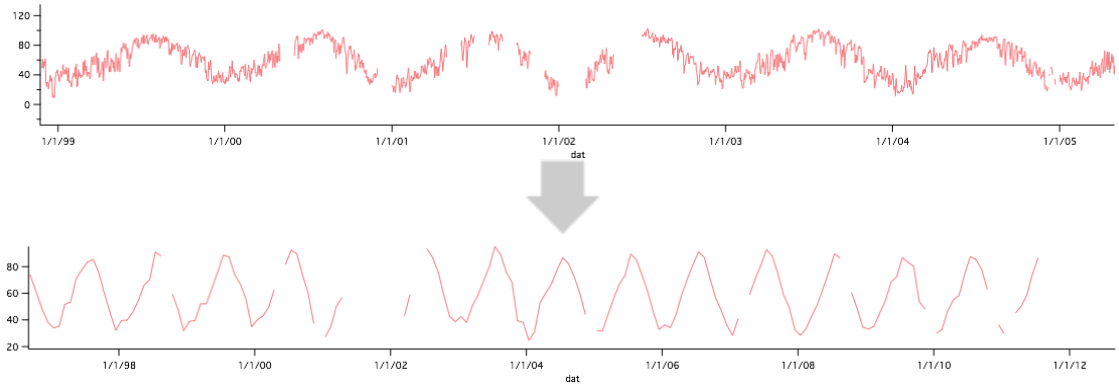


Fig. 2a. Gaps in daily temperature data (top) lead to gaps in monthly data (bottom).

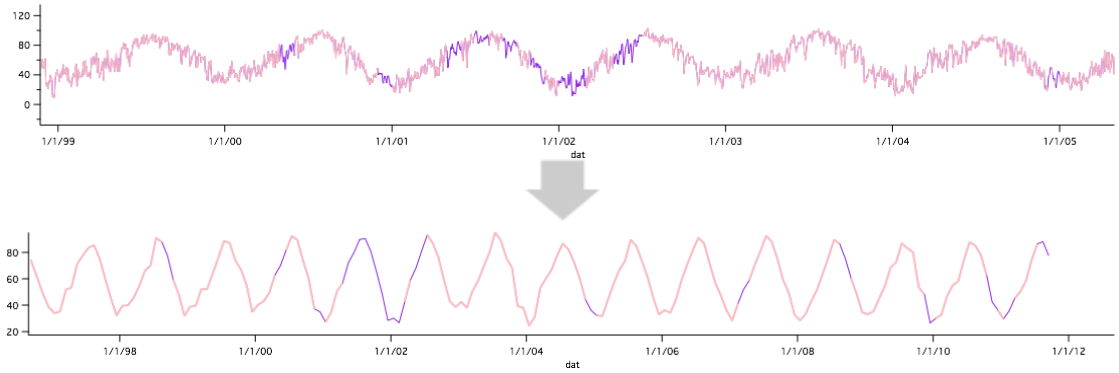


Fig. 2b. Filling gaps in daily data with estimates derived from correlation analyses with surrounding stations (top purple) enables filling of gaps in monthly data (bottom purple).

- *Best Practices for Interpreting Temperature Time Series* — this work is tied to website development and the Utah temperature trend work. The goal is to make climate data from the instrumental record (late 1800s until the present) accessible to public audiences, decision makers and educators in a manner that the seasonality, inter-annual variability and long term trends can be easily visualized, accurately portrayed, and therefore effectively communicated. A paper for publication is in work.
- Nepal – Past and Future Climate Assessments of Livestock Vulnerability in Nepal.
- *Cache Valley Air Quality* — late this year, Dr. Davies began examining Cache Valley air quality quantification. Specifically, looking to normalize PM2.5 levels to local meteorological conditions as this is a necessary step in understanding the effectiveness of mitigation measures.

Publications and Internet Resources (click here to see a listing of the articles)

Vermont State Climate Office (VTSCO)

Department of Geography
University of Vermont
94 University Place
Burlington, VT 05405-0114
Tel: 802-656-2146
Fax: 802-656-3042
State.Climatologist@uvm.edu
http://www.uvm.edu/~ldupigny/sc

Lesley-Ann L. Dupigny-Giroux, State Climatologist
Stephen Hogan, Assistant

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 emphasizes outreach as one of its core missions. The VTSCO is located in a laboratory setting donated by the Geography Department. National Science Foundation (NSF) and NOAA 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.

With the loss of the VTSCO graduate research assistant in AY 2010, undergraduate interns provided the primary assistance in AY2011-2012. Four interns earned academic credit in Fall 2011, while another four received a competitive University of Vermont, Irene Undergraduate - Faculty Research Award in the amount of $2911 for "Conducting a synoptic meteorological and geospatial analysis of the extreme precipitation during Tropical Storm Irene: A contribution to flood mitigation planning".

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

- The VTSCO website (http://www.uvm.edu/~vtstclim) served as the portal for disseminating information and research about the two major flooding events of 2011 (Lake Champlain in April and Tropical Storm Irene in August). A NOAA SARP grant was submitted in October 2011 to work with Dr. Michael Brewer and team at the Climate Monitoring branch of NCDC (initiated during a SCEP-funded visit in February 2011) on the creation of a seamless geospatial data portal for this site. This was unfunded due to federal budget restrictions.
- Provided free data, expert opinions, and recommendations via the telephone, facsimile,

electronic mail, and regular mail.

Information services:

- Provided four interviews to news media (*Fox 44 News (TV), Rutland Herald, UVM Today, Local Banquet)* and 3 special interviews in August 2011 related to Tropical Storm Irene's impact on Vermont (*Seven Days, Boston Globe, UVM Today*).
- Special profile in the April/May issue of the Vermont Woman entitled "State Climatologist makes the weather clearer" (http://www.vermontwoman.com/articles/0412/climatologist.shtml).
- Handled 60 requests (58 email and 2 telephone requests). These were primarily for Vermont State Agencies, undergraduate and graduate students seeking specific weather information for policy making, manuscript preparation or class projects.

Research

- Dupigny-Giroux, L-A., Toolin, R., Fortney, M.D. and Hogan, S. (2012) "The Satellites, Weather and Climate (SWAC) teacher professional development program: Making the case for climate and geospatial literacy", *Journal of Geoscience Education,* in press (May).
- Contributing lead author on "Case Study on the Impacts of Hurricane Irene," in the Assessment of Climate Change in the Northeast United States: A Technical Report Prepared for the U.S. National Climate Assessment. Peer reviewed report.
- Lead author on "Clarifying the communication of climate and climate change," in the Assessment of Climate Change in the Northeast United States: A Technical Report Prepared for the U.S. National Climate Assessment. Peer reviewed report.
- Dupigny-Giroux, L.A., (presenter), Stooksbury, D., Akyuz, A., Hubbard, K.G., Nielsen-Gammon, J.W. and Timofeyeva, M., "AASC Recommendations for the Education of an Applied Climatologist," presented at the Association of American Geographers meeting, New York, New York, February 24-28, 2012.
- CDMP-related data collection of weather and climate data in personal diaries from the 1800s at the Springfield & Rutland Historical Societies. Databases of the contacts, findings and progress of visits around the state were updated.

Outreach

- 5 public presentations on Vermont's perspective in terms of climate change; Tropical Storm Irene.
- Liaise with the Vermont Emergency Management on the potential Presidential Disaster Declaration for drought-affected farmers in northwestern Vermont in August 2011 [obviated by TS Irene].
- Expanded the Vermont Weather and Climate Research group to 62 members including University of Vermont, Lyndon State College, Vermont Emergency Management, VTrans, National Wildlife Federation, Audubon Society, NOAA/NWS, NOAA Climate Services, US Forest Service, USGS, Atmospheric Research, Vermont Agency of Natural Resources/DEC/Air Quality, Vermont Agency of Natural Resources/DEC/Water Quality, Vermont Agency of Natural Resources/Forests, Parks and Recreation, NESCAUM,

USDA/Farm Service Agency, USDA/NRCS, and the Lake Champlain Basin Program. The Working Group meets every three months to quantify the weather and climate needs of state and federal agencies in Vermont and New Hampshire over the short and long terms. Submitted two federal grant proposals to pursue research needs identified - the aforementioned NOAA SARP & a NASA Disasters proposal.

University of Virginia Climatology Office

Department of Environmental Sciences
University of Virginia
Clark Hall
291 McCormick Road
Charlottesville, VA 22904-4123
Tel: 434-924-7761
Fax: 434-982-2137
wx@virginia.edu
http://climate.virginia.edu

Philip J. Stenger, Director and State Climatologist

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 and the director sits on the center's Technical Advisory Committee.

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 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. The office has recently acquired real-time lightning detection capabilities through the Telvent System.

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 was a long-term integral participant in the ShenAir Institute Research Program, designed to expand understanding of the atmospheric environment of the Shenandoah Valley of Virginia. Under this program, the office was 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

After the formal conclusion of the contract period, the office is continuing follow-up discussions, publications and impact planning based on this work.

In addition, significant research efforts of the office included:

- Examination of the relationships between climatic regimes and exacerbation of respiratory distress — in collaboration with the U.Va. Health Sciences Center.
- Investigation of the relationships between large-scale atmospheric teleconnections and tropical cyclone impacts in Virginia. This is being expanded to cover the entire Mid-Atlantic region.
- Investigation of potential secular changes in the timing of seasonal transitions.
- Drought and drought impact research and monitoring.
- Analyses regarding climatic conditions in East Africa as part of a review of research into the relationships of climate and neurological disorders for the *Journal of Neurosurgery*.
- Analyses regarding thunderstorm precipitation distributions and relationships to flash flooding during a major event in Virginia.

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, on-line and television media.
- The office serves as a lead scientific contributor to the Virginia Drought Monitoring Task Force, with periodic conferences, drought reports, and analyses.
- A series of Video Climate Advisories regarding aspects of Virginia climate, produced for television and web-based distribution, including PBS and Farm Bureau networks, are archived and available through the office website and YouTube.
- The office has been emphasizing its website as a vehicle for making information available to potential users. This has succeeded in reaching larger numbers of individuals and organizations in a more cost-effective fashion. The estimated amount of information accessed continues to increase substantially each year.
- Presentation of education and training lectures for the Virginia Master Naturalist Program. This includes core instruction requirements for chapters around the state.
- Informational presentations before local government and advisory groups regarding climate-related topics of community concern.

- Involvement with school (K-12) and related groups (e.g. – Boy Scouts) regarding weather and climate science.
- Work with graduate and undergraduate students at the University of Virginia and other institutions on degree research and class-related projects.
- The office has been recognized by the National Weather Association as an approved institution for seal holders to receive recertification education and experience. As such, it provides this service to local television weather forecasters.
- Provided critical expert witness testimony for a landmark weather-related property damage case in a decision that was upheld by the Virginia Supreme Court.

Monitoring and Impact Assessment

- Continuing work and publication regarding human health impacts in relation to changing weather conditions.
- Provision of data and impact assessment for and service as a member of the Virginia Drought Monitoring Task Force as lead climatologist.
- Participation as a member of the Virginia Hazard Mitigation Steering Committee, including development of climatic hazards analyses. The final version the Virginia Hazard Mitigation Plan was formally accepted by FEMA and now provides the guidelines for planning across the state. Assessment work has begun on an update to the plan and proposed projects for mitigation and response are undergoing review and recommendation.

Papers in Review in 2011

Hondula D.M., R.E. Davis, D.B. Knight, L.J. Sitka, K. Enfield, S.D. Gawtry, P.J. Stenger, M.L. Deaton, C.P. Normile and T.R. Lee. A Respiratory Alert Model for the Shenandoah Valley, Virginia, USA, *International Journal of Biometerology*.

In Preparation

Davis, R.E., D.M. Hondula, D.B. Knight, L.J. Sitka, P.J. Stenger, K. Enfield. Climate, Air Quality and Respiratory Morbidity in the Shenandoah Valley, Virginia, USA, *Environmental Health Perspectives.*

Hondula D.M., D.B. Knight, R.E. Davis, L. Marr, L.J. Sitka, S.D. Gawtry, K. Enfield, P.J. Stenger. Respiratory Hospital Admissions, Population Demographics and Air Quality Controls in the Shenandoah Valley of Virginia, *Health and Place*.

Stenger, P.J., J.M. Rawley, B.R. Kennett, A.M. Milligan. Secular Changes in the Relationship of ENSO with Atlantic Tropical Cyclones Impacting the Mid-Atlantic Region of the U.S. *Journal of Service Climatology*.

Office of Washington State Climatologist (OWSC)

University of Washington
3737 Brooklyn Ave NE
Box 355672
Seattle, WA 98195
Tel: 206-543-3145
climate@atmos.washington.edu
http://www.climate.washington.edu

Nicholas Bond, State Climatologist
Karin Bumbaco, Assistant State Climatologist

This report focuses on the Office of the Washington State Climatologist (OWSC) activities in the last 12 months (May 2011 through April 2012). The objectives of OWSC continue to be as follows: (1) to provide climate data for Washington for users ranging from the public to state agencies to professional meteorologists, (2) to represent a resource in the analysis and interpretation of the past, present, and future climate of the state, and (3) to conduct outreach and educational activities on behalf of the residents of Washington State. The office is affiliated with the Joint Institute for the Study of the Atmosphere and Ocean (JISAO) of the University of Washington and receives the majority of its financial support from the State of Washington. It seeks additional support from federal agencies to conduct research on issues related to regional climate.

Outreach and Support

OWSC has continued the outreach and support activities that we have provided for the past several years, and added some new activities as well. Climate data and information requests have continued to be answered in a timely fashion (over 75 in the last 12 months), and we have also been a resource for court cases. A monthly newsletter with details on the previous month's climate and weather events, and with other climate updates, is now distributed to 230 people and organizations. OWSC has continued to maintain their website (www.climate.washington.edu), providing links to reputable climate and weather information. The most significant change to the site in the last 12 months has been the update to the new 1981-2010 climate normals for many of our utilities. That changeover is still in progress.

OWSC continues to be involved in the CoCoRaHS program, helping to recruit new volunteers and advocate the program. The OWSC Facebook page, which had a very modest following at this time last year, now has over 100 "likes". Also new in the past 12 months, is the State Climatologist weekly spot on KUOW – the Seattle affiliate of National Public Radio.

Numerous appearances have been made by OWSC in the last 12 months, whether they were scientific presentations, outreach demonstrations, or talks to the general public. An abbreviated list follows:

- Outreach demonstrations: Girl Scouts of Western WA GirlFest (September 2011), PNW Weather Workshop (March 2012), Paws-on-Science at Pacific Science Center (March 2012).

- Scientific presentations: AMS Applied Climate Meeting (July 2011), PNW Climate Conference (September 2011), National Climate Assessment PNW Health Sector Meeting (February 2012).
- Numerous climate and climate change talks to the general public, including: NWS Emergency Management Workshop (October 2011), Art Institute of Seattle (November 2011), Sound Waters workshop (February 2012).
- Training and information sessions: climate information training given to the Department of Natural Resources (June 2011), WERA 102 meeting (October 2011).

Research: Pacific Northwest Heat Waves, Optimal Network Design, Cascade Mountain Climate, and North Pacific Climate Change

A collaborative research effort between OWSC and the Oregon Climate Service on historical western WA and OR heat events was introduced in last year's AASC annual report. The research, focusing on regional daytime and nighttime heat events in the historical record and their associated synoptic pattern and health impacts, has now been written up and submitted to the Journal of Applied Meteorology and Climatology.

Bumbaco, K.A., K.D. Dello, and N.A. Bond, 2012: History of Pacific Northwest Heat Waves: Synoptic Pattern and Trends. J. Appl. Meteor. Climatol. [submitted]

In addition to the heat wave research, OWSC has been involved in continued work on designing optimal observing networks, and also had a role in a study of salmon behavior conducted by the USGS (citation below). Additionally, work has commenced on a small grant from the National Park Service for analyzing mountain climate and trends.

Kock, T.J., T.L. Liedtke, D.W. Rondorf, J.D. Serl, M. Kohn, K.A. Bumbaco (2012): Elevated streamflows increase dam passage by juvenile coho salmon during winter: Implications of climate change in the Pacific Northwest. North American Journal of Fisheries Management. [submitted]

With the support of externally-funded programs, the OWSC has carried out research on the implications of global climate change for the Northeast Pacific Ocean, with a focus on the marine ecosystem. This work features collaborations with climate scientists, oceanographers, and fisheries scientists from a variety of academia and federal institutions.

Furtado J., E. Di Lorenzo, N. Schneider, and N. Bond, 2011: North Pacific Decadal Variability and Climate Change in the IPCC AR4 Models. Journal of Climate, doi: 10.1175/2010JCLI3584.1.

King, J.R., V.N. Agostini, C.J. Harvey, G.A. McFarlane, M.G.G. Foreman, J.E. Overland, E. Di Lorenzo, N.A. Bond, and K.Y. Aydin (2011): Climate forcing and the California Current ecosystem. ICES J. Mar. Sci., 68(6), doi: 10.1093/icesjms/fsr009, 1199–1216.

AASC Activities

OWSC received SCEP funding (February-June 2011) to catalog AASC-developed web tools into a database and write a monthly feature on a tool in the database. Some work has extended beyond the funding period, and the database is now displayed on the AASC site (http://stateclimate.org/productsurvey/list.php) with 85 entries. OWSC has worked with the AASC webmaster, Lou Vasquez, to highlight a tool in this database on a monthly basis, and those have been listed in the "Latest News" section of the website since January 2012. OWSC will keep providing the highlights through December 2012. The project status was presented at the AASC meeting in Asheville in July 2011.

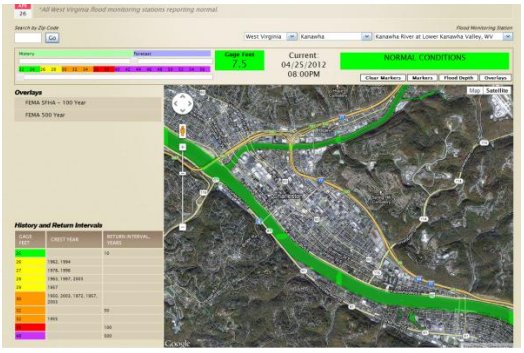
West Virginia State Climate Office (WVSCO)

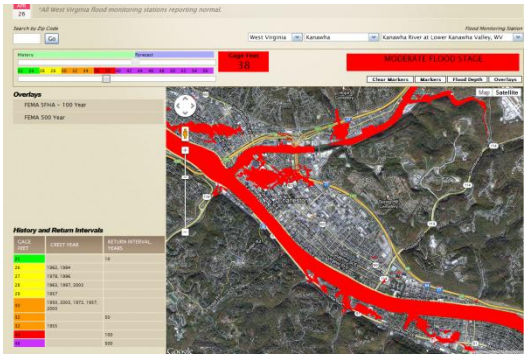
Marshall University
Department of Geography
211 Harris Hall
1 John Marshall Drive
Huntington, WV 25755
Tel: 304-696-2503
law14@marshall.edu
http://www.marshall.edu/met/

Kevin Law, State Climatologist

The mission of the West Virginia State Climate Office (WVSCO) is to deliver climate products and provide professional consultation to stakeholders. The service the WVSCO offers allows stakeholders such as engineers, researchers, and government agencies to make informed decisions. In the past year, the office has assisted the U.S. Army Corps of Engineers, the Environmental Protection Agency, and legal counsels to name a few. In addition to consultation, the WVSCO assists in climatic education, taking the opportunity to speak with media outlets and educational institutions when possible.

The WVSCO continues to remain active with the CoCoRaHS network and plans to partake in new recruiting activities to increase the number of volunteers. The office is also continuing a collaborative project with the National Weather Service in Charleston, West Virginia, Engineering Perfection, PLLC, and Marshall University. By creating a better flood inundation visualization tool, the product could help minimize the devastating impacts of flooding in the state. Sample flood maps can be found on the website http://www.myfloodalert.com (some aspects of the website are still under construction). Once a location is chosen, two "slider bars" can be selected. One shows the current conditions at the flood gage and the forecast from data downloaded from the River Forecast Center. The second slider can be adjusted to reflect where the flood waters will be at varying flood gage heights.





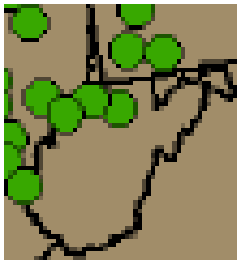
Notice that the color scheme is the same utilized by the River Forecast Center for consistency. The goal of this project is to make West Virginia a prototype for flood inundation mapping and to expand it after the state is completed. Marshall University students have been able to receive paid internships to help develop the Geographic Information System (GIS) and they are able to use the

GIS laboratory in the Geography Department (where the WVSCO is located). Other department GIS projects have received funding from the WV Environmental Protection Agency and the US Surface Mining and Land Reclamation to execute environmental analysis.

2011 Weather in Review- Warm and Rainy Year

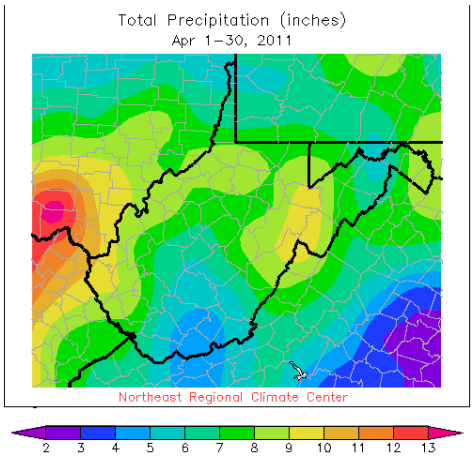
Statewide mean annual temperatures and precipitation totals were well above average in West Virginia. For 2011, the mean annual temperature was 53.4°F making it the 11th warmest year, while the mean annual precipitation was 53.96" which was the 5th wettest year. In fact, four cities in the state experienced its wettest year on record (Clarksburg, Huntington, Middlebourne, and Parkersburg). Many locations across the entire Ohio Valley experienced record rainfall in 2011, particularly during the spring.

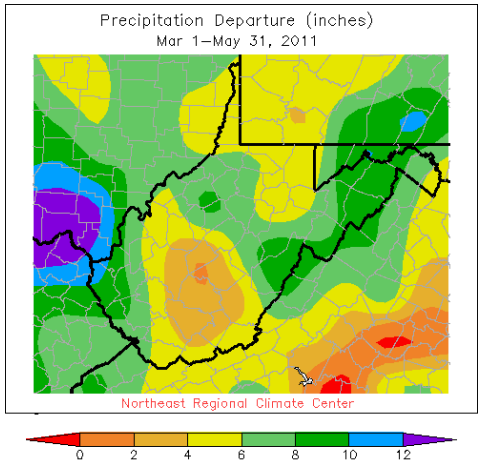
Location	State	Yearly Record Type	2011 Value	Previous Record	Year
Clarksburg	West Virginia	Wettest	65.54	63.82	1996
Huntington	West Virginia	Wettest	62.46	59.98	1989
Middlebourne	West Virginia	Wettest	56.57	56.24	1996
Parkersburg	West Virginia	Wettest	57.53	56.12	1990



Green dots show record rainfall locations in 2011

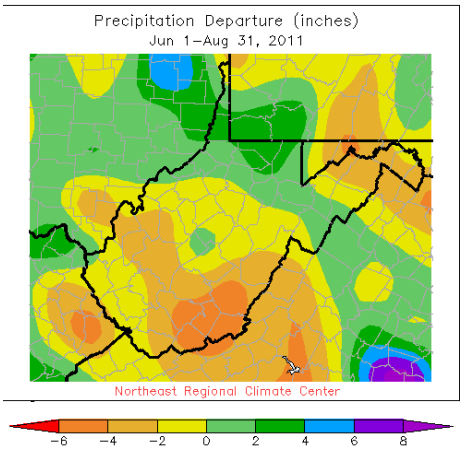
Meteorological spring (March, April, and May) was the wettest on record in West Virginia (18.28") breaking the old record of 17.11" set in 1967. April was an extremely rainy month as up to 10" fell in the Ohio Valley and parts of the central mountains. The "driest" locations were in the southern part of the state where approximately 5" fell. Over the 3 month spring period, much of the state reported large precipitation departures from normal. Departures ranged from 2" to as much as 10" above normal. Much of the precipitation can be attributed to a series of storms where the cold fronts (and sometimes stationary fronts) aligned parallel to the Ohio River. The west-southwest flow (parallel to the fronts) caused the storms to "train" along the Ohio River. Despite all of the rain, the west-southwesterly flow, along with being on the south side of the stationary fronts, allowed temperatures to be above normal as the springtime mean was 53.0°F ranking as the 18th warmest.

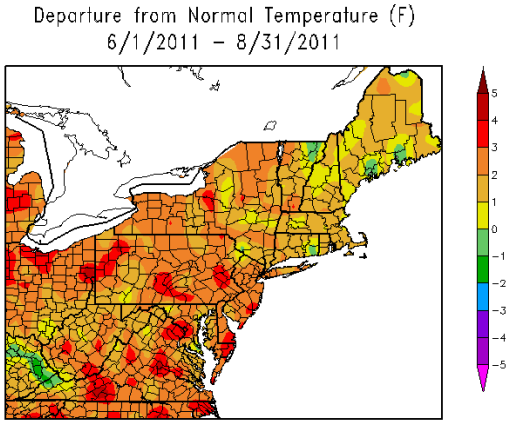




The warm temperatures in spring were actually a continuation of the wintertime patterns. The winter (December, January, and February) mean temperature was 37.2°F ranking as the 6th warmest on record. This was despite December 2010 being extremely cold across the entire state. However, in January the weather dramatically changed and the remainder of the winter was exceedingly mild. Actually, this brought great relief to many citizens across the state since the last two winters were some of the snowiest in recent memory.

The summer months had continued warmth as the mean temperature was 71.9°F ranking as the 16th warmest summer. But the heavy rains experienced in the spring came to an end as the summer turned much drier. Many of the same areas that had record rainfall in the spring reported negative departures from normal in the summer. The only exceptions were the northern parts of the state, which did not have as much springtime precipitation.





Wyoming State Climate Office

Water Resources Data System
University of Wyoming
Dept. 3943, 1000 E. University Ave.
Laramie, WY 82071
Tel: 307-766-6651
stateclim@wrds.uwyo.edu
http://www.wrds.uwyo.edu/sco/climate_office.html

Tony Bergantino	***Assistant State Climatologist***
Chris Nicholson	Interim Director, Water Resources Data System
Barbara Muller	Librarian and Archivist
Jodi Preston	Office Administrator and Data Manager
Michelle Ogden	Data Services/Research Associate

The State Climate Office (SCO) is a part of the Wyoming Water Resources Data System (WRDS; http://www.wrds.uwyo.edu) and together are the single largest providers of water- and climate-related data in the state. Established in 1967 and 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 staff 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

Providing Support for Resource Management in the State and Region

- Concluded work on Bear River Basin Water Plan Update. Quantify consumptive use from evaporation on major reservoirs. The Bear River Basin Water Plan was last updated in 2001 and projections of available streamflow were updated to reflect the last decade, much of which had Wyoming experiencing drought conditions.
- CoCoRaHS participation also addresses a key problem within the state, namely a lack of precipitation monitoring sites in many areas. By combining these observations with PRISM (http://www.prism.oregonstate.edu) we are also working to place these real-time measurements in a longer, historical context.

Coordinating and supporting the collection of weather and climate data

Over the past year, WRDS/SCO has been involved in supporting and enhancing weather/climate data collection platforms in the state. In 2011, in partnership with the National Weather Service (NWS) and the City of Laramie, an automated station was re-established on the Laramie River at Laramie and streamflow conditions were made available real-time to the public via the NWS

Advanced Hydrologic Prediction Service. Efforts are now underway to include additional sensors such as precipitation, temperature, solar radiation, etc. at this site. In further partnership with the NWS, equipment has been purchased to enhance existing sites and to establish new sites in critical/data-sparse areas.

WRDS/SCO continues to maintain and enhance the NWS COOP station 485435 (Laramie 2NW), which it has done for the last 45 years. Enhancements underway include the collection of solar radiation and soil moisture data.

CoCoRaHS continues to play an important part in operations at the WRDS/SCO. While there has not been a great increase in the number of observers in the network in Wyoming, the number of daily reports has remained consistent.

Weather and climate research, assessments, and data dissemination

- Continued to produce a series of climate summaries for the Regional Climate Centers which are also distributed widely throughout regional agricultural and resource management communities.
- Continued development of a series of ArcIMS interfaces that allow users to explore spatial data in an online-mapping framework. Access to related products can be found at http://www.wrds.uwyo.edu/sco/gis/IMS.html.
- Launched Google Maps interface to facilitate access to PRISM time series data for any location in the 48 states. Results include monthly averages of maximum, minimum, average, and dewpoint temperature as well as total monthly precipitation with the ability to show monthly or annual plots (http://www.wrds.uwyo.edu/sco/data/PRISM/PRISM.html).
- Concluded drought study for the years 1998-2010 using data from NCDC and the WRCC for 137 COOP sites in Wyoming to illustrate the monthly, annual, and water-year parameters of total precipitation, average maximum, and average minimum temperature.
- WY streamflow study, water-years 1994-2009: USGS stream gauge data from 24 Wyoming stations was used to evaluate each station's water-year daily discharge (cfs) vs daily and estimated mean discharge (cfs), median daily statistic values for period of record (cfs), and total and average mid-pt total discharge (cfs). Product: 384 pdf graphs with 384 csv files.
- Continued to offer ready access to a large suite of water and climate-related data via the World Wide Web. These web products continue to serve an increasing audience with the number of accesses being up over 10% from last year.
- Although numbers have declined by a little less than 10% from last year, WRDS/SCO continues to provide data to “in-person” requesters as well. Sometimes these requests are more of a value-added type and require specific interpretations of the data provided whether for construction design or legal matters.
- WRDS/SCO maintains a circulating Library containing over 21,000 documents on water and climate. The Library has weekly visits by students, faculty, and consultants and in the past few years WRDS/SCO has undertaken efforts to digitize portions of the collection for online access (http://library.wrds.uwyo.edu).
- Presentations to stakeholders at various meetings around the state and country.
- Various interviews with media organizations regarding drought and snowpack with the associated potential for flooding.

Representative Publications

Service/Outreach Publications

Nicholson, C. & Bergantino, A. 2012. Point-Specific, Online Climate Data Retrieval: Developing Improved Methods for Accessing Wyoming's Climate Data through Online Web Mapping Application. To be presented at the 2012 American Water Resource Association

Specialty Conference, GIS and Water Resources VII. New Orleans, LA.
Taucher, P., and others. 2011. Available Groundwater Determination in the Wind/Bighorn River Basin, Wyoming. Wyoming Water Development Commission, Cheyenne, Wyoming. In Press.

Pederson, G.T., S.T. Gray, T. Ault. W. Marsh, D.B. Fagre, A.G. Bunn and L.J. Graumlich. 2011. Climatic controls on trends and variability in snowmelt hydrology of the northern Rocky Mountains. Journal of Climate, 24, 1666–1687. doi: 10.1175/ 2010JCLI3729.1.

Gray, S.T., J.J. Lukas and C.A. Woodhouse. 2011. Millennial-length records of streamflow from three major Upper Colorado River tributaries. Journal of the American Water Resources Association (JAWRA), 1-11. DOI: 10.1111/j.1752-1688.2011.00535.x.

Compiled by Tony Bergantino

AASC 2011 Annual Meeting Business Meeting Minutes

American Association of State Climatologists 36th Annual Meeting, Asheville, NC
Lesley-Ann Dupigny-Giroux, AASC Secretary

Thursday, July 21, 2011

New SCs:

- Dan Leathers (DE) was welcomed back after 5-6 years' absence. Renee McPherson was acting SC last year and is fully on board now.
- Steve Grey left WY, so Tony Bergantino is acting SC.
- Don Potts left MT.
- Jeff Underwood left NV, so Kate Berry is acting SC.

New NCDC liaison:

- Danielle Swallow has been the liaison since last Fall. Dennis mentioned the importance of her role in the Federal government

Regional Climate Service Directors (RCSD) were introduced and welcomed:

- Ellen Mecray (east)
- Dave Brown (south)
- Doug Kluck (central)
- DeWayne Cecil (west)
- James Partain (Alaska)

AASC Executive Committee:

- Dennis Todey (President)
- Nolan Doesken (Past-President)
- Lesley-Ann Dupigny-Giroux (Secretary)
- Mike Anderson (Treasurer)
- David Robinson (ARSCO coordinator)

The Secretary/Treasurer position was divided last year, with the Secretary position being replaced this year. The Treasurer transition occurs mid-year (end of calendar year 2012). Ex-officio members are Fiona Horsfall, Marina Timofeyeva (one slot filled by both Fiona and Marina), Danielle Swallow, and Jan Curtis. Harry Hillaker was recognized for his service after stepping down at the end of 2010.

2010-2011 activities:

- Paul Knight & Dennis Todey attended a NOAA meeting in October, AMS Spring meeting in April. Nolan Doesken attended a NWS HQ meeting in March in Dennis' stead. Dennis attended NOAA regional coordination team meeting in St. Paul in June.
- The AASC membership list has been updated.
- The 501(c)3 issue has been resolved, as reported by Harry Hillaker.

Business Meeting

Joint Meeting with AMS Applied Climate:

It seemed to be more AMS than AASC, and we missed a lot of state reports, but only 6 states responded as wanting to do their state reports. Some people can only go to one conference, so the joint meeting was helpful for them. Joint meetings with AMS Applied Climatology can only occur once every 3 years. We enjoy meeting alone, so let's not have a joint meeting every time.

Regional lunches with RCCs – SCs:

We need a quieter environment as some regional groups are quite large and it's hard to hear and participate. Maybe boxed lunches if they are reasonably priced. Or perhaps an open-ended discussion where we adjourn at 3 pm and then break into regional groups. SE has monthly conference calls, so they stay in touch all the time.

ARSCO report (Dave Robinson):

- There are currently 47 "state climatologists" - some have yet to be designated. TN, RI, MT do not have programs at this time.
- Those who are attending the AASC meeting for the first time were invited to raise their hands. (We did not get a count on these, but Nancy will check the attendance sheet.)
- David Legates (DE), Don Potts (MT), Steve Grey (WY), and Jeff Underwood (NV) have stepped down.
- There are no new ARSCOs in 2011. There are 38 ARSCO states with 37 submitting their reports. Nolan asked Dave to define ARSCO for the benefit of those attending the meeting for the first time.
- Dave thanked the partners for submitting their reports. He also thanked Mat Gerbush and Christina Speciale for working on The State Climatologist publication.
- Dennis picked up the thread of what it means to be an ARSCO and if we need to revisit the question of re-defining the ARSCO status requirements and how the MOUs are executed (which parties are involved).

Executive Director:

- We have had this discussion for the last 2 years.
- Last year Executive Council was given the approval from the AASC membership to explore an Executive Director. A volunteer has stepped forward to help AASC pilot test an Executive Director without financial obligations. Nolan introduced Scott Archer. Nolan said that we had dozens of opportunities but our officers don't have sufficient time to be able to follow up on the opportunities and issues due to their individual workloads. Scott understands the lay of the land working with state agencies, state-federal issues etc. as he has worked for BLM for 20+ years, and been an associate member of AASC for more than 10 years.
- Scott Archer - how the AASC could best work with an Executive Director.
    - Organization had expanded enough and become complex enough that elected officials find it difficult to run the organization and do all the work needed. ED would undertake the administrative activities, provide support and facilitation of all

the entities.
    - Pointed to the duties on the landscape sheet that was distributed.
    - He has developed a draft strategic plan to facilitate discussion. He views this as a living document subject to revision.
    - Some useful initial functions will be to provide a good archive of all documents, constitutional and by-law changes.
    - Next step is that funding is needed. He is retired and so has taken funding off the table as an issue as we get started. As we move forward and pursue grant funding, the overhead from that would fund the ED position.
- Dennis - We currently use SCEP overhead to help SC
- Nolan - Scott committed to volunteering his time over the next year. "Let's not worry about that (the funding) now."
- Paul - Asked what role the ED would have on the Executive Committee in terms of voting.
- Nolan - We would need to revisit this issue. The Exec Committee views this as a non-voting position that is very different from an Ex-officio member.
- Dennis - Scott is looking to us for direction and will not be providing that.
- Keith - When a new ED term comes up, will the person be appointed by the Executive Committee.
- Scott - Sees this as a staff function. Organization determines how to hire and fire people.
- Mary Knapp - Brought up point of length of commitment. 2-3 years would defeat the point of smoothing over transitions.
- Renee - Linking to legislative educational efforts (aka lobbying) - having a consistent message from a single person would be good. Had we considered this?
- Nolan - Would not fund this from overhead from federal grants – as lobbying is a prohibited use of federal funds.
- Scott - EPA has shut down an organization that didn't keep the federal money separate.
- Stu - Funding will be an issue in the long term. If we find someone who will be in it for the long haul, will require substantial amount to funding to keep them. Do we have an idea of how much this would take?
- Nolan - 3 or 5 year phase in from local SCOs to contribute to this funding. Believes we need minimum $50 000 to start up. This will become a stumbling block for some states, but not for others.
- David St - ED could be writing the grants when the AASC is going in as a group. Some of the overhead could be used to pay ED salary. This would be an incentive for the ED to write the grant to pay his/her salary. If they are being paid with federal dollars, they cannot contact Congressional Liaisons, but could provide information. 50% overhead is not unheard of. 30% is not unreasonable. Private companies charge 100%.
- Harry - Whole concept is an opportunity that we can't pass up especially since Scott has already volunteered. Sees parallels with Lou being webmaster. Lou is looking for the direction of what we want. We need to take the time to give Scott the direction.
- Dev - Not clear what the milestones representing the success of this position at various timelines. We need to identify these outcomes clearly laid out.
- Nolan - Basic documentation, updated membership lists.
- Dennis - Constitution is about 4 years out of date. Better communication amongst Exec Comm and membership. Quarterly email updates/webinars to keep us in the loop.

- David St - **Moved that the Exec Comm acquires Scott's services over the next year, and figure out what the relationship means and have Scott report back to us next year. Harry seconded**.
- Marina - Asked about Scott's background. Scott left the room for discussion.
- Dennis - Scott has an air quality background. Has worked with Western entities. Was with the Bureau of Land Management. We need someone who is not an SC to help us. Someone who has time to commit and can focus on that.
- Karin - Where will he sit?
- Dennis - He will be working out of his home. Travel would be covered out of AASC funds.
- Paul - Amendment to motion - does this require a change in the Constitution?
- Dennis - Thought yes.
- David Z - Doesn't think so.
- Paul – Non-voting member who is not a member of the Exec Comm - not.
- Keith - Motion was for this to be a one year position and so no changes needed to the Constitution.
- Konstantin - Asked if state had a problem.

Call the question - motion to accept Scott as ED for one year and metrics for his success will be evaluated jointly: Motion passed unanimously

Nomination of Officers:

- Paul - Nominating Committee members Hope Mizzell, Tim Brown, Jim Angel in addition to Paul Knight.
- President-elect (4 year term) & Secretary (2 year term).
- 2-3 phone calls to select the position. Discuss the wealth of talent in the membership. List of candidates submitted to Exec Committee. Latter contact the candidates.
- Nomination for **President-elect is Stu Foster (Kentucky)** who accepts the nomination. No further nominations from the floor. **Motion to close nominations - made by Steve Hillberg and seconded by Mary Knapp. Unanimously approved.**
- Nomination for **Secretary is Nancy Selover (Arizona)** who accepts. No further nominations from the floor. **Motion to close nominations - made by Steve Hillberg and seconded by David Stooksbury. Unanimously approved**.

2012 Meeting Locations:

1/) North Dakota - Adnan

- Medora, ND is proposed location, the site of 121F temperature in 1926.
- Located at entrance to Theodore Roosevelt National Park, 30 miles from MT border. Surrounded by the ND Badlands.
- 3 blocks by 5 blocks.
- Conference space at the Rough Riders Hotel - 160 people banquet.
- Medora Musical outdoors, right next to Pitchfork Steak Fondue.
- Next to Little Missouri River. Few people.
- World class golf course.
- Medora has no airports. Bismarck (2hrs), Fargo (5 hours), Rapid City (4 Hours), Billings (4.5 hours), Dickinson TR Regional Airport (40 minutes).

- Questions - no bowling alley.
- Medora has a reputation for developing their play skills.

2) St. Louis - Pat Guinan
- Co-host with Jim Angel.
- Hyatt Regency at the Arch (20 minute shuttle ride).
- Close to the Gateway Arch & Museum of Westward Expansion.
- Tram up into the arch.
- Old Courthouse.
- Laclede's Landing - outdoor café style.
- Busch Stadium - could time it for Cardinals home game - 10 minute walk from the hotel.
- Anheuser-Busch Brewery Tour is free and 3.2 miles away. Beer master tour costs $25
- Missouri Botanical Garden $8 entry. Located 5 miles from hotel. Oldest operational garden in US since 1859.
- St. Louis Zoo is free.
- St. Louis Art Museum - free 1 mile north of the zoo.
- 9-12 July.
- Question - bowling alley. Bowling is big in St. Louis.

3) Destin - presented by Melissa Griffin
- Meeting has never been held in Florida.
- Destin-on the Gulf of Mexico side.
- 9-12 July or 23-26 July suggested dates.
- Recreation climatology.
- Airports - NW Florida 30 minutes.
- Panama City Beach - 40 minutes.
- Pensacola.
- Sandestin Golf and Beach Resort - on both intercoastal waterway and Gulf of Mexico.
- Bayside Inn - free internet.
- Onsite transportation.
- Free bikes, canoes, kayaks.
- 4 championship golf courses.
- Own private beach.
- Fishing.
- Baytown Wharf. Silver Sands Shopping Center (outlet). Hurricane Lanes bowling. Eglin Air force Base. Pensacola Aviation Museum.
- 10th Weather Squadron - parachute in and could be guest speaker.
- Plans in the contract if we have to leave the area for a forecasted hurricane. Do get money back.
- Peak hurricane is mid-August.
- Dinner boat is present.

Discussion:

- Paul - can we consider one for 2013 and not restrict ourselves to only 1 for next year.
- Dennis - discussion of Asheville's being a neutral site. He has no pre-conceived notion of how it will fall out.
- Barbara Mayes Boustead - asked about hotel rates.
- ND Rough Rider - $148.
- $100 govt rate and $106 otherwise in Missouri.
- $149 govt rate in Destin.
- John Young - what about the joint AMS meeting? – Won't be until 2014 for Applied Climate.
- David Stooksbury - proposal to vote for the next 2 years.
- Ryan - this is already in the bylaws.
- Dennis - asked if all 3 sites would be amenable for planning 2 years in the future? All agreed.
- Proposal on the table to choose places for the next 2 years. Membership agreed to this
- Membership instructed to vote for 2 locations.

Motion to adjourn for the day. Seconded by Jerry Stenger.

Result of vote announced at banquet – Destin Florida had most votes – will be 2012 meeting site, and St. Louis had second most votes, will be site of 2013 meeting.
On Friday, Melissa Griffin took a poll on the choice of dates for Destin, FL for next year. Majority voted for 9-12 July, 2012.

Business meeting resumed Friday, July 22, 2011 at 0810

Journal of Service Climatology - David Stooksbury:

- Several years ago, we had three items that we needed to move forward with:
    - 1) Dissertation Award - we have now instituted that.
    - 2) Our own professional journal.
        - Journal started 5 years ago with 3 publications in the 2010-2011.
        - One of the articles in 2010-2011 was used in a Federal Court case in the West. The public is more concerned about impacts than peer-reviewed articles.
        - David is stepping down as Journal Editor effective 1 January 2012.
        - Pam Knox is willing to continue with the reformatting of the articles.
        - Volunteers are being solicited for the position of editorship. Current volunteers for co-editorship are Nolan Doesken and Jim Angel.
    - 3) What the professional standards for that profession should be.
        - David is continuing to work on this with his committee, and will present the curriculum committee report later.

Treasurer Report - Mike Anderson:

- Received $99,900 from NCDC for SCEP. Balance in the account is still large due to his not receiving all invoices.
- No journal expenses.
- Hired a CPA for assistance with taxes and tax status.
- Have paid $46,000 to date on SCEP. Total outstanding payments $74,500.
- We have already received paperwork for this year SCEP funds which is the same as last year.
- He will circulate a hard copy.

Harry Hillaker:

- Hope Mizzell had done the first tax filing for the organization.
- September 2010 received a letter from the IRS that there was no record of AASC being tax exempt organization, dated a year and half before. The letter said we need to prove tax exempt status or pay taxes. We went with the former and neither we nor the IRS had letter proving exemption status. We felt more comfortable having a CPA review our documents. IRS had no record of our tax exempt status, but we were able to get a copy from our original attorney. CPA suggested that taxes were being filed under a different employer identification number (EIN). Taxes were filed under one EIN and the tax exempt status was under a second EIN. Third phone call to the IRS was able to merge the two numbers. We were able to complete the process within the 3-year window.

SCEP Update:

- Received about $100,000 again this year.
- 15 climate impact monthly assessments were awarded in year 1 and a similar number last year. Report posted on both SCO and AASC website.
- Part of the funds are used for overhead for Ph.D. award, award (PhD award comes from dues, not SCEP, although we could use the SCEP overhead for PhD award – note from HH), and Exec Council travel to national meetings.

Associate Members Nomination:

- Lesley-Ann Dupigny-Giroux presented list of nominations
    - Justin Rawley - has been assisting Jerry Stenger in Virginia.
    - Rachel Riley – OCS.
    - Marjorie McGuirk – NCDC.
    - Kevin Murray – NOAA.
    - Jess Whitehead SC Sea Grant.
    - Mike Hayes - NDMC UNL.
    - Eric Hunt – UNL.
    - Ned Gutmann – Retired NOAA.
    - Richard Anyah – Connecticut State Climate Center.
    - Molly Woloszyn – Illinois Water Survey.
    - Michael Brown – Mississippi State.
    - Zach Schwalbe – CoCoRaHS – Colorado State University.
    - Chris Fuhrmann – SERCC.

Motion to accept them by David Stooksbury and seconded by Jerry Stenger. Unanimously accepted.

Curriculum Committee Report- David Stooksbury:

- What are the education standards for our profession?
- This process started at the Grand Rapids meeting with a survey. Results were discussed in Lake Tahoe and the requirements were whittled down. We now propose 60 hours for undergrad and grad, including 6 hours of thesis work.
- Last week there was a concern about whether it was climatology or climate science. Consensus is around climatology.
- Second issue raised was that the definition was for an Applied Climatologist and not one of the other types.
- An Applied Climatologist needs breadth as well as depth in some things. To complete this, a Masters degree is required.
- List of recommended curriculum. AMS requirements do not include basic math and science courses and neither does our recommendation.
- Expanded recommendations. Includes academic experience or equivalent experience.
- The Data Analysis topics separate us from Meteorology. Universities would be free to map out the actual courses, without having to redo their curriculum. Could also be used to advocate for a new hire to cover the missing elements of the curriculum.
- Detailed sub-topics are included because of the various methods that we use as climatologists that are not necessarily used in other disciplines.

Jim Zandlo asked about optimization techniques such as non-linear fitting should be included. Climate core topics include Instrumentation, Microclimate (most geography departments already have such a course), past and future climate, Climate Models (does not include the expectation that students become climate modelers or a standalone course). Kostastin suggested adding "land-surface process models" to the Climate Models topics.

- Secondary area of expertise.
- Research project.

Ned Guttman concerned that with today's software you can push a button and get an answer. What is missing is when to use, assumptions and other part of the interpretation.

- What are the assumptions of statistics, how do you test the validity of them - need to be added.
- When to violate the assumptions for the purpose at hand.
- Critical importance of metadata about the data and techniques.

Jim Zandlo - homogenization has been a large part of NCDC. Data quality issues are a big deal. This is larger than instrumentation.

Jan Curtis - downscaling always comes up in conferences. Importance and implications of downscaling of models should be emphasized. Important to understand strengthens and weaknesses. A good primer is:
http://www.wucaonline.org/assets/pdf/pubs_whitepaper_120909.pdf

Scott Archer - did not see environmental laws and regulations.

- Could be added under social dimensions

Henry Reges - public speaking importance. This is listed under other recommended skills.

Dennis Todey - looking for a better phrasing than Social Dimensions

Renee McPherson - details still came across as a very long, prescriptive list that you must have. One of differences with an applied climatology issue is the ability to problem solve in a way that is very difficult to teach during a class. When you want to teach someone to problem solve, need to decide that all the content and techniques and have the students work through them - only pick a few and work through in a detail. Concerned about a new Assistant Professor coming in and trying to cram all of this material into a lecture style class.

- Important things are how to apply them correctly and how the methods developed.

Ned Guttman - include logic, critical thinking, problem identification and problem solving should be included in the communication skills.

Lesley-Ann Dupigny-Giroux - that this is broader than the track that most of us have followed and embraces new pedagogies such as service-learning. There are other ways of working through and helping students learn higher order thinking skills that are not always easily captured or defined. Please send suggested terminology.

David Stooksbury - asked the membership to send comments by 15 August. Mid September committee will send out final version for a vote. Further comments until end of September. Vote on 1 October. The final version will be submitted to EOS for broad outreach. Would like to present results in the Education symposium

Mark Shafer - concerned about only 3 hours of social dimensions. Extension programs include more. Should be on the level of 12 hours of courses. This would better prepare our students. May be better to put it out on our website for further comment (like AMS) before moving forward.

Dev Nyogi - suggests 2 subsets - one core essentials and the second would be relevant to where creating a new program. Would be helpful of 18-20 credit hours that could be added to the modules. Guidance to allow programs to create streams using these recommendations.

Ryan Boyles - as a matter of policy it is good to put it out for public comment. Makes us a professional society. Send to ClimList.

David Stooksbury - put the final version on the AASC website after 15 September. Lou said that we could figure out a comment section on the website.

Dave - AMS abstracts are due in a couple of weeks. Also suggested AAG which will meet in

February in NYC.

Motion to adjourn the business meeting at 0916 by Paul Knight and seconded by Renee McPherson. Unanimously accepted.

Other items for action from the annual membership meeting:

National Climate Assessment:
They are trying to get a coherent picture of what has been happening regionally from a physical climate perspective. Context for regional physical climatology outlooks by attention to climate and societal vulnerabilities and those aspects where trends have been occurring. What is the perception and how do these match the actual trends? - NCADAC decided that the outlooks will be based on the AR4 simulations - A2 emissions scenarios as the primary basis for high climate future B1 as low climate future. Direct GCM output from CMIP3 archive. Maurer et al monthly statistically downscaled data.

SC involvement:

- AASC funding in FY2010 for assessment work. $200K remains. Can support SC travel to regional planning meeting 2011 and perhaps beyond.
- Funds must get used and there be accounting of their use.
- Looking to AASC for additional ways to best contribute to assessment this year and ongoing.
- We need to be proactive in reaching out to all players involved. This is a fast track with lots of improvisation due to lack of resources and accelerated timeline.
- Tom Karl challenged AASC - what are the outcomes and measures of how to measure regional variability and then we could try to move this up the line in terms of what needs to be funded.

Dennis - Tom and Ken have left the door open to AASC on formulating on how to deal with impacts issue, and contributing to the NCA process. Mentioned the use of the climate impacts. Thinks this should be an ACTION ITEM for those interested in working on this to contact him.

TV weathercasters teaching Climate Change:
The debate about TV weathercaster's being the trusted purveyor of climate change information. We need to be a part of this discussion and re-claim climate. TV weathercasters are subject to the political whims of their station manager or network, and most aren't trained in climate.

AASC Current State Climatologists/Office Directors

State	State Climatologist/Office Director	ARSCO
Alabama	John Christy	Yes
Alaska	Gerd Wendler (Director), Peter Olsson (SC)	Yes
Arizona	Nancy Selover	Yes
Arkansas	Michael Borengasser	No
California	Michael Anderson	Yes
Colorado	Nolan Doesken	Yes
Connecticut	Xiusheng (Harrison) Yang	Yes
Delaware	Daniel Leathers	Yes
Florida	David Zierden	Yes
Georgia	Bill Murphey	No
Hawaii	Pao-Shin Chu	Yes
Idaho	Russell Qualls	Yes
Illinois	Jim Angel	Yes
Indiana	Dev Niyogi	Yes
Iowa	Harry Hillaker	Yes
Kansas	Mary Knapp	No
Kentucky	Stuart Foster	Yes
Louisiana	Barry Keim	Yes
Maine	George Jacobson	No
Maryland	Konstantin Vinnikov	No
Massachusetts	David Taylor	No
Michigan	Jeff Andresen	Yes
Minnesota	Greg Spoden	Yes
Mississippi	Michael Brown	Yes
Missouri	Patrick Guinan	Yes
Montana	vacant	No
Nebraska	Allen Dutcher	No
Nevada	Doug Boyle	Yes
New Hampshire	Mary Stampone	Yes
New Jersey	David Robinson	Yes
New Mexico	David DuBois	Yes
New York	Mark Wysocki	No
North Carolina	Ryan Boyles	Yes
North Dakota	Adnan Akyuz	Yes
Ohio	Jeffrey Rogers	No
Oklahoma	Renee McPherson	Yes
Oregon	Philip Mote	Yes
Pennsylvania	Paul Knight	Yes
Puerto Rico	Amos Winter	No

Rhode Island	vacant	No
South Carolina	Hope Mizzell	Yes
South Dakota	Dennis Todey	Yes
Tennessee	vacant	No
Texas	John Nielsen-Gammon	Yes
Utah	Robert Gillies	Yes
Vermont	Lesley-Ann Dupigny-Giroux	Yes
Virginia	Philip Stenger	Yes
Washington	Nicholas Bond	Yes
West Virginia	Kevin Law	No
Wisconsin	John Young	No
Wyoming	Tony Bergantino	Yes