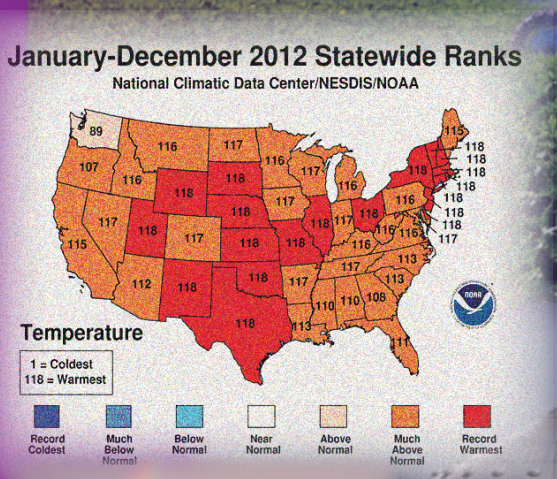
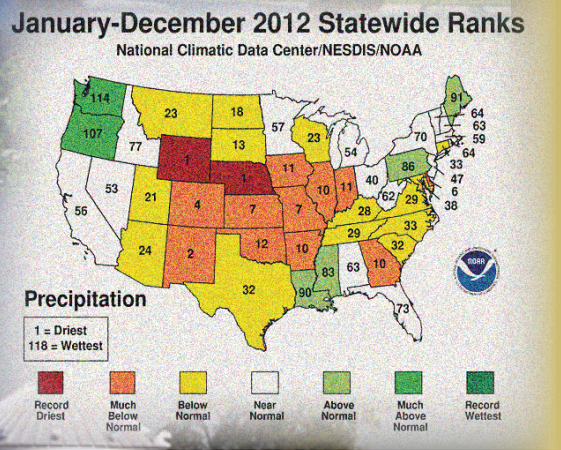
The State Climatologist

2012 Annual Summary

Volume 31, Issue 1

Compiled by the Indiana State Climate Office - iclimate.org
Purdue University





AASC
Recognized State Climate Office

38 Annual Meeting | July 8 - 11, 2013 | St. Louis, Missouri

THE STATE CLIMATOLOGIST

2012/13 Annual Summary

Volume 31, Issue 1

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

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Summer 2013

Dear Fellow Climatologists, Partners, and Friends of the AASC,

I am privileged to share the 2013 edition of The State Climatologist and look back on accomplishments of the AASC over the past year. This publication summarizes and highlights activities of state climate offices, regional climate centers, and our federal partners over the past year. The contributors are a dedicated group of professionals helping to ensure the collection and availability of reliable climate data, to disseminate insightful climate information, to further knowledge of climate from the local to the national scale, and to enhance the quality of decision making in matters related to climate.

Our climate is a valuable natural resource that contributes to the quality of life enjoyed by people in communities throughout the United States. But it is also an ever present threat. A look back at 2012 highlights the nature and extremes of our climate. Record warmth in spring across much of the contiguous United States preceded the emergence of extreme drought across much of the Midwest and Great Plains. Hurricane Sandy made landfall near Atlantic City, NJ and caused extensive damage and numerous fatalities across the Northeast. These and other extreme weather and climate events are highlighted in the report below and were the focus of applied research and service efforts by our members and partners.

Efforts of the AASC Executive Board have been focused in response to directives collectively provided by our members during the business meeting portion our 2012 Annual Meeting. A rebranding initiative has resulted in adoption of a new AASC logo and slogan by a majority vote of our members. An organizational review has been conducted by an external consultant. This review has further helped to guide a strategic planning process and development of a proposal that would create a permanent office and fund the position of executive director for the AASC. I look forward to presenting this proposal for consideration by our members at the upcoming 2013 Annual Meeting in St. Louis.

Over the past year, I have benefitted greatly from the wisdom and advice offered by many of you. Thank you! It is an honor to work on behalf of such an outstanding and dedicated group.

Sincerely,

President of the American Association of State Climatologists
State Climatologist for Kentucky

A word from this year's editors, the Indiana State Climate Office:

It is a pleasure to present *The State Climatologist*, Volume 31 Issue 1!

Production of *The State Climatologist*: *2012 Annual Summary* is an involved task and it has been a pleasure for us to interact with the different offices and complete this report. Reading through all the annual summaries while assembling the report (of which you all now have the pleasure of doing) has shown the new and exciting opportunities climate offices around the country have partaken in or plan to execute. The reports endorses the continued drive and passion fellow climatologists have towards the advancement, growth, and application of climate science for socioeconomic well being, while being stewards of robust climate information.

We thank all ARSCOs – AASC Recognized State Climate Offices for their cooperation in providing us with their annual reports in a timely manner. This allowed for detailed formatting and production of hard copies of *The State Climatologist: 2012 Annual Summary* available for review at the AASC 38th Annual Meeting in Saint Louis, Missouri July 8th-11th, 2013.

Cheers from the Indiana State Climate Office,

Dev Niyogi, Indiana State Climatologist
Ken Scheeringa, Associate State Climatologist
Olivia Kellner, Ph.D. Candidate and Climate Specialist
Matt Price, Undergraduate Student

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 48 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 employment of the state climatologist, representatives of federal climate agencies, retired state climatologists, or others interested in climate services. 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.

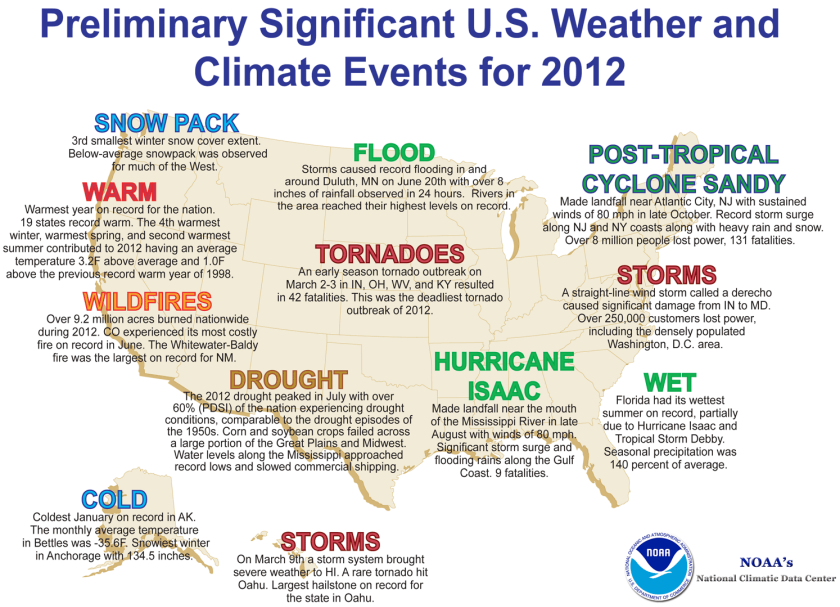
Candidate offices must demonstrate the following capabilities:

- 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.

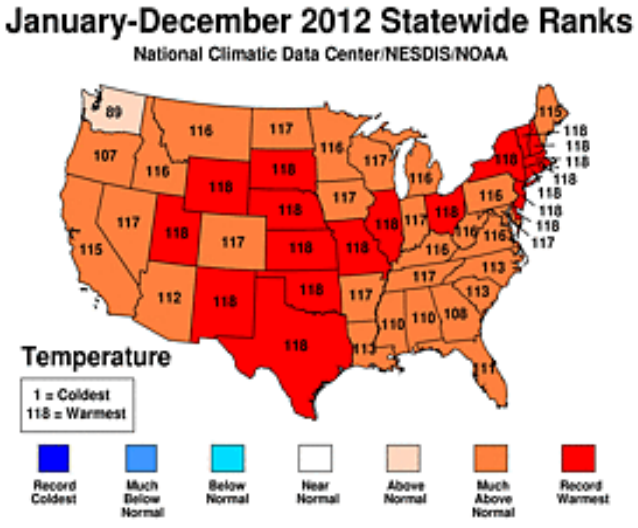
Upon receipt of the materials and approval of the AASC Executive Board, a Memorandum of Agreement (MOA) with the National Climatic Data Center shall be issued. Currently, 38 states have received ARSCO status.

National Overview - Annual 2012

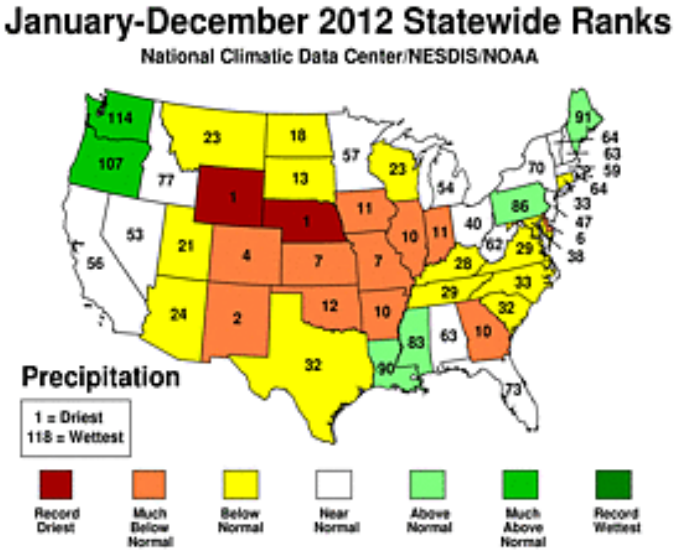
The following National Overview information for 2012 is reproduced from NCDC:
http://www.ncdc.noaa.gov/sotc/national/2012/13
NCDC point of contact: Derek Arndt, derek.arndt@noaa.gov



National Temperature and Precipitation Analysis



2012 National Temperature Rank Map



2012 National Precipitation Rank Map

Supplemental 2012 Temperature and Precipitation Information

- 2012 by the numbers
- Year-to-date temperature evolution for select U.S. cities
- Year-to-date temperature evolution for the contiguous U.S.
- Annual and seasonal statewide temperatures
- 2012 station temperature and precipitation extremes
- All-time station temperature records set in 2012
- Evolution of monthly temperature anomalies and evolution of 2012 drought conditions
- 100°F days during summer 2012
- Warmest 12-month periods for contiguous U.S.

In 2012, the contiguous United States (CONUS) average annual temperature of 55.3°F was 3.2°F above the 20thcentury average, and was the warmest year in the 1895-2012 period of record for the nation. The 2012 annual temperature was 1.0°F warmer than the previous record warm year of 1998. Since 1895, the CONUS has observed a long-term temperature increase of about 0.13°F per decade. Precipitation averaged across the CONUS in 2012 was 26.57 inches, which is 2.57 inches below the 20th century average. Precipitation totals in 2012 ranked as the 15th driest year on record. Over the 118-year period of record, precipitation across the CONUS has increased at a rate of about 0.16 inch per decade.

On a statewide and seasonal level, 2012 was a year of both temperature and precipitation extremes for the United States. Each state in the CONUS had annual temperatures which were above average. Nineteen states, stretching from Utah to Massachusetts, had annual

temperatures which were record warm. An additional 26 states had one of their 10 warmest years. Only Georgia (11th warmest year), Oregon (12th warmest), and Washington (30thwarmest) had annual temperatures that were not among the ten warmest in their respective period of records. A list of the annual temperatures for each of the lower-48 states is available here. Numerous cities and towns were also record warm during 2012 and a select list of those locations is available here. Each state in the CONUS, except Washington, had at least one location experience its warmest year on record. One notable warmest year record occurred in Central Park, in New York City, which has a period of record dating back 136 years.

Much of the CONUS was drier than average for the year. Below-average precipitation totals stretched from the Intermountain West, through the Great Plains, into the Midwest and Southeast. Nebraska and Wyoming were both record dry in 2012. Nebraska's annual precipitation total of 13.04 inches was 9.78 inches below average, and Wyoming's annual precipitation total of 8.08 inches was 5.09 inches below average. New Mexico, Colorado, Kansas, Missouri, Illinois, Arkansas, Georgia, and Delaware had a top ten dry year. The large area of dry conditions in 2012 resulted in a very large footprint of drought conditions, which peaked in July with about 61 percent of the CONUS in moderate-to-exceptional drought, according to the Palmer Drought Severity Index (PDSI). The footprint of drought during 2012 roughly equaled the drought of the 1950s which peaked at approximately 60 percent. Wetter-than-average conditions were present for the Northwest, where Washington had its fifth wettest year on record. Washington's statewide precipitation total of 47.24 inches was 10.40 inches above average. Wetter-than-average conditions were also present across parts of the Gulf Coast and Northeast.

Seasonal highlights in 2012 include the fourth warmest winter (December 2011-February 2012), with warmer-than-average conditions across a large portion of the country. The largest temperature departures from average were across the Northern Plains, Midwest, Mid-Atlantic, and Northeast. Winter was drier than average for the East and West coasts, while the Southern Plains were wetter than average improving drought conditions across New Mexico, Oklahoma, and Texas. The warmer and drier than average conditions resulted in the third smallest winter snow cover extent on record for the contiguous United States. Spring (March-May) was record warm for the country, with 34 states being record warm for the period. The season consisted of the warmest March, fourth warmest April, and second warmest May on record. Spring precipitation was near-average for the lower-48, with the Pacific Northwest and Upper Midwest being wetter than average, while the Central Rockies and Ohio Valley were drier than average. The summer (June-August) continued the warmer-than-average trend for the contiguous U.S. with national temperatures ranking as the second warmest on record. The summer average temperature for 2012 was very close to the warmest summer (2011) and the third warmest summer (1936), with only 0.1°F separating the three. The summer season consisted of the eighth warmest June, record warmest July, and 13thwarmest August. Drier-than-average conditions were anchored in the central U.S. with record breaking wildfires and a drought footprint comparable to the drought episodes of the 1950s causing large-scale agriculture problems in the Midwest, Plains, and Mountain West. Autumn (September-November) temperatures were closer to average

compared to the preceding three seasons, but still ranked as the 22nd warmest autumn on record. Warmer-than-average conditions were present for the West, while cooler-than-average conditions were present for the Eastern Seaboard. Precipitation totals for the nation averaged as the 22nd driest autumn on record.

This annual report places the temperature and precipitation averages into historical perspective, while summarizing the notable events that occurred in 2012. More detailed analysis on individual months can be found through the Climate Monitoring home page.

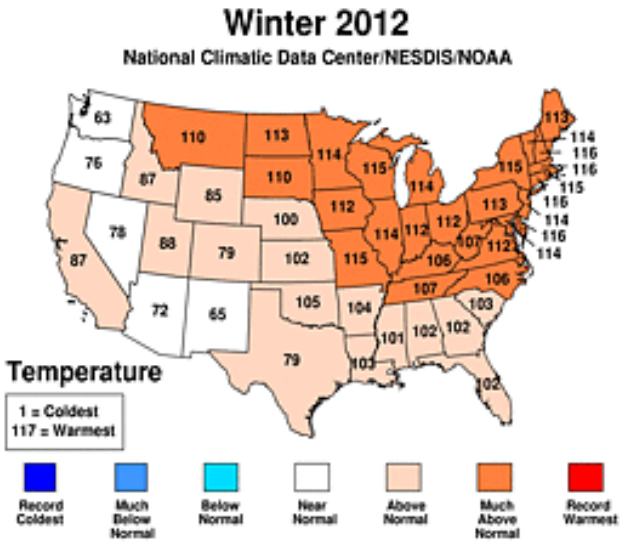
Top Ten U.S. Weather/Climate Events for 2012

Selected by a panel of weather/climate experts from around the country:

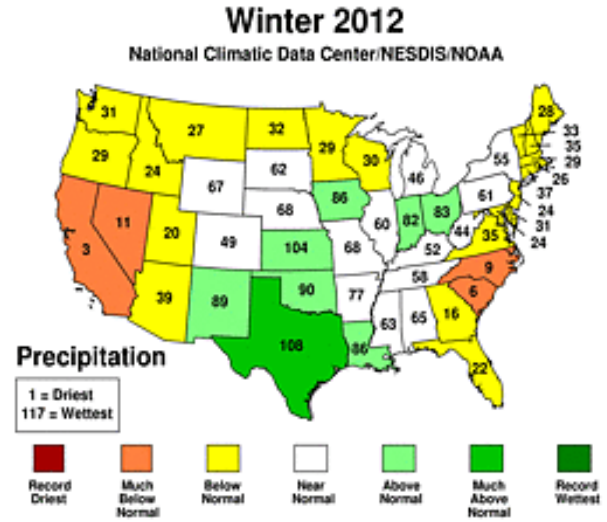
Rank	Event
1	Hurricane/Post-Tropical Storm Sandy
2	Contiguous U.S. Drought
3	Contiguous U.S. Warmest Year on Record
4	Record Wildfire Activity
5	Multi-State Derecho
6	March 2nd-3rd Severe Weather Outbreak
7	Alaska Cold Winter/Snow Records
8	Near-Record Low Great Lakes Levels
9	Contiguous U.S. Snow Cover
10	Hurricane Isaac

Seasonal Analysis 2012

Winter



Winter 2011/2012 Statewide Temperature Rank Map

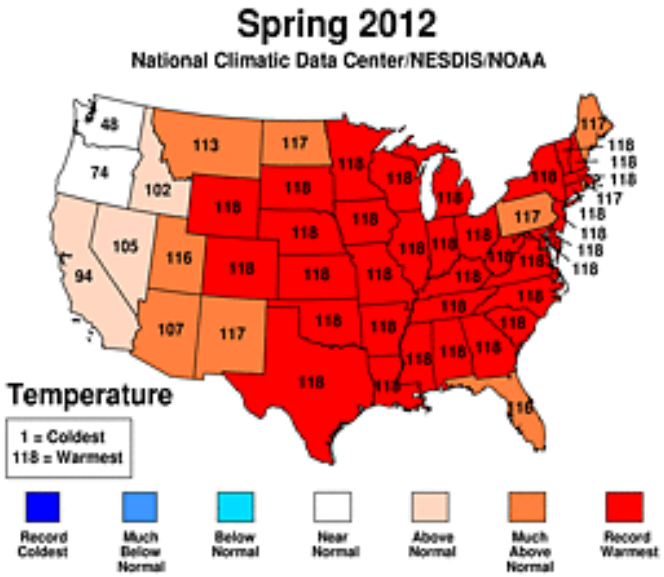


Winter 2011/2012 Statewide Precipitation Rank Map

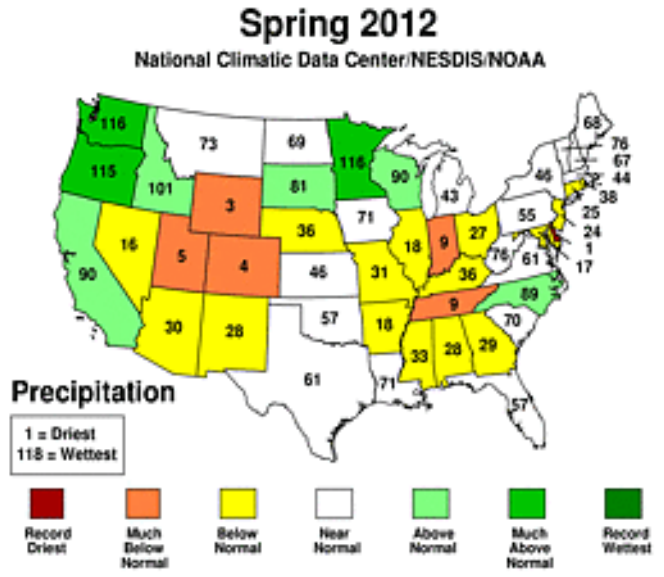
The 2011/12 winter season was marked by above-average temperatures for a large portion of the nation, stretching from the Rockies, through the Plains, and along the East Coast. The Northern Plains, Midwest, and Northeast had the largest temperature departures from average for the season. The CONUS had an average winter temperature of 36.4°F, which was 3.8°F above the 20th century average and was the fourth warmest winter on record. In total, 22 states had December-February temperatures ranking among their ten warmest and four states in the West had winter temperatures which were near-normal. This winter season contrasted with the previous two winters for the CONUS (2009/10 and 2010/11) which ranked as the 14th and 34th coldest winter seasons, respectively. The 2009/10 and 2010/11 winters were marked by record and near-record negative phases of the North Atlantic (NAO) and Arctic (AO) oscillations, which were associated with frequent and long-lasting cold-air outbreaks. The 2011/12 winter had the opposite configuration of the NAO and AO. The NAO averaged for December 2011 was +2.52, the largest positive phase of the index for a month on record. When the NAO and AO are in a positive phase during the winter, the jet stream, which divides cold Arctic air to the north and warm sub-tropical air to the south, tends to remain north of the U.S.-Canadian border. This was the case for the 2011/12 winter which was marked by few and short-lived cold air outbreaks in the CONUS.

The presence of La Niña during the winter had a minimal influence on precipitation patterns during the season. The 3-month average CONUS precipitation of 5.77 inches was 0.70 inch below average. The western U.S. was drier than average, where California had its third driest winter on record, with a statewide precipitation total of 4.09 inches, 7.82 inches below average. Drier-than-average conditions stretched across the Northern Plains into theUpper Midwest. Much of the Eastern Seaboard was also drier than average, where North Carolina had its ninth driest winter and South Carolina its sixth driest. The warm and dry conditions during winter limited snow across a large portion of the country, and the CONUS had its third smallest seasonal snow cover since satellite records began 46 years ago. Many of the major cities in the Northeast and Midwest had record and near-record low seasonal snowfall. Wetter-than-average conditions occurred in the Southern Plains, where Texas had its tenth wettest winter with a precipitation total of 7.63 inches, 2.50 inches above average. The above-average winter precipitation in Texas helped to improve drought conditions which plagued the state during much of 2011. Above-average precipitation was also present for parts of Ohio Valley. The drier-than-average conditions observed along the East Coast and wetter-than-average conditions in the Ohio Valley are consistent with La Niña, but the winter wetness in the Southern Plains is more typical of an El Niño, not a La Niña.

Spring



Spring 2012 Statewide Temperature Rank Map

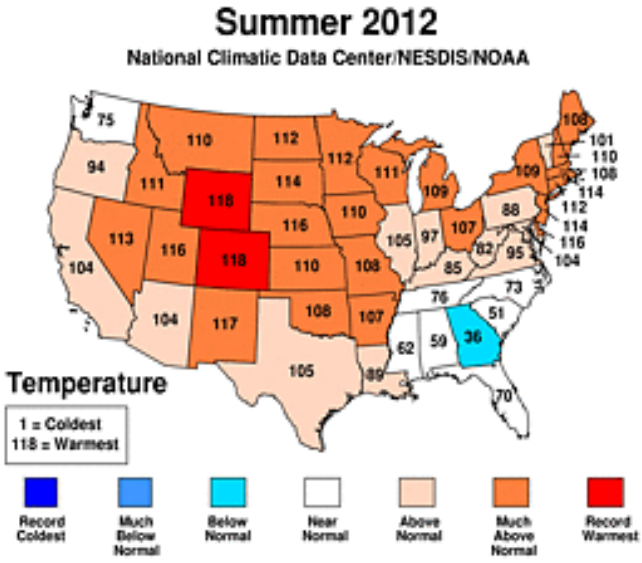


Spring 2012 Statewide Precipitation Rank Map

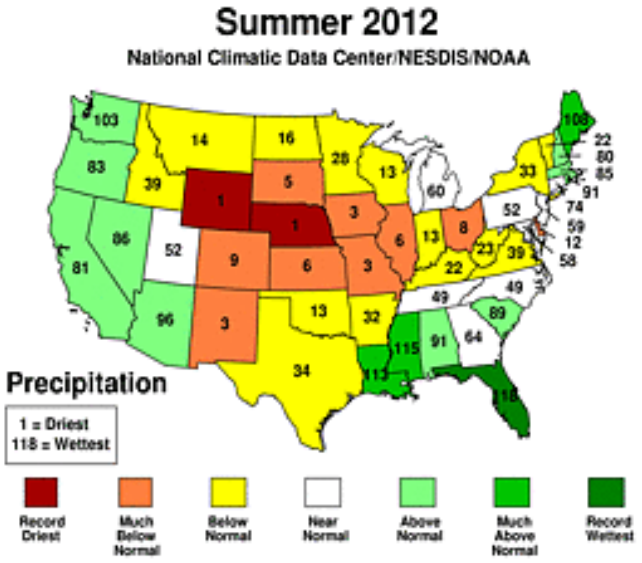
The spring (March-May) of 2012 was marked by record warmth over a large portion of the country. The CONUS average temperature for the season was 56.1°F, 5.2°F above the 20th century average, and the warmest spring on record, by 2.0°F. The previous record warm spring occurred in 1910 with a seasonally averaged temperature of 54.1°F. Spring 2012 also marked the largest warm temperature departure from average for any season on record for the CONUS. All three months of the season ranked among their five warmest, also a first for the nation. The March average temperature was 8.6°F above average and the record warmest March, April was 3.6°F above average and the fourth warmest April, and May was 3.5°F above average, the second warmest May on record. Thirty-four states were record warm for spring, all east of the Rockies, while an additional eight states were top ten warm. The U.S. Climate Extremes Index (USCEI) was record large for the season, driven mostly by the large footprint in extremely warm daytime and warm nighttime temperatures. Numerous states, mostly across the Midwest, had spring temperatures more than 7.0°F above average. Only Oregon and Washington had seasonal temperatures near normal.

The spring CONUS precipitation total of 7.32 inches was 0.39 inch below average and ranked near the median value. The near-average CONUS precipitation total masked regional extremes on both the wet and dry ends of the spectrum. The Pacific Northwest was bombarded by numerous storms during the spring season, resulting in Oregon and Washington having seasonal precipitation totals among their ten wettest. The active storm pattern resulted in above-average snowpack for the Cascades of Oregon and Washington, with near-normal snowpack stretching eastward through the northern Rockies of Idaho, Montana, and northern Wyoming. The Upper Midwest was also wetter than average, where Minnesota had its third wettest spring. Below-average precipitation totals were centered in the central Rockies and the Ohio Valley. Colorado, Utah, and Wyoming each had a top ten dry spring season, where below-average snowpack resulted. In the Ohio Valley, Indiana and Tennessee both had a top ten dry spring. The below-average precipitation in the Midwest was accompanied by below-average tornado activity, despite a few deadly tornado outbreaks. The warm and dry spring, in combination with other factors, played precursor to the large expansion of drought which impacted the nation during the summer of 2012.

Summer



Summer 2012 Statewide Temperature Rank Map

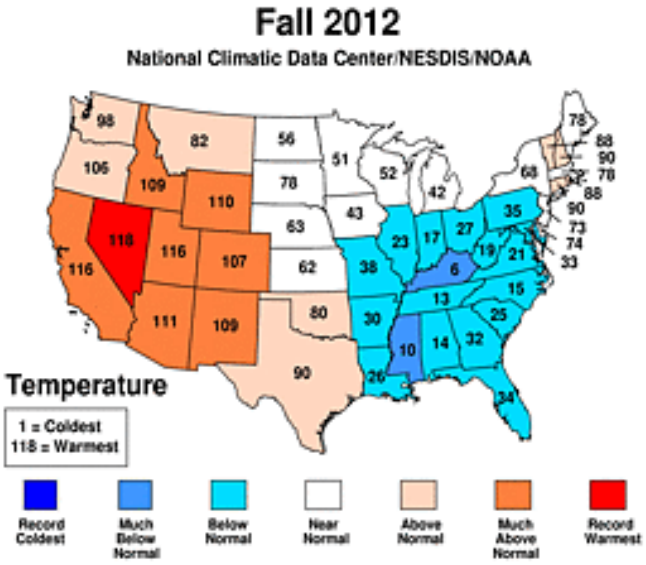


Summer 2012 Statewide Precipitation Rank Map

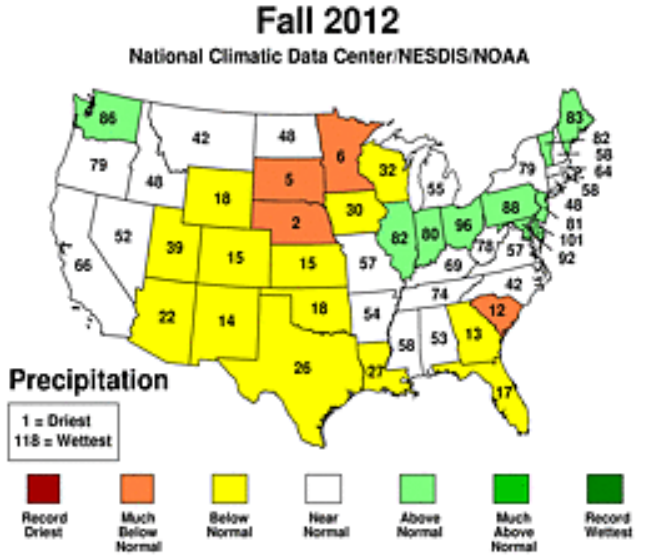
The summer (June-August) of 2012 brought a continuation of warmer-than-average conditions for a large area of the CONUS. The summer's average temperature for the CONUS was 73.8°F, 2.6°F above the 20th century average and the second warmest summer on record. Only the summer of 2011 was warmer. Above-average temperatures were present for the Rockies, Great Plains, Midwest, Northeast, and much of the West, with the exception of Washington State. The Southeast had near-normal summer temperatures.
Colorado and Wyoming each had their warmest summer on record, with 3-month average temperatures 4.9°F and 4.6°F above average, respectively. Twenty-one additional states had summer temperatures among their ten warmest. During the summer, at least 357 all-time hot daytime temperature records were broken, including a new all-time state record for South Carolina (113.0°F). During the summer period, approximately 99.1 million Americans experienced at least 10 days with daytime temperatures exceeding 100.0°F — nearly one third of the country's population. In addition to the warm summer, the period from August 2011 through July 2012 was the warmest consecutive 12 months that the nation has observed.

In addition to the summer being hot for a large part of the country, it was also dry, resulting in a drought footprint comparable to the drought episodes of the 1950s. The drought peaked in July, when according to the Palmer Drought Severity Index (PDSI), the spatial area of the CONUS in at least moderate drought was 61.8 percent. The summer CONUS precipitation total of 7.22 inches was 1.03 inches below average and the 14th driest summer on record. The epicenter of the drought stretched from the Rockies through the Great Plains and into the Midwest. Wyoming and Nebraska had their driest summer on record with precipitation totals 44 percent and 39 percent of average, respectively. Six additional states had summer precipitation totals among their ten driest. The hot and dry conditions also caused significant wildfire activity across the nation. The 7.0 million acres which burned during the three summer months was the second most in the 13-year record, slightly behind the summer of 2005. The West Coast was slightly wetter than average during the summer, where an active storm pattern in the Northwest, and an active monsoonal flow in the Southwest kept conditions wet. The Gulf Coast was wetter than average, with Florida having its wettest summer on record with a seasonal precipitation total 140 percent of average. The summer wetness along the Gulf Coast was partially attributable to Hurricane Isaac in August and Tropical Storm Debby in June. The Northeast was also wetter than average.

Fall



Fall 2012 Statewide
Temperature Rank Map

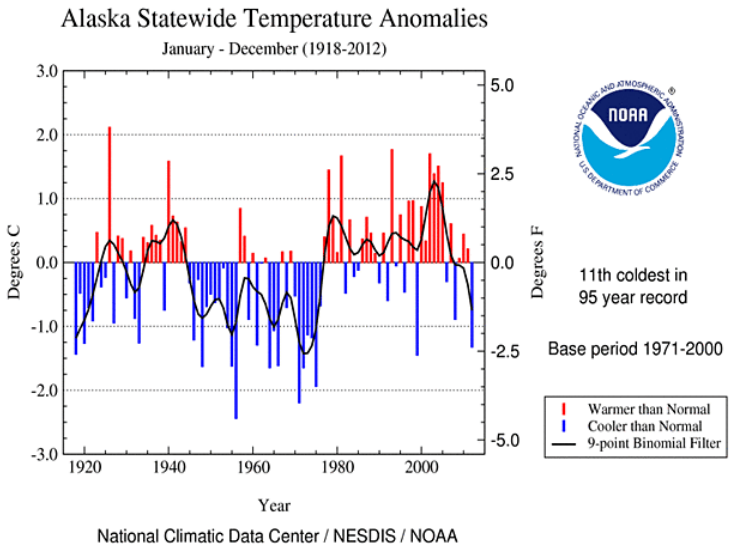


Fall 2012 Statewide
Precipitation Rank Map

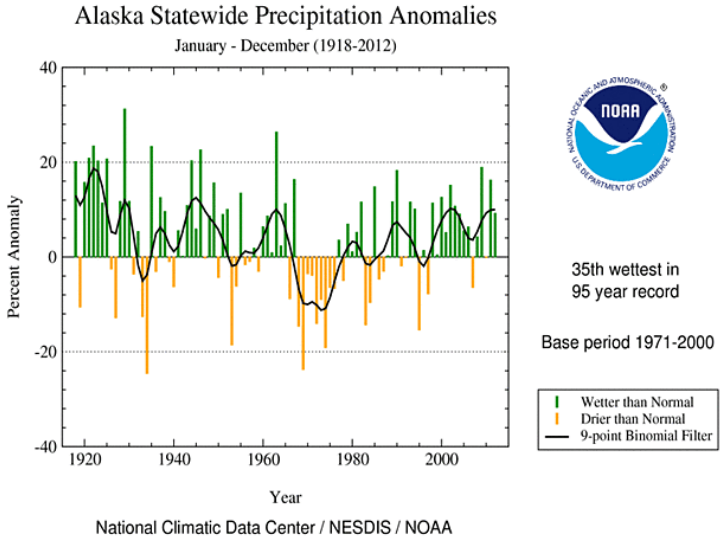
The CONUS average temperature for autumn (September-November) was 54.7°F which was 1.1°F above average. During the season, cooler-than-average conditions were present from the Midwest and Mid-Atlantic into the Southeast and Gulf Coast. Kentucky had its sixth coolest autumn with seasonal temperatures 2.5°F below average, and Mississippi had its 10th coolest with temperatures 2.2°F below average. The cool temperatures in the East were counterbalanced by warmth in the West. Arizona, California, Idaho, New Mexico, Utah, and Wyoming each had a top ten warm season. Nevada had its warmest autumn on record with a statewide average temperature of 53.8°F which was 3.7°F above average. Despite the seasonal temperature being above average, the October CONUS temperature was 0.3°F below average, ending a 16-month streak of above-average temperatures for the lower 48 that began in June 2011. The 16 consecutive months of above-average temperatures for the CONUS was the longest such streak on record.

The autumn precipitation for the lower-48 was 1.00 inch below average at 5.71 inches. Drier-than-average conditions persisted for the central parts of the country, where Minnesota, Nebraska, and South Dakota each had a top ten dry season. Dry conditions were also present for the Southeast coast, Southern Plains, the Southwest, and Central Rockies. The dryness during autumn, combined with the drier than average conditions during much of 2012, were associated with the western Great Lakes approaching record low water levels. The drought also hit the Lower Mississippi River hard, where near-record low water levels drastically slowed commercial shipping. Washington State, as well as parts of the Midwest, Mid-Atlantic, and Northeast, were wetter than average. Post-tropical cyclone Sandy, which slammed into the New Jersey coast in late October, brought heavy rains to the Northeast and heavy snowfall to the Central Appalachians.

Alaska Annual Summary



[Jan-Dec 2012 Alaska Temperature Time Series]



[Jan-Dec 2012 Alaska Precipitation Time Series]

Alaska temperatures in 2012 were below the 1971-2000 average. The annual temperature for Alaska was 2.3°F below average, which ranked as the 11th coolest year on record for the state. Alaska had its coldest January on record with a statewide temperature 14.0°F below average and statewide temperatures remained cooler than average for much of the rest of 2012. Winter temperatures (December 2011-February 2012) were 1.4°F below the 1971-2000 average, spring temperatures were 2.7°F below average, summer temperatures were 0.7°F below average, and autumn temperatures were 1.1°F below average.

Precipitation across Alaska in 2012 was 9.2 percent above average and the 35th wettest year on record for the state. Alaska had its 12th wettest winter on record with a statewide precipitation total 42.6 percent above average. Several winter storms impacted the state over the course of the season and numerous locations broke seasonal snowfall records, including Anchorage with 134.5 inches. Spring precipitation was 10.5 percent above average, summer precipitation was 19.3 percent above average, and autumn precipitation was 11.6 percent above average. During the autumn season, several large storms hit the state bringing heavy rain to the southern coasts and snowfall to the high elevations. September was the fifth wettest such month on record, with a statewide precipitation total 48.1 percent above average.

Very Warm/Cold and Wet/Dry Percentages

United States Percentage Area

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". The “very warm” categories translate to the “much above average” while the “very cold” categories translate to the “much below average” in terms of the NCDC ranking methods. This is similar for the “very wet” and “very dry” categories and the NCDC ranking methods of precipitation totals.

During 2012, the U.S. experienced its fourth warmest winter, a record warm spring, second warmest summer, and a warmer-than-average autumn. The warmer-than-average seasons resulted in large percentages of the country ranking as "very warm" and very small percentages ranking as "very cold" for most of the months during 2012. The table below shows the percent area of the nation "very warm" and "very cold" for each month of 2012 as well as the annual averaged values.

Month	Percentage Area of CONUS "Very Warm"	Percentage Area of CONUS "Very Cold"
January	28.8	0.0
February	12.9	0.0
March	75.4	0.4
April	43.2	0.0
May	48.6	0.0
June	28.7	2.6
July	60.4	0.0
August	28.9	1.1
September	14.6	0.1
October	1.2	3.1
November	26.6	3.6
December	20.0	0.3
2012	32.5	0.9

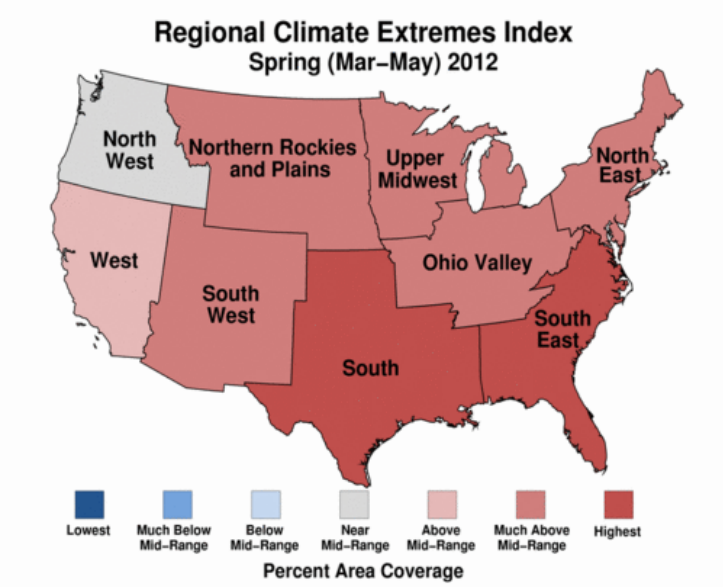
During 2012, large portions of the nation were drier than average, but areas of the country were also wetter than average. Each season had CONUS precipitation totals below average. The table below shows the percent area of the nation "very wet" and "very dry" for each month of 2012 as well as the annual averaged values.

Month	Percentage Area of CONUS "Very Wet"	Percentage of CONUS "Very Dry"
January	2.3	8.2
February	6.6	8.4
March	16.4	10.6
April	4.1	10.2
May	6.1	20.0
June	6.6	33.1
July	8.3	12.2
August	6.4	21.4
September	5.4	24.8
October	9.7	4.5
November	2.1	36.2
December	9.9	2.7
2012	7.0	16.0

Climate Extremes Index

U.S. Climate Extreme Index

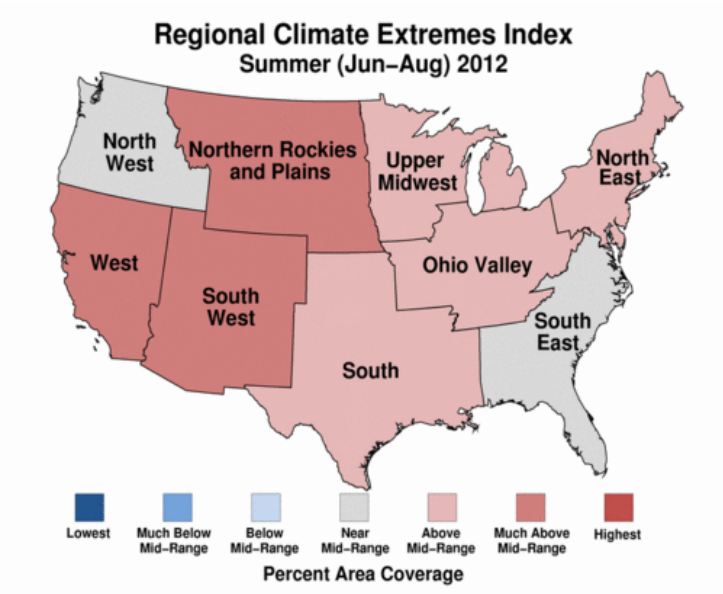
The U.S. Climate Extremes Index (USCEI) measures the occurrence of several types of climate extremes, such as record or near-record warmth, dry spells or rainy periods. In 2012, extremes in warm temperatures as well as extensive drought conditions persisted across the country. Drought conditions overwhelmed much of the central portion of the contiguous U.S. (CONUS) and grew as large as areas of drought from the 1950s during the summer months of 2012. Record to near-record heat beginning in March led to the warmest year on record for the CONUS. The spatial extent of extremes, as measured by the USCEI, during the calendar year was 19 percent greater than the historical average and the second largest extent in combined extremes on record (since 1910). This record extent of extremes was primarily the result of extremes in warm maximum and minimum temperatures as well as large areas of dryness, as denoted by the Palmer Drought Severity Index (PDSI). Regions that experienced some of the most wide-spread extremes during 2012 include the Southwest, Northern Rockies and Plains, Upper Midwest, South, Ohio Valley and the Northeast. During 2012, the most prominent and wide-spread extremes occurred during: spring and summer.



Regional CEI values for spring 2012

At the national level, nearly half of the U.S. experienced a combination of extremes in the spring, primarily resulting from exceptionally warm maximum and minimum temperatures and drought conditions. March temperatures across the Upper Mississippi Valley, Great Lakes and into the Northeast were comparable to average May temperatures and were more than 10°F warmer than average. Drought conditions began to expand across much of the central Great Plains as warm temperatures conspired with low spring rainfall and a relatively snow-free winter, to leave soils parched.

For the CONUS, the spatial extent of the CEI was approximately 25 percent greater than the historical average during spring, a record extent for the season. Factors contributing to this record spring value were large footprints of warm maximum and warm minimum temperatures as well as areas of extreme PDSI dryness. Warm extremes blanketed the eastern three-quarters of the CONUS with all or nearly all of the Upper Midwest, Northeast, Ohio Valley, Southeast and South regions experiencing extremes in both maximum and minimum temperatures. In fact, the South and the Southeast regions had their largest extent of combined extremes on record with 52 percent and 53 percent of each region affected during this season, respectively.

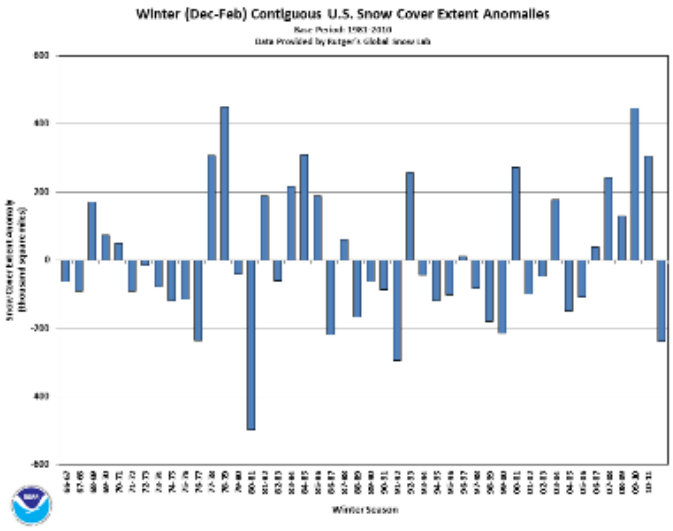


Regional CEI values for summer 2012

The summer season was second warmest on record for the CONUS with above average temperatures extending from the Southwest though the Rocky Mountain and High Plains states and into the Great Lakes region. Precipitation received from Hurricane Isaac in August helped mitigate drought conditions across portions of Arkansas, Missouri and into parts of southern Illinois. The CEI for the contiguous U.S. was approximately 12 percent greater than the historical average during summer. This above-average extent was due primarily to record extent of extremes in warm maximum temperature, nearly four times the average extent of warm minimum temperatures, and more than a third of the country experiencing extremes in PDSI dryness.

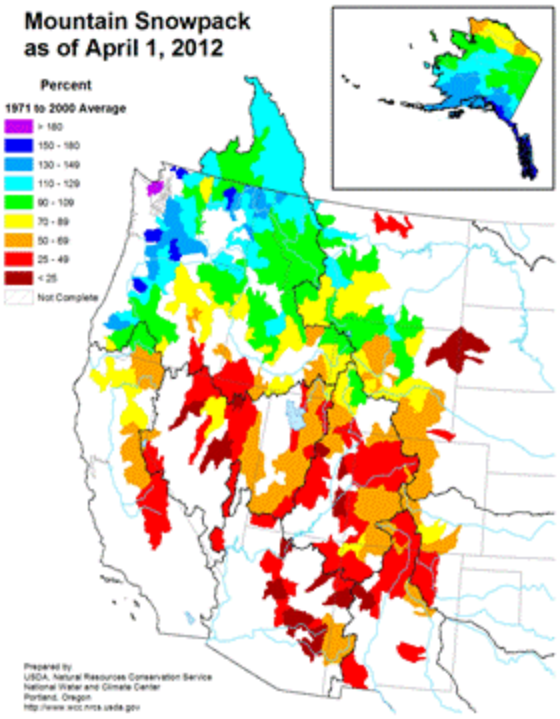
National Snow & Ice

The 2011/12 winter season was nearly non-existent for much of the eastern half of the nation. The December 2011-February 2012 three-month period was marked by near-record warmth across the U.S.-Canadian border, the Midwest, Mid-Atlantic, and Northeast, limiting seasonal snowfall across those regions. Many locations had near-record low snowfall totals for the winter season. Early spring brought much of the same, when the contiguous U.S. had its warmest March on record, with a monthly temperature 8.6°F above average. The lack of snowfall and snowpack for the winter and spring across the Rockies, Great Plains, and Midwest was a precursor to the large drought episode that impacted two-thirds of the nation during the summer and autumn of 2012. In contrast to the rest of the nation, the Pacific Northwest was closer to average during winter in terms of temperature and precipitation, with several winter storms bringing heavy snowfall to the high elevations. The early-spring was wetter and cooler than average for the Northwest, contributing to above-average snowfall for many locations in the region.



Contiguous U.S. Winter Snow Cover Extent Anomalies
Data Source: Rutgers Global Snow Lab

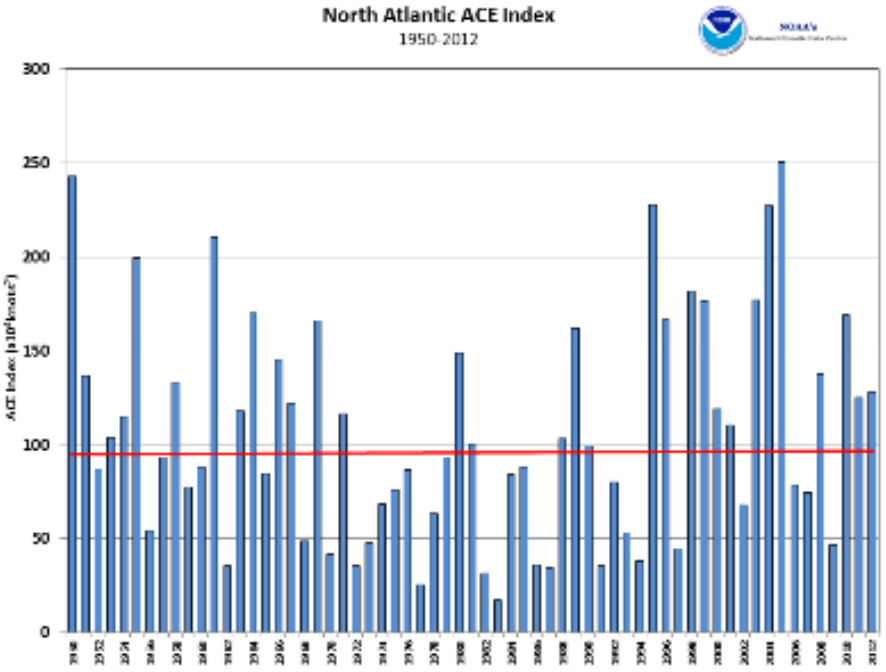
According to data from the Rutgers Global Snow Lab, both the winter and spring seasons brought below-average snow cover to the contiguous United States. The satellite-derived snow cover extent for December 2011-February 2012 was approximately 237,000 square miles below the 1981-2010 average — the third smallest winter snow cover footprint in the 46-year satellite record. This was the first winter since 2005-2006 with below-average snow cover for the country. Only the winter seasons of 1991/92 and 1980/81 had smaller snow cover extents. The March-May spring snow cover extent was 151,000 square miles below the 1981-2010 average — the third smallest spring snow cover extent on record. The springs of 1968 and 2000 had smaller seasonal snow cover footprints.



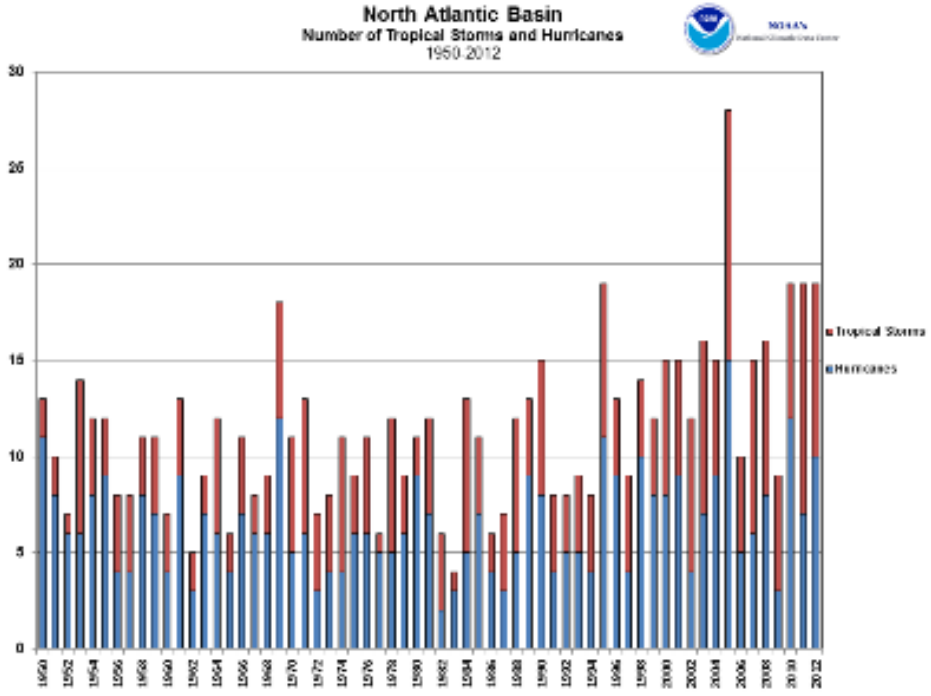
Western U.S. Snowpack
April 1, 2012
Source: USDA

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 highly dependent on 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. According to data from the USDA, on April 1st, 2012, above-normal snowpack was observed through the Cascades of Oregon and Washington, with near-normal snowpack stretching eastward through the northern Rockies of Idaho, Montana, and northern Wyoming. To the south, below and much-below snowpack was observed for the Sierra Nevada Mountains, the Great Basin, and the Central and Southern Rockies. Snowpack totals less than 50 percent of normal were widespread in California, Nevada, Utah, Colorado, Arizona, and New Mexico. In Alaska, snowpack totals were above normal for the Southern coasts and peninsula, and below-normal across the North Slope.

Hurricanes & Tropical Storms



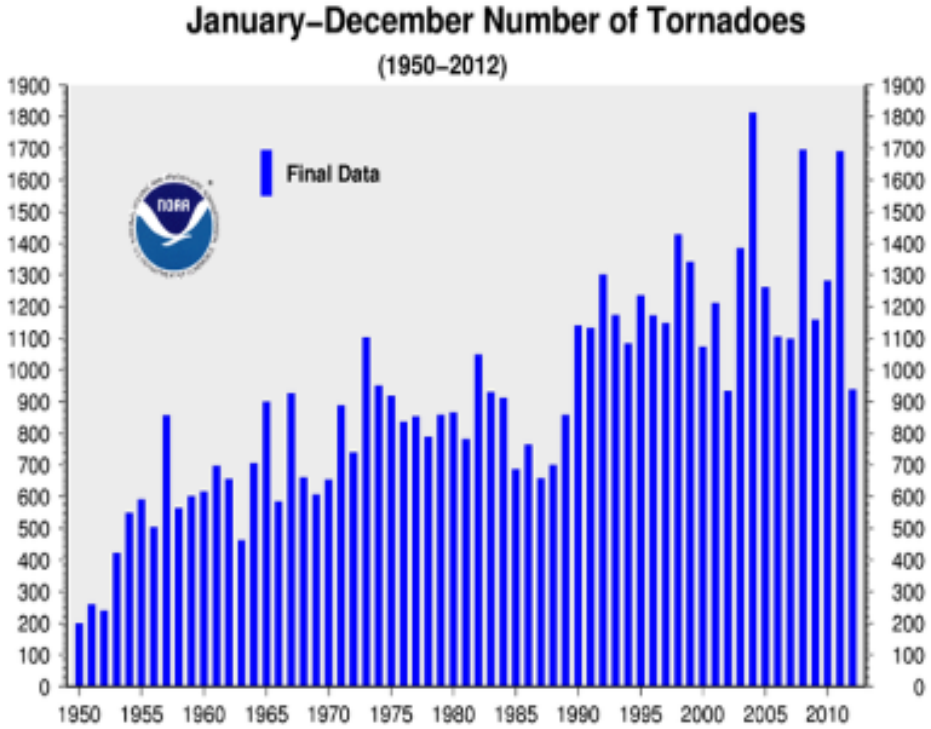
2012 Atlantic Tropical Cyclone ACE



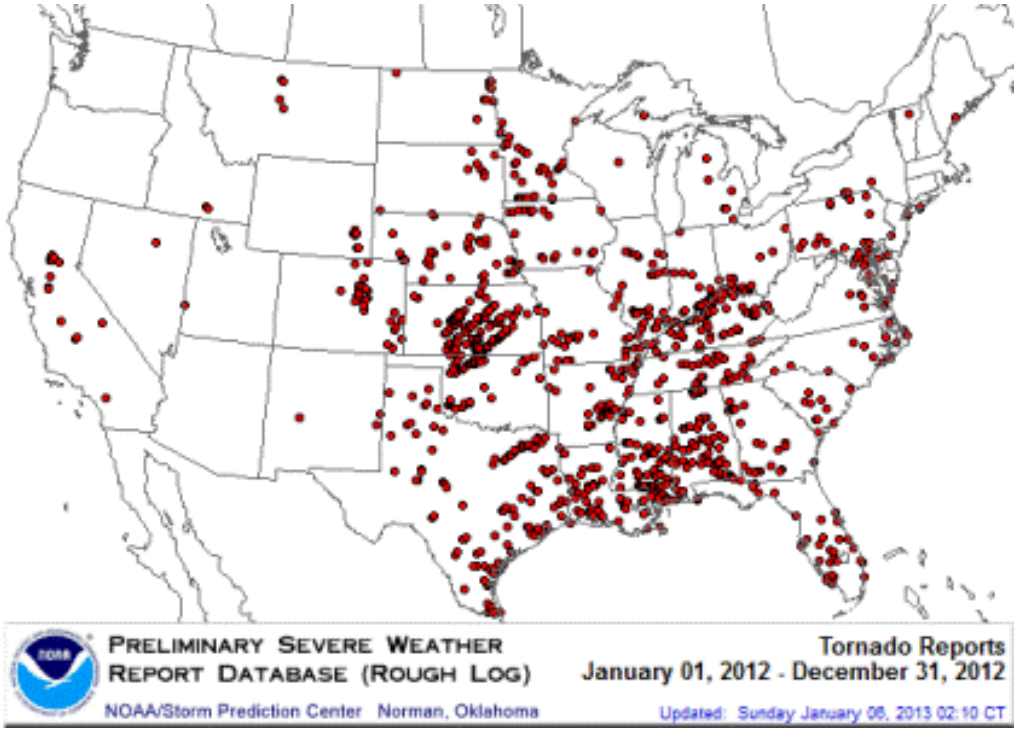
North Atlantic Tropical Cyclone Count 1950-2012

The 2012 North Atlantic hurricane season had 19 named storms, ten hurricanes, and one major hurricane. The number of named storms marked the third consecutive hurricane season with 19 named storms for the basin and tied with 2011, 2010, 1995, and 1887 as the third busiest year for North Atlantic tropical cyclones. An average season has 11 named storms, six hurricanes, and two major hurricanes (Category 3 strength or stronger). The number of named storms and storms that reached hurricane strength was above average, while the number of major hurricanes was below average. The 2012 season marked the lowest number of major hurricanes in the basin since 1997, which also had only one. There were no Category 4 or 5 storms during the season, only the third time this has occurred since 1995. Hurricane Michael, the only Category 3 hurricane of the season, retained major hurricane strength for 6 hours. One hurricane (Isaac), two tropical storms (Beryl and Debby), and one post-tropical storm with hurricane force winds (Sandy) made landfall during the season. No major hurricanes struck the U.S. coast, marking the seventh consecutive year without a major hurricane strike.

Tornadoes



Annual Tornado Counts
1950-2012



2012 Tornado Occurrences
Source: SPC

On the heels of one of the most destructive tornado years on record for the country (2011), tornado activity during 2012 was below average. During 2012, there were 878 confirmed tornadoes during January–October, with 58 tornado reports still pending for November and December according to data form the Storm Prediction Center. The 1991-2010 annual tornado average is 1,253 and 2012 marks the slowest tornado year since 2002 when there were 934 tornadoes. If the confirmed tornado count is below 935, depending on the confirmation rate of the end-of-year tornadoes, 2012 could be the slowest tornado year since 1989 which had 856 tornadoes. Despite the slower-than-average year for tornadoes, there were still several large, destructive, and deadly tornado outbreaks during the year. Three tornado outbreaks caused at least one billion dollars in damage and there were 68 tornado-related fatalities.

The last tornado-related fatality in the U.S. occurred on June 24th, so December 31st was the 190th consecutive day without a tornado-related fatality. According to analysis by the Storm Prediction Center, the longest consecutive day stretch with no tornado fatalities in the 1950-present official record was 197 days between August 15th 1986 and February 28th 1987. Longer periods without tornado fatalities have occurred prior to 1950, but inconsistent observing practices make comparisons to current data difficult.

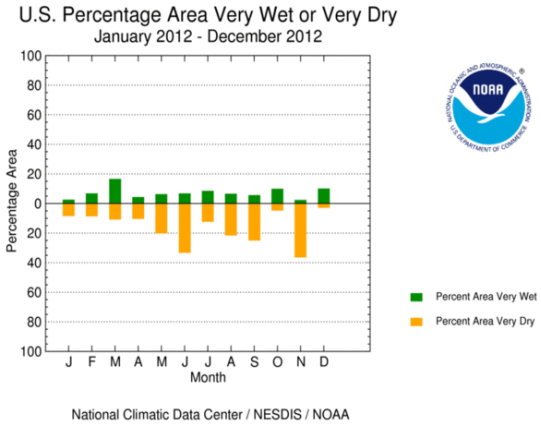
The 2012 tornado year started off above average, with above-average tornado activity for each month between January and April. The lack of storm systems during the late spring and summer across the Great Plains was associated with a lack of tornadoes. May and June,

which are typically the most active months of the year, both had less than 50 percent of average number of tornadoes confirmed. The below-average tornado activity continued through November. The most active regions of the country during 2012 were the Central Plains, the Gulf Coast, and the Ohio Valley. An active storm pattern during December along the Gulf Coast caused the monthly tornado count to be above average, according to preliminary data. The tornadoes that did form during 2012 tended to be weak to moderate strength in nature. There were only four EF-4 tornadoes, the least since 2009, with no confirmed EF-5 tornadoes during the year.

Drought - Annual 2012

The data presented in this drought report are preliminary. Ranks, anomalies, and percent areas may change as more complete data are received and processed.

National Drought Overview



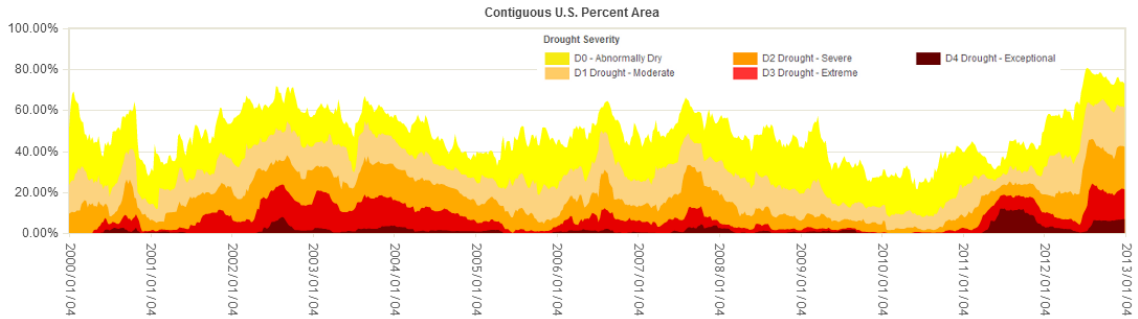
On a month-by-month basis, 2012 was characterized by large areas of dry and, earlier in the year, large areas of wet weather. Eight months (all except January, February, October, and December) had ten percent or more of the country experiencing very dry (at the tenth percentile of the historical record or drier) precipitation anomalies, with five months (May, June, August, September, and November) having more than a fifth (20 percent) of the country very dry. June and November had a third of the country very dry. The percent area very wet (monthly precipitation totals at the 90th percentile of the historical record or wetter) stayed under ten percent for all but one of the months in the year, with March having the largest percent area very wet (16%). When averaged together, the wet and dry anomalies resulted in the 20th driest February, 23rd driest May, 10th driest June, 22nd driest July, and 8th driest November, nationally, in the 1895-2012 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 every month except October. More than a fourth (25%) was very warm during eight months, with July (60%) and March (75%) having more than half of the country very warm. This persistent and anomalous heat resulted in the warmest month ever (July 2012), ranked 2012 as the warmest year on record, and (especially during the growing season) increased evaporation and intensified local drought conditions.

An important feature of the weather conditions in 2012 was the persistence of the areas of dryness and warm temperatures, the magnitude of the extremes, and the large area they encompassed. Dry weather affected parts of the West almost every month, especially the Intermountain Basin during April-July, the Southwest during April-June and October-November, and the Rockies during March-November. The Central Great Plains were plagued by dryness much of the year (especially March-November), with dryness especially acute

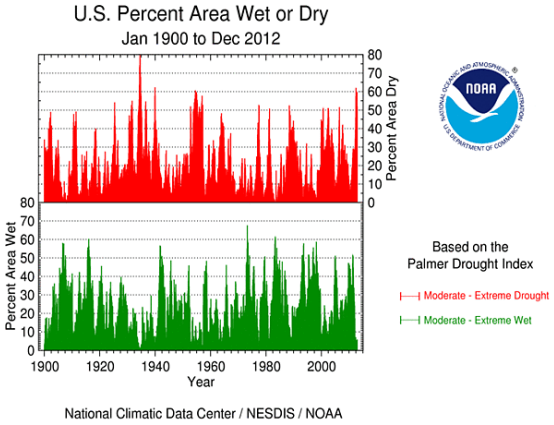
during the summer across the Plains (June-August). Dry weather dominated across the Central Plains to Midwest agricultural areas during the critical May-July growing season, but the dryness lasted longer in parts of this region (for example, the Midwest during February-July). August-September saw very dry weather from the Pacific Northwest, across the Northern Rockies and Central to Northern Plains, and into the western Great Lakes. Dry weather afflicted the eastern U.S. early in the year, with the Southeast dry during January-April and the Northeast during February-April. Large areas of the country were very dry during May-June (from the West Coast to the Ohio and Tennessee valleys), August-September (from the Pacific Northwest to the western Great Lakes), and November (from the Southwest and Southern Plains to the Northeast and Southeast).

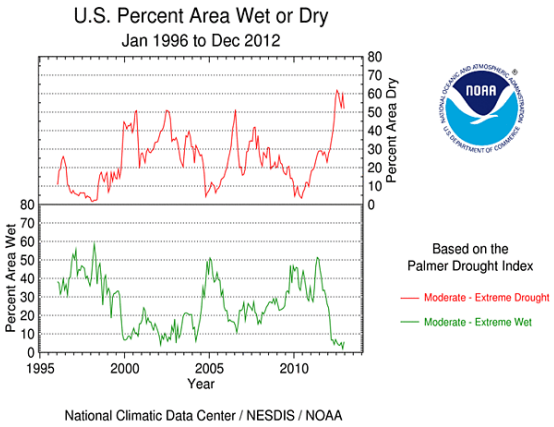
The hot temperatures exacerbated the impact of the dry weather. When maps of the dryness (Standardized Precipitation Index [SPI]) are compared to maps of the Palmer Z Index (which incorporates the effects of both dryness and heat), larger areas of monthly drought are evident on the Z Index maps for March (SPI, Z Index), April (SPI, Z Index), May (SPI, Z Index), July (SPI, Z Index), and November (SPI, Z Index).

The year started out with 31.9 percent of the contiguous U.S. in moderate to exceptional drought (based on the U.S. Drought Monitor [USDM]) manifested in two drought epicenters — areas of moderate to exceptional drought in the Southern Plains and moderate to extreme drought in the Southeast — with areas of moderate to severe drought in the Upper Mississippi Valley and moderate drought in the Far West. As the year progressed, the western drought expanded to link with the Southern Plains drought area and new drought areas developed along the East Coast, pushing the national drought area to 38.2 percent by May 1. Dryness during the late spring began to take its toll in the agricultural heartland by summer as drought intensified and expanded to cover much of the country from the Central Rockies to the Ohio Valley, and the Mexican border to the Canadian border, by the end of August. This solid mass of drought, which stretched from border to border and (by now) West Coast to Mississippi River, persisted through the fall. The percentage area in drought peaked at about 65.5 percent on September 25 (a new high in the 1999-2012 USDM record) and ended the year at 61.1 percent. The percent area of the contiguous U.S. in the worst drought categories (D3-D4, extreme to exceptional drought) peaked at 24.1 percent on August 7, which is also a record.



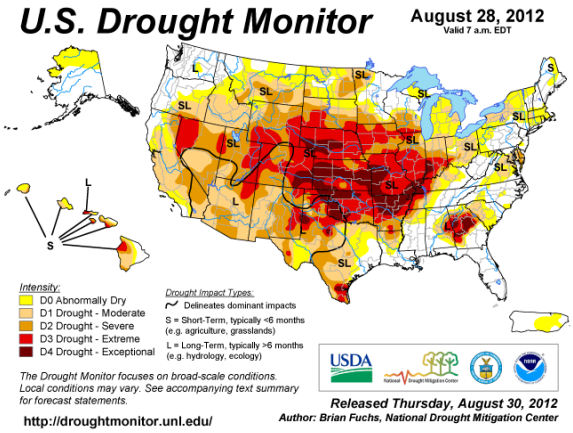
The percent area* of the contiguous U.S. experiencing moderate to extreme drought (based on the Palmer Drought Index) started the year at about 22.9 percent, grew steadily to a peak of about 61.8 percent during the summer, then contracted slightly during the fall, ending the year at about 51.8 percent. The Palmer Drought Index data go back 113 years.





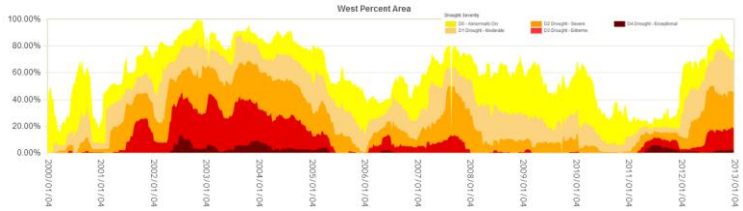
*This drought statistic is based on the Palmer Drought Index, a widely used measure of drought. The Palmer Drought Index uses numerical values derived from weather and climate data to classify moisture conditions throughout the contiguous United States and includes drought categories on a scale from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

Regional Drought Overview



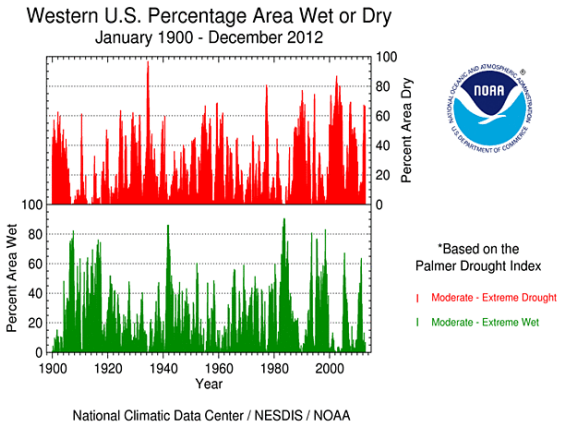
The year began with drought epicenters in the Southern Plains, Southeast, Upper Midwest, Far West, and Hawaii. As winter ended and spring began, dryness in the West spread to join the Plains and West drought areas while the Southeast drought crept up the East Coast. The spring months were quite dry with drought spreading or pockets of drought developing in several regions. The summer months were extremely dry across a large part of the central U.S., with the result being a merging of the drought epicenters in the West, Plains, and Midwest into one large drought area stretching from the West Coast to the Great Lakes. Beneficial autumn rains helped portions of the Midwest recover from drought, but dryness continued in the Plains where drought intensified. By the end of 2012, three drought epicenters remained — Hawaii, the Southeast, and one large area of drought stretching from the southern California coast across the West and Great Plains to the Midwest, with the worst drought conditions focused on the Plains states.
The dry weather (which lowered moisture supplies), coupled with intense spring and summer heat (which increased evapotranspiration and, thus, moisture demand), depleted soil moisture, lowered streamflow (May, June, July, August), reservoir and stock pond levels, and ravaged crops and livestock. By year's end, low river levels threatened commerce on the vital Mississippi River shipping lanes.

West:

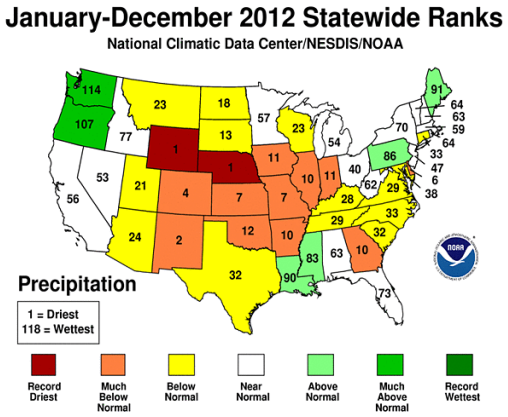


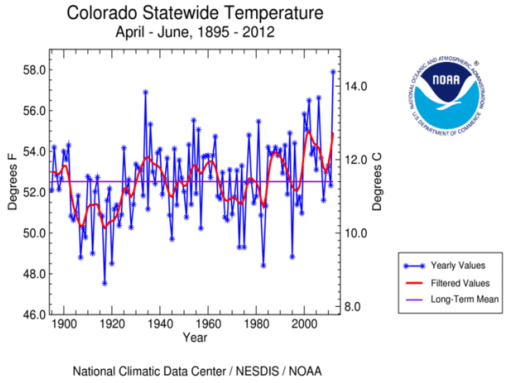
The percent area of the West in moderate to exceptional drought steadily grew during 2012, peaking at 77% in October.

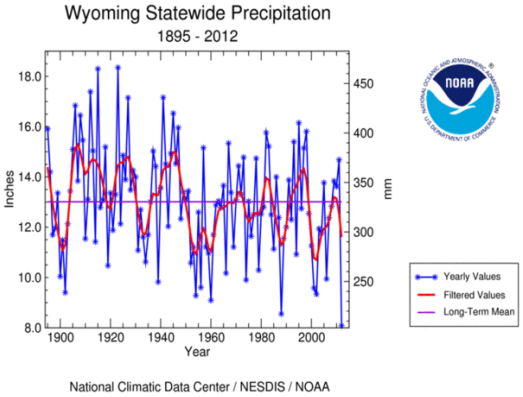
The West began the hydrologic year (water year, October-September) on a dry note, with below-normal precipitation and snowpack water content. As the wet season (October-April) ended, the southern portions of the West had significant precipitation and snow water content deficits, while the northern areas were not as bad off. Continued dryness and intense heat during the spring and summer caused numerous wildfires to break out, with Colorado especially hard hit. Record heat and near-record dryness occurred in the state, with April-June 2012 ranking as the hottest and third driest April-June on record. Wyoming was record dry for several time scales, including June-August, April-August, March-August, June-September, May-September, April-September, and several others. Utah was record dry in June and April-June. A total of four states (Colorado, Nevada, Utah, Wyoming) ranked in the top ten driest category for April-June, six states were in the top ten driest for January-June, and three for January-November, including Colorado and Wyoming (which were record dry) and New Mexico (second driest). The weather pattern shifted during summer and early autumn, bringing much-needed precipitation to the southern areas but drying out the northern states. Five western states (Idaho, Montana, Oregon, Washington, Wyoming) ranked in the top ten driest category for July-September, with Montana having the driest August-September and July-September on record. When last year's dryness is combined with this year's dryness, the last two years (December 2010-November 2012) in New Mexico ranked as the driest such 24-month period on record. For January-December 2012, three states (Wyoming [driest], New Mexico [second driest], Colorado [fourth driest]) ranked in the top ten driest category and three other states (Arizona, Montana, Utah) ranked in the driest third of the historical record.

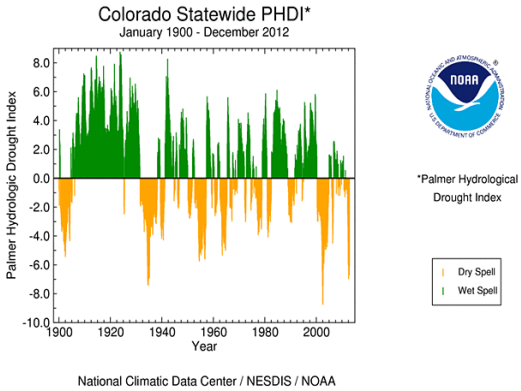


The percent area of the West in moderate to exceptional drought, as measured by the USDM, steadily grew during 2012, peaking at about 77.2 percent in October. Based on the Palmer Drought Index, which goes back to the beginning of the 20th century, moderate to extreme drought peaked at about 67.2 percent of the West during June. Both of these numbers were surpassed by the 2002-2003 drought and (for the Palmer index) earlier droughts.

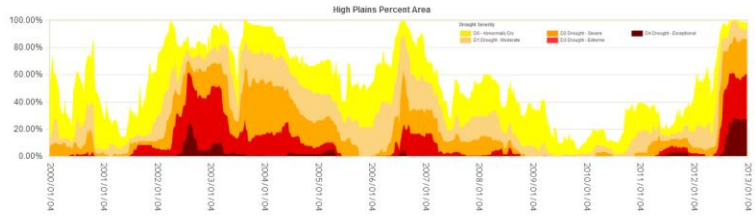








Great Plains and Midwest:

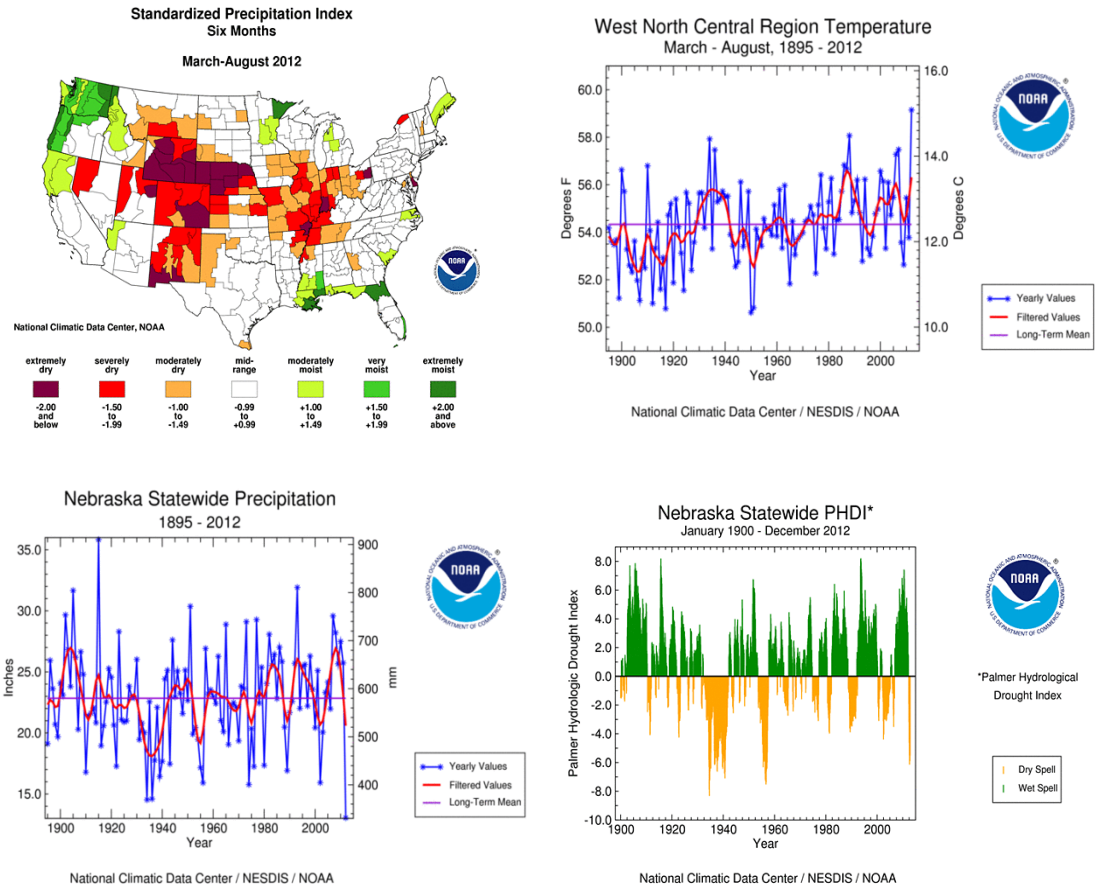


The percent area of the High Plains (Kansas to North Dakota) in moderate to exceptional drought skyrocketed during summer 2012, covering nearly the entire High Plains region by October.

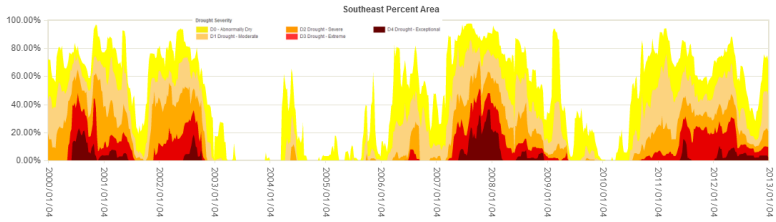
Last year, drought was centered in the Southern Plains. This year, the entire Plains region was afflicted by drought with a significant part of the Midwest sharing the misery. Dryness affected the Northern Plains during March, the Southern Plains during April, and the Southern to Central Plains during May, with different portions of the Midwest affected during each of those months. But that was just a prelude to even worse conditions. The entire Plains and Midwest were baked and moisture-starved during June and July. Beneficial rains came to parts of the Midwest and Southern Plains during August and September, and to the Northern Plains and Midwest in October, but widespread dry conditions returned in November.

Record dryness occurred for several states in August and September. The persistence of drought gave several states record dry seasons, including Arkansas (April-June and other seasons), Kansas (May-July), Nebraska (June-August and other seasons), and South Dakota (July-September). Six states in the Plains and Midwest (Arkansas, Indiana, Iowa, Kansas, Missouri, Nebraska) ranked in the top ten driest category for January-November, with Nebraska having the driest January-November on record. For January-December 2012, five Great Plains and Midwest states ranked in the top ten driest category, including Nebraska which had the driest year on record.

The percent area of the Great Plains and Midwest in moderate to exceptional drought, as measured and defined by the USDM regions, rapidly increased during 2012. Nearly all of the Northern Plains was enveloped in drought by October, which is a record in the 13-year USDM history. Drought coverage also rapidly increased in the Midwest, peaking at about 73.7 percent in July, which is also a USDM record. In early 2012, the Southern Plains was recovering from the 2011 drought. The percent area in moderate to exceptional drought decreased to a low of about 32.3 percent in May 2012 before expanding again to peak at about 73.7 percent in July.



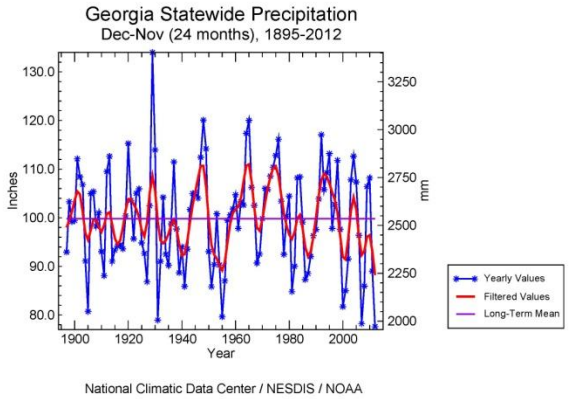
Southeast to Northeast:

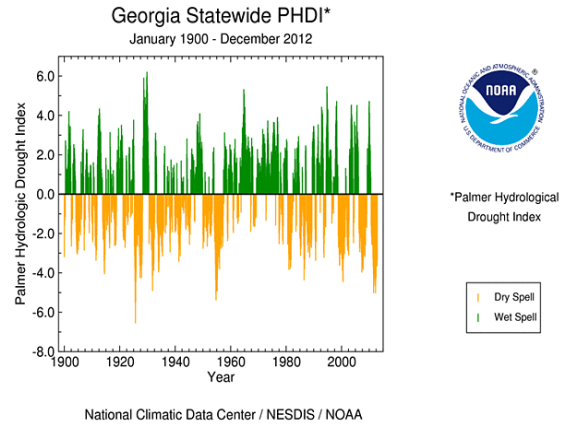


The percent area of the Southeast in moderate to exceptional drought oscillated up and down during 2012.

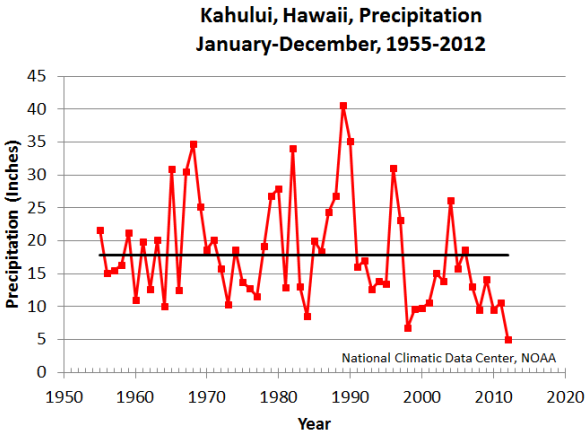
The precipitation pattern for the eastern U.S. fluctuated between wet and dry during 2012. The Southeast started the year on the dry side, with January-February ranking in the driest third of the historical record for several states. February-April was dry for the Northeast, with Connecticut having the driest February-April on record and most other states ranking in the top ten driest category. Three southeastern states (Alabama, Georgia, and Tennessee) ranked in the top ten driest category for April. The weather patterns, which brought drought to the Great Plains and Midwest during the late spring and summer, doused many of the eastern states with beneficial rainfall during this time. Although helpful, the rains were not enough to erase several years' of deficits in the Southeast. November was dry for all eastern states, with most ranking in the top ten driest category. The cumulative impact of the 2012 precipitation deficits gave Delaware the fourth driest January-November and Georgia, the epicenter of the Southeast drought, the eighth driest January-November. For the year (January-December), several states along the eastern seaboard were drier than normal, with Georgia ranking tenth driest and Delaware having the sixth driest year on record. The prolonged dryness in parts of the Southeast gave Georgia the driest December-November 24-month period (December 2010-November 2012) on record.

Parts of the Southeast have been in drought for the last two years. The percent area of the Southeast in moderate to exceptional drought, as measured by the USDM, hovered around 50 to 65 percent during the first five months of the year, then contracted during the summer and fall before expanding again at the end of the year. It peaked at about 69 percent at the beginning of May.





Hawaii and other Pacific Islands:

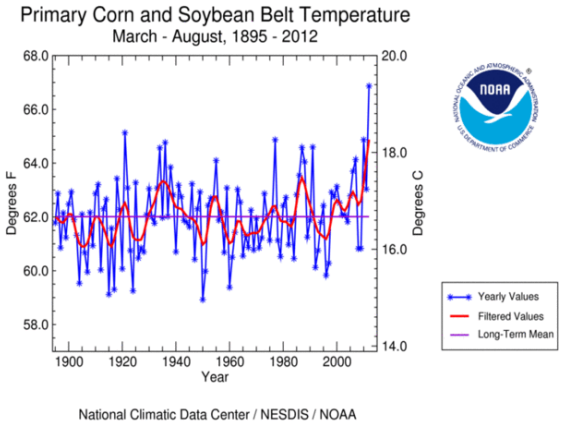


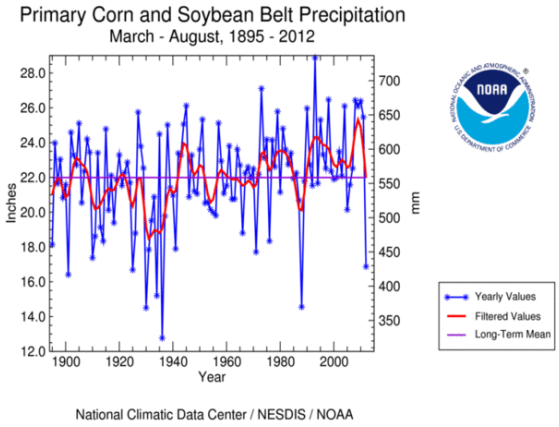
Drought in Hawaii was resurgent in 2012, with 47.4 percent of the state affected by moderate to exceptional drought on January 3, growing to 73.2 percent by December 4. The state has been in drought for the last four years, with the December 4, 2012 peak approaching the peaks of 2008-2010. Several locations had record to near-record dry conditions in 2012, with Kahului recording the lowest rainfall for the year based on data from 1955-2012, and

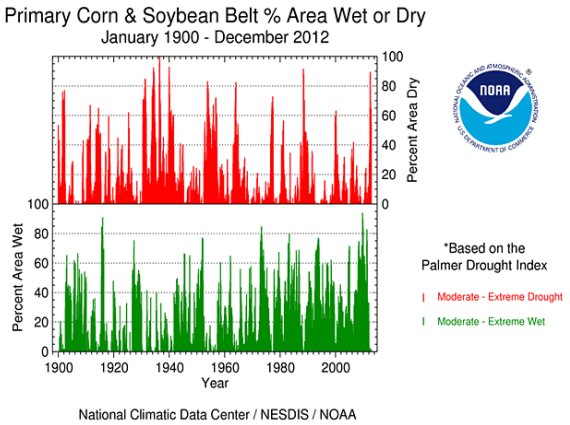
Honolulu having the fifth driest and Hilo eighth driest year in their 1950-2012 records. Annual rainfall at other U.S.-affiliated Pacific Island stations during 2012 was near or above normal.

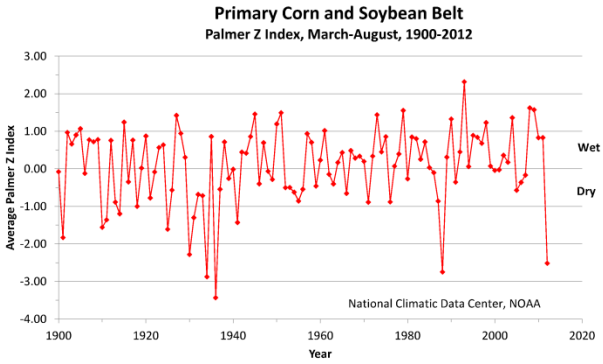
Agricultural Belts:

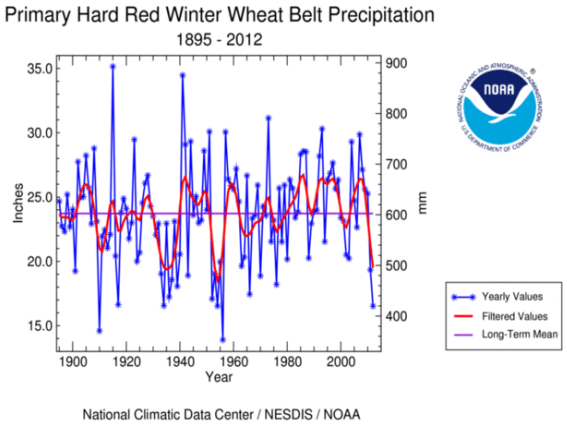
The spatial pattern of drought this year closely overlaid the agricultural area of the U.S. heartland, and the excessive temperatures and lack of rain during the critical growing season severely reduced corn and soybean crop yield. The Primary Corn and Soybean agricultural belt, collectively, experienced the warmest and seventh driest March-August in 2012, resulting in the fourth most severe Palmer Z Index for the season (behind 1936, 1934, and 1988). The extreme severity of the dryness and evapotranspiration demand over the growing season resulted in a rapid increase in the percent area of this agricultural belt experiencing moderate to extreme drought (as defined by the Palmer Drought Index) and moderate to exceptional drought (for the Midwest and High Plains as defined by the USDM). By August 2012, about 89.3 percent of the Primary Corn and Soybean Belt was experiencing moderate to extreme drought (based on the Palmer Drought Index), surpassing all previous droughts except those in 1988 and the 1930s. The August-October rains in the eastern part of this region were beneficial and helped reduce the intensity of the drought there, but they did little to shrink the overall drought area for the entire region, with the value down to only 54.9 percent by the end of the year. By year's end, January-December 2012 ranked as the tenth driest year on record.





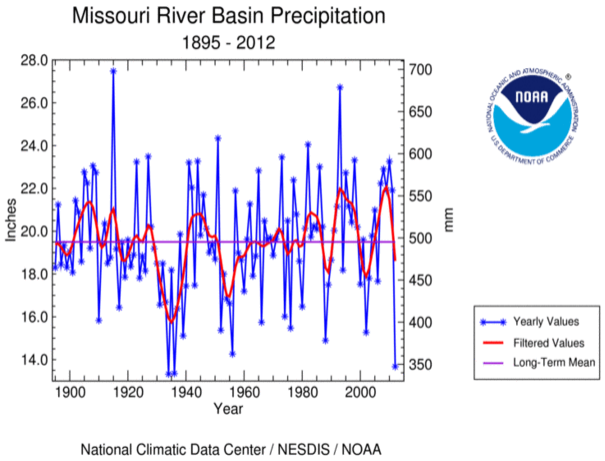


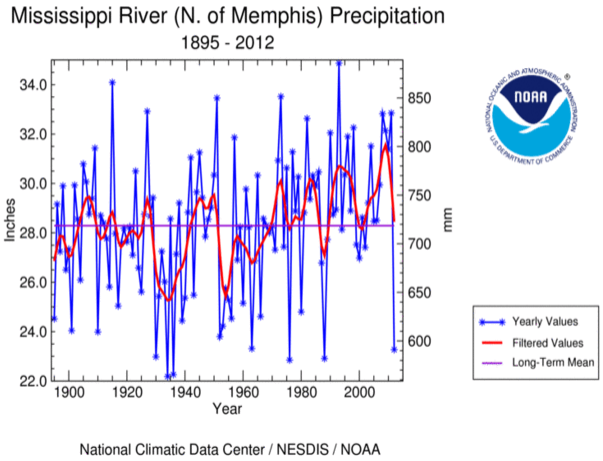




The growing season (October-April) has started out on a dry note for much of the Winter Wheat agricultural belt. October-December 2012 ranked as the 27th driest October-December in the 1895-2012 record, with November 2012 ranking as the 13th driest November. For the smaller Primary Hard Red Winter Wheat belt, November 2012 ranked 23rd driest and October-December tenth driest. By year's end, January-December 2012 ranked as the ninth driest year on record for the Winter Wheat belt and third driest for the Primary Hard Red Winter Wheat belt.

River Basins:



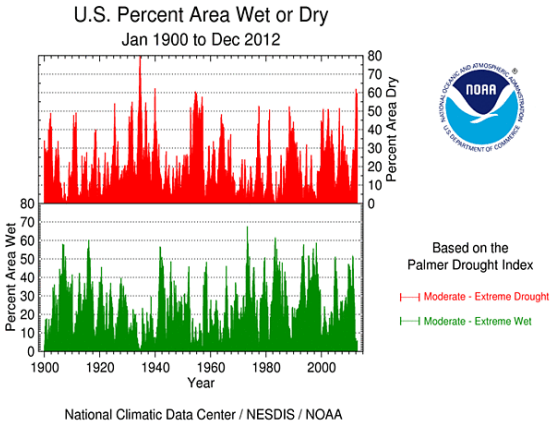


2012 Precipitation Ranks (out of 118 years) for the Major River Basins in the Contiguous U.S.: Calendar Year (January-December) and Water Year to Date (October-December)

River Basin	Jan-Dec	Oct-Dec
Pacific Northwest	11th wettest	10th wettest
California	56th driest	36th wettest
Great Basin	41st driest	35th wettest
Lower Colorado	24th driest	33rd driest
Upper Colorado	driest	29th driest
Rio Grande	10th driest	5th driest
Texas Gulf Coast	41st driest	4th driest
Arkansas-White-Red	9th driest	11th driest
Lower Mississippi	48th driest	35th driest
Missouri	3rd driest	37th driest
Souris-Red-Rainy	35th driest	31st wettest
Upper Mississippi	10th driest	59th driest
Great Lakes	54th driest	26th wettest
Tennessee	38th driest	59th driest
Ohio	27th driest	55th wettest
South Atlantic-Gulf	53rd driest	46th driest
Mid-Atlantic	46th driest	37th wettest
New England	38th wettest	38th wettest

Several river basins have experienced unusually dry conditions during 2012, with the Upper Colorado having the driest year in the 1895-2012 record. As noted by the Midwest Regional Climate Center, drought has contributed to low water issues from the Great Lakes to the Missouri and Mississippi rivers, with navigation on the Mississippi River continuing to be a concern through December. The Missouri River basin had the third driest year in 2012 (behind 1934 and 1936), the Arkansas-White-Red River basin had the ninth driest year, and the Upper Mississippi and Rio Grande both ranked tenth driest. For the Mississippi River and all of its tributaries north of Memphis, Tennessee, 2012 ranked as the sixth driest year on record (behind 1934, 1936, 1976, 1988, and 1930). The aggregate PDSI for the Missouri basin reached the lowest value since the 1950s, while the aggregate PDSI for the broader Mississippi and its tributaries was the lowest since only 1988.

Historical Analogs:



As seen in the National Drought Overview section, the percent area of the contiguous U.S. experiencing moderate to exceptional drought (based on the USDM) reached 65.5 percent in September, a record in the 13-year USDM history. The percent area of the contiguous U.S. experiencing moderate to extreme drought, based on the Palmer Drought Index (which goes 113 years), peaked at about 61.8 percent in July. This is only slightly larger than the peak percent area values of the 1950s drought decade and is the largest value since December 1939. So, in terms of total area covered by drought, the 2012 drought closely resembles the 1950s droughts.

The geographical pattern (location and intensity of dryness) of the 2012 drought can be compared to the patterns of previous droughts by using statistical tools such as the correlation coefficient and mean absolute difference. In the two tables below, the 2012 climate conditions (Palmer Z Index, Palmer Hydrological Drought Index [PHDI], temperature [Temp], precipitation [Precip]) were compared two different ways. In the table to the left, each month (January-December) of 2012 was compared individually to the previous years (1900-2011) to find the year with the closest match to each individual month (January closest match to January 2012, *and* February closest match to February 2012, *and* March closest match to March 2012, etc.). In the table to the right, the 2012 annual average values were compared to the annual average values for each of the previous years. No consistent pattern in historical analogs can be found in the monthly comparison (left-hand table) due to normal

month-to-month variability (climatic noise). However, when the month-to-month variability is averaged out (by computing annual values as in the right-hand table), a consistent pattern becomes evident — the drought years 1955 and 1956 are the closest historical analogs to the geographical pattern of drought in 2012, and 1998 (the second warmest year on record) and 2006 (third warmest year on record) are the closest historical analogs to 2012 for the spatial temperature pattern.

Top 5 Analog Years to 2012 (each month January-December compared individually)

Rank*	Z Index	PHDI	Temp	Precip
1	1966	**1955**	1991	1904
2	1974	**1956**	2006	1901
3	1901	1920	1921	1917
4	2002	1918	1946	1931
5	1988	1963	1990	1974

* Rank: 1 = most similar to 2012.

Top 5 Analog Years to 2012 (annual values compared)

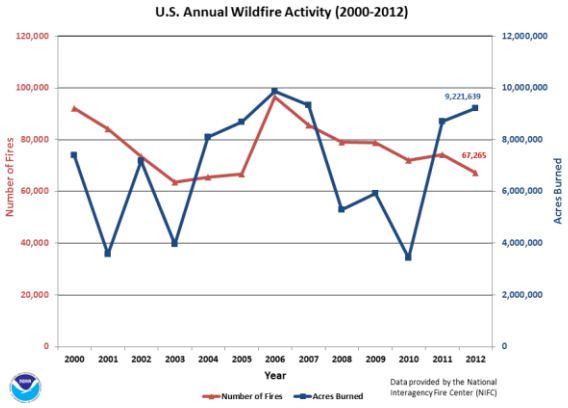
Rank*	Z Index	PHDI	Temp	Precip
1	**1955**	**1955**	1998	**1955**
2	**1956**	**1956**	2006	1966
3	1988	2000	1921	**1956**
4	1933	2006	1999	1980
5	1939	1981	1931	1988

* Rank: 1 = most similar to 2012.

Wildfires - Annual 2012

Please note: Material provided in this report is chosen subjectively and included at the discretion of the National Climatic Data Center (NCDC). The ability to report on a given event is limited by the amount of information available to NCDC at the time of publication. Data included in this report are preliminary unless otherwise stated. Links to supporting information are valid at the time of publication, but they are not maintained or changed after publication.

Updated: 07 January 2013



2000–2012 Annual U.S. Wildfire Counts
Data Source: NIFC

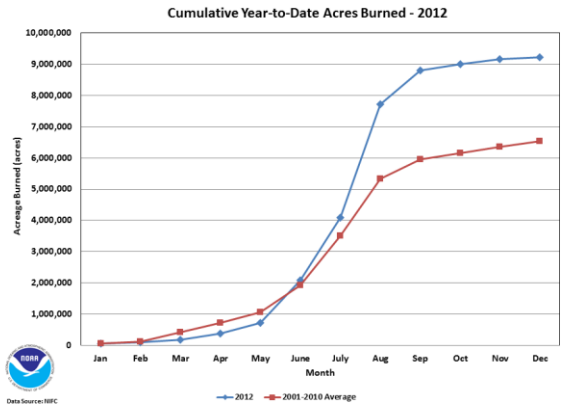
2012 marked the warmest year on record for the contiguous U.S. in a period of record that dates back to 1895. The record-breaking warmth was paired with exceptional dryness across much of the nation. Drier-than-average conditions were experienced from the Rockies to the East Coast. Nebraska and Wyoming each had their driest year on record. Meanwhile, wetter-than-average conditions existed in the Pacific Northwest, the central Gulf Coast, and New England. By September's end, the percentage of the country experiencing moderate-to-exceptional drought peaked at about 64.6 percent for the contiguous U.S. (about 54 percent including Alaska, Hawaii, and Puerto Rico), according to the U.S. Drought Monitor. The wildfire activity of 2012 supplanted 2011's rank as third most acres burned, behind the 2006 and 2007 seasons. Although the number of fires was below-average, the size of the fires was notably increased. The annual fire size of 137.1 acres was the *most* since 2000 for any January through December period, which was about 1.5 times the 10-year average (based on 2001-2010). Large wildfires occurred in New Mexico (largest in state history), Colorado (second largest in state history), and Oregon (largest since the 1860s). Overall, the number of fires remained below-average for 19 of the past 20 months (every month since May 2011, with the exception of January 2012). The month of January saw elevated wildfire activity as the result of combined warmth and dryness in the Great Plains, and a lack of snow pack having left the grasslands of the High Plains exposed to strong winds.

Year-to-Date Wildfire Statistics*

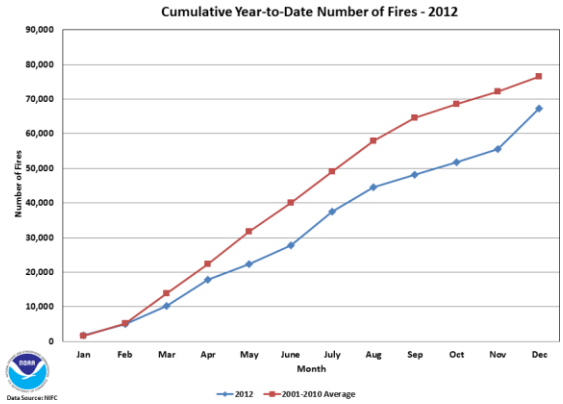
January–December	Totals	Rank (out of 13 years)	Record Value	Record Year	10-Year Average (2001-2010)
Acres Burned	9,221,639	3rd Most 11th Least	9,873,745	2006	6,534,250.2
Number of Fires	67,265	10th Most 4th Least	96,385	2006	76,521.1
Acres Burned/Fire	137.1	Most on Record 13th Least	137	2012	85.7

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

Through December 28th, the nationwide number of fires year-to-date reached 67,265 fires which was the fourth least annual number of wildfires since 2000. Texas experienced the most number of wildfires of any state during 2012 with more than 10,600 fires (about 16 percent of the national total). Nationally, the amount of acres burned was 9,221,639 during 2012, which represents about 1.5 times the 10-year average (based on 2001-2010) of 6,534,250 acres burned. The month of August saw notable wildfire activity, when the fire size reached 523.4 acres per fire (the highest for any August in the 2000-2012 record) and the acres burned in August were nearly equal to the acres burned from January through July 2012. Idaho wildfires burned the most acres of any state during the year, with over 1.5 million acres (about 17 percent of the national total). Oregon and Montana followed closely with each having in excess of 1.2 million acres burned within their respective states. During 2012 the damages from wildfires across the country will top one billion U.S. dollars.



Acres Burned during 2012
Compared to 2001–2010 Average



Number of Fires during 2012
Compared to 2001–2010 Average

Cumulative wildfires for contiguous U.S.
from January 1 through October 31, 2012
Source: NASA

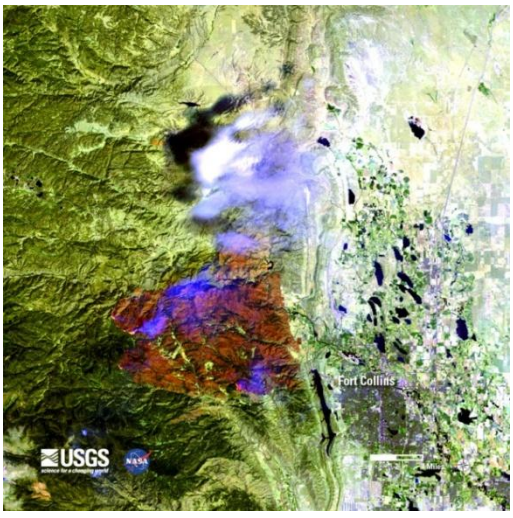
Records maintained by the National Interagency Fire Center (NIFC) and NASA both indicate that 2012 was an extraordinary year for wildfires in the United States. The visualization in the satellite image depicts total fires that burned between January 1st and October 31st as detected by the MODIS instruments. Yellow and orange areas indicate fires that were more intense and had a larger area of active burning, which were likely produced by wildfires. Red areas represent the lower intensity of fires typically associated with prescribed burns, which are used for agricultural or ecosystem management purposes.

Significant Wildfire Events in 2012

Please note, this is a list of select fires that occurred during the year. Additional fire information can be found through Inciweb.

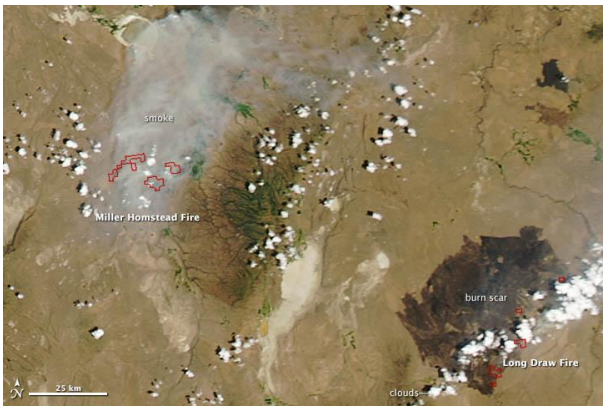
Whitewater-Baldy Complex Fire in New Mexico on 06 June 2012. Source: USFS Gila National Forest

Two large wildfires which began in mid-May in New Mexico, the Baldy Fire and the Whitewater Fire, merged to create the Whitewater-Baldy Fire complex. Both fires were ignited by lightning strikes in the very dry Gila National Forest in western New Mexico and resulted in the charring of nearly 300,000 acres by late June. The amount of smoke from the fire was unusually high due to the dense coniferous forests which were impacted, causing very low air quality conditions across a large area of western New Mexico. The fire surpassed the Las Conchas Fire of 2011, which destroyed over 156,500 acres, as the largest fire in New Mexico history. Aerial seeding and mulching of the high-severity burn areas were conducted as part of Burn Area Emergency Rehabilitation that concluded in October when most of the trails reopened to the public.



High Park Fire in Colorado on 18 June 2012. Source: USGS/NASA

Of Colorado's 252,000 acres consumed by wildfires during 2012, more than half were lost in the month of June as part of the state's worst wildfire season in a decade. Two devastating fires erupted that month including the High Park Fire, which destroyed 259 homes and nearly 87,300 acres, followed by the Waldo Canyon Fire, which destroyed 346 homes and more than 18,000 acres. One fatality was attributed to the High Park Fire — the second largest fire in Colorado's history. The Waldo Canyon Fire was deemed the most destructive fire in the state's history and resulted in two deaths.



Oregon wildfires during July 2012. Source: NASA

As one of three major eastern Oregon wildfires during July, the Long Draw Fire scorched almost 560,000 acres of short grass and sagebrush to become the state's largest fire since the 1860s. Ignited by lightning in the Owyhee River Canyon, the wildfire destroyed rangeland, livestock, and habitats for prairie wildlife (rabbits, coyotes, grouse) in the remote area of southeast Oregon. Close to 800 firefighters with aerial support battled two other blazes, which threatened the town residents of Frenchglen (Miller Homestead Fire fueled by dry peat) and Westfall (Bonita Complex Fire fueled by sage and juniper).

Idaho wildfires during August 2012
Source: NASA Earth Observatory

Intense wildfires were concentrated in the beetle-killed forest lands of Idaho. Large fires actively burned from mid-summer through autumn. Heavy smoke from the various fires resulted in adverse air quality for area residents. Three notable fires collectively blazed over 669,200 acres of national forest during 2012, which represented about 45 percent of the state's annual total. The Halstead Fire scorched nearly 181,800 acres (late July-late October), the Mustang Complex consumed more than 340,600 acres between late July and early November, and the Trinity Ridge Fire destroyed over 146,800 acres while raging from early August through mid-October.

2012 National and Regional Center Summaries

Natural Resources Conservation Service

National Water and Climate Center

1201 NE Lloyd Blvd, Suite 802

Portland, OR 97232

http://www.wcc.nrcs.usda.gov

National Water and Climate Center Overview

The National Water and Climate Center (NWCC) is part of the Natural Resources Conservation Service (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*." A primary goal of NWCC is to be "*a globally recognized source for quality snow, water and climate information and technology*."
The Center's Snow Survey and Water Supply Forecasting (SSWSF) Program provides water and climate information and technology support for natural resource management in 12 Western states (Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming).

Staff

NWCC is organized into three branches under the Center's Director, Mike Strobel. Team leads are Tom Perkins, Water and Climate Services (WCS), Tony Tolsdorf (acting), Water and Climate Monitoring (WCM), and Laurel Grimsted, Information Systems (IS).
The Center also provides climate services for the NRCS and other cooperating USDA agencies. This function is under the supervision of the Center Director. Key climate services staff members are:

- Jan Curtis, Meteorologist and Applied Climatologist
- Jim Marron, Resource Conservationist

Data Interpretation

In October 2012, NWCC released the 1981-2010 Climatic and Hydrologic 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 data and products are available on the Center's website.
Adjusted streamflow normals are also 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.

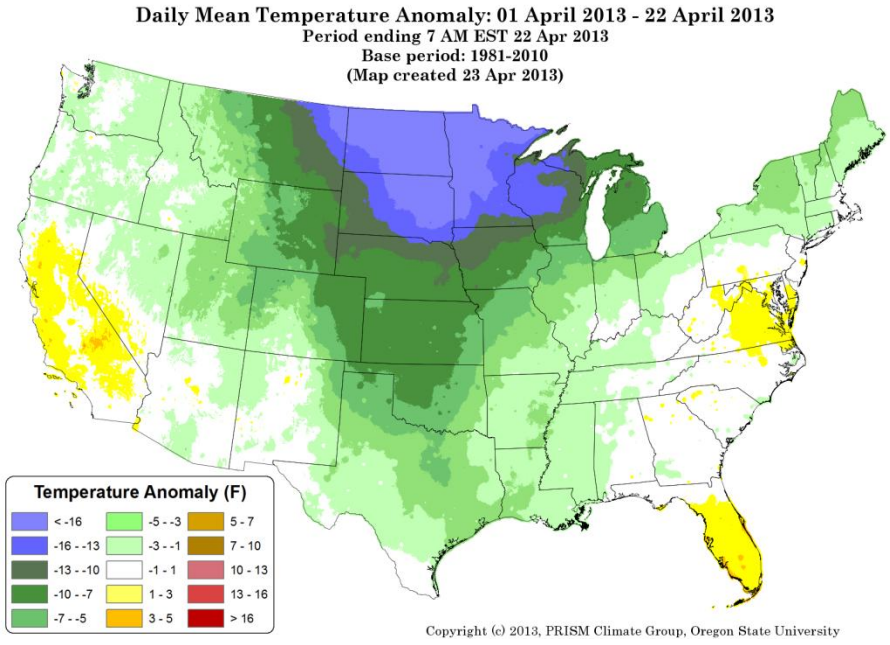
Spatial Climate Services

NWCC coordinates and manages datasets produced in cooperation with Oregon State University's PRISM Climate Group. This cooperative effort produces 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.

In addition, during 2012-2013 Risk Management Agency (RMA) integrated PRISM information into its operations for Crop Insurance and Compliance. An agreement between the RMA, Oregon State University and NRCS was recently developed to provide crop production information directly to NRCS for conservation planning purposes.

To meet the need for a near real-time data quality control (QC) system, the PRISM group is currently developing an improved, operational system for the NWCC Snow Telemetry (SNOTEL) network. The system components in this two-year project include: (1) Operational single-station QC checks, (2) In-situ SNOTEL checks, such as comparing snow-water equivalent (SWE) to precipitation, (3) Correlation-based spatial QC checks.

A map-based web portal will allow NRCS data editors access to the final QC values and flags.
Effective this fall, the PRISM Group in coordination with RMA will provide publicly accessible daily and accumulated spatial climate maps for temperature and precipitation (actual and anomaly) for the Lower-48 as noted:



Data Retrieval Tool

In January, NWCC introduced its Report Generator data retrieval tool to integrate data and interpret them dynamically. The tool allows users to create custom reports from multiple data sources, including the current (1981-2010) 30-Year Normals.

Flood Early Warning System

Last season's Whitewater-Baldy fire burned over 265 square miles of the Gila National Forest, making it the largest wildfire in New Mexico history. After the fire subsided, a team comprised of Jim Marron (NWCC Resource Conservationist), Gus Goodbody (NWCC Forecast Hydrologist) and Dan Moore (West National Technology Support Center) completed an analysis of severe burn and monsoonal precipitation pattern spatial layers to determine locations that had a high potential for damaging debris flows in the upcoming rainy season.

The information provided by the analysis facilitated the NRCS Emergency Watershed Protection (EWP) Program in funding the installation of 13 Early Warning and Detection System (EWDS) units in New Mexico. The stations are located near streams in the upper reaches of the watersheds damaged by fire. The units provide emergency management officials more time to notify about 30,000 residents in five communities of impending floods.

The first 13 EWDS sites are located on US Forest Service-managed lands. Under an agreement with the Department of Homeland Security, USGA will monitor and maintain the sites. NRCS is currently working with several Federal and State partners to determine whether more detection units are needed across the state.

Standards and Specifications

A major revision to the National Engineering Handbook, Part 22, Snow Survey and Water Supply Forecasting is in the final formatting and production stage. 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 already available via the NRCS eDirectives System.

Social Media Connects NWCC to Customers

As part of its outreach activities, NWCC is now sharing information with customers via various social media outlets. The GovDelivery system allows NWCC to reach targeted audiences with topic-specific bulletins related to water supply and drought monitoring activities. Weekly bulletins currently reach almost 2000 subscribers. The NWCC YouTube channel features monthly videos on streamflow forecasts for the Western states, and the Twitter feed provides up-to-date water supply information to followers.

Midwestern Regional Climate Center

Illinois State Water Survey
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Champaign, IL 61820
mrcc@isws.illinois.edu
http://mrcc.isws.illinois.edu
Beth Hall, Director

Administration

Mark Reynolds joined the MRCC staff part-time as UNIX/LINUX system administrator. He works with the University of Illinois' campus IT program.

During summer 2012, the MRCC hosted 3 summer interns from Northern Illinois University, Western Illinois University, and Purdue University. Each intern got the opportunity to not only work in the MRCC service office, but was also assigned to 2 research projects. One of the interns got the opportunity to present his summer research findings at the Annual AMS conference in Houston, TX in January 2013.

Climate Services and Products

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 1,100 offline contacts since July 2012. Including access to the MRCC online data system, MACS, there have been over 43,000 page views since July 2012.

Several new resources were added to the MRCC website. In response to public need for information on what to expect and how to handle extreme weather events, a new website was developed called "Living With Weather". While continuing to be expanded at the time of this report, there are already sections dedicated to heat waves, drought, and winter storms. A new "Climatology References" page has also been added that is continually being updated with published sources of information on a broad range of topics from fog to tornadoes to derechos. A new product was also launched with the online data delivery tool (MACS) that provides climatological dates of last and first freezes of the season per observation station.

In late summer 2012, the MRCC was contacted by two separate National Weather Service (NWS) offices to help coordinate operational online guidance tools and communication means between NWS and local vegetation experts to help advise NWS when frost / freeze headlines might be warranted based upon the state and vulnerability of local vegetation. Initial operational guidance tools were developed for late fall, when early freezes could impact vegetation late in their growing season. A listserv was also established that included subscribers from the NWS, state climatologists, and university extension personnel. The project expanded greatly in Spring 2013 to include interactive GIS operational maps, online guidance forms that could be submitted by any of the project's subscribers, and freeze impact reporting forms. With over 180 subscribers across 16 states, the project has proven to be

useful in sharing information over a broad area with a large number of people. The issuance of frost / freeze forecast headlines can now be more coordinated across regions and broader communities can benefit from these results.

The MRCC has also made the following accomplishments to improve climate services, including:

- In response to NWS office requests, the MRCC has added NWS county warning areas (CWA's) as an option on MACS when producing gridded maps of data. Other regions that can be chosen include NWS River Forecast Center regions, National Climate Assessment region, and National Interagency Fire Center regions.
- Also at the request of NWS offices in our region, the MRCC added ThreadEx stations to MACS as well.
- Data from a variety of networks that is available via ACIS is now available on MACS including CoCoRaHS, WBAN, Coop, GHCN, WMO, ThreadEx, ICAO, FAA, and NWSLI
- The MRCC worked to improve the internal infrastructure of MACS to make it more efficient to maintain and update in the future.
- A data networks webpage that summarizes the various national, regional and state observational data networks (e.g., mesonets).

Future plans for the MRCC over the next year include:

- Continue to expand and improve the operational Frost / Freeze project to possibly become both national and an all-year project to help forecasters, climatologists, and vegetation experts work together.
- Develop additional climatological tools for agriculture and other vegetation foci including products related to heat stress and pest impacts driven by climatology
- Human interest climatology resources such as heat index and wind chill index
- Incorporate operational mesonet data from states throughout our region to provide online tools and resources based upon that data

Collaboration Efforts and Outreach

March 2013 marked the 100-year anniversary of the 1913 flood that devastated the Indiana-Kentucky-Ohio region. The Silver Jackets organizations of Ohio and Indiana (multi-agency group concerned with flood awareness and education), including several NWS offices, collaborated on commemoration activities for this anniversary. The MRCC had the honor of developing the entire website for this event (http://mrcc.isws.illinois.edu/1913Flood/index.shtml).

The MRCC continues to work closely with Illinois-Indiana Sea Grant to foster the relationship between climate and Great Lakes issues. Several projects are either active or near completion with this opportunity including working with the City of Chicago to develop winter adaptation initiatives as part of the Chicago Climate Action Plan and working with the

Chicago Metropolitan Agency for Planning and the Illinois State Climatologist to develop a climate adaptation toolkit for local governments in northeastern Illinois.

The MRCC has been actively involved in the Useful To Usable (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.

The MRCC engaged in 4 regional road trips in 2012 and early 2013 that brought the opportunity for MRCC personnel to go to many NWS offices, state climatologist universities and state offices, NOAA labs, private companies, state forests, and individual farmers and vineyard operators. This helped spread the word about who the MRCC is and what our mission includes.

Other outreach efforts by the MRCC include 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.

High Plains Regional Climate Center

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http://hprcc.unl.edu
Marth Shulski, Director

The High Plains Regional Climate Center (HPRCC) was established in 1987 and represents one of the six federally-funded Regional Climate Centers in the United States, operating within a three-tiered system of climate services (state, regional, national). HPRCC encompasses a six-state area of North Dakota, South Dakota, Nebraska, Kansas, Colorado, and Wyoming. The Center is part of the School of Natural Resources at the University of Nebraska-Lincoln. The mission of the Center is to increase the use and availability of climate data with long-term objectives to 1) provide climate services in the High Plains region, 2) develop improved climate information products, and 3) carry out applied climate studies. The Center serves clientele across a broad spectrum, however, agriculture is the dominant economic influence in the region and many products and services are tailored to this sector. HPRCC personnel work closely with scientists from other regional and federal climate centers on services and programs to *provide a regional structure for climate applications*. There are currently 10 full time employees at the Center, 3 undergraduate interns, and 4 graduate students (3 Ph.D., 1 M.S.).

Climate Services and Products

Representatives from a variety of sectors have contacted the HPRCC to seek expert advice on the data available and how it can be summarized. Each month, the center receives hundreds of customer contacts. These contacts include applications such as engineering, legal, insurance, media, education, transportation, agricultural and other decision-makers. Key service activities include:

- a collection of a *quality set of near-real time data* for decision making situations
- development of a *framework for climate data distribution and management (ACIS)*, in conjunction with other Regional Climate Center staff
- maintenance of web-based sites and interfaces for *user-defined climate information requests* relevant to recent and historical climate data (> 450,000 web hits per year)
- generation of *graphical climate monitoring products* at the local, regional, and national level
- development of software specific to *evaluating the risks associated with climate events* (freeze, drought, and extremes of cold, heat, precipitation).

Regional Mesonet

Through collaboration with state partners, the HPRCC maintains a network of more than 200 weather stations across a ten-state area through the Automated Weather Data Network (AWDN). Data from this network have been the *basis for real-time decisions* in various sectors like agriculture and water management. In agriculture, decisions on planting, fertilizing, disease treatment, irrigation, insect scouting and harvesting are supported by this information. In water management, the data have been used for drought monitoring and assessment and to meet the water accounting requirements regarding waters of the North Platte (Supreme Court Decree) and Republican Rivers (interstate Compact). Several crop decision aids utilize the AWDN data and irrigation scheduling tools have been developed in-house. The Center maintains hundreds of subscribers accessing AWDN information online in customized reports of raw and/or summarized weather data. Most recently, the HPRCC has partnered with the UNL Department of Agronomy and Horticulture to develop SoyWater – a crop water use tool for soybean growers (www.hprcc3.unl.edu/soywater/). This tool makes use of the many AWDN stations across Nebraska in a real-time and user-defined environment. AWDN data are also used extensively for research – approximately 70 journal articles during the last decade have been published utilizing these data. Topics include agriculture, ecology, human health, soils, water quantity and quality, and weather and climate.

Applied Climate Research

Staff at HPRCC have authored or co-authored more than 30 peer-reviewed journal articles and reports since 2009. Topics for these papers are wide ranging, and include: data quality control techniques, climate variability, soil moisture, evapotranspiration, and land use influence on climate trends. More about our research can be found at: http://www.hprcc.unl.edu/research.php

The Center is part of a large research team in the North Central U.S. investigating the influence of a variable and changing climate on regional corn production – termed *Useful to Usable: Transforming Climate Variability and Change Information for Cereal Crop Producters*. The USDA funds are being utilized to develop decision support tools based on user need. HPRCC collaborates with the National Drought Mitigation Center and UNL Extension for the EPA-funded *Climate Masters of Nebraska* project. Similar in nature to the Master Gardener program, it is an adult education program developed to teach participants about climate change and understanding their carbon footprint. The Center has received NSF funds to study climate change educational materials focused on rural communities in the *Central Great Plains Climate Education Partnership* project. This work is being done in collaboration with the UNL Public Policy Center and Kansas State University.

Education and Outreach

HPRCC is actively engaged in various types of education and outreach activities across the region. Staff provide classroom visits around the area as requested teaching students about weather and climate. Hands-on guides have been developed to learn how to build weather

instruments and observe the weather. Additionally, HPRCC attends and presents at local, hands-on educational events both on campus and off, including such venues as severe weather symposia, 'NaturePalooza Nebraska', and 'Dinosaurs and Disasters'. In 2011, the HPRCC designed and hosted its first ever Weather Camp – a highly successful week-long day camp for middle school age children. Participants were able to observe the weather in the University's football stadium, visit an NWS office and a local television station to talk with meteorologists, and presented their own mini research project to their families at the end of the week. More about outreach can be found at: http://www.hprcc.unl.edu/outreach.php There are currently three Ph.D. students and one M.S. student studying under the direction of faculty at the Center. Topics include winter season severity in the Central Plains and communication of climate information, corn production and recent climate trends in the U.S., crop modeling and climate, and energy budgets on green roofs

The HPRCC hosts an annual workshop on Regional Climate Services and invites the state climatologists in the region, local NWS staff, National Drought Mitigation Center staff, and the North Central Climate Science Center. The 1.5 day long workshop in fall 2012 was held in Nebraska City, NE.

HPRCC has participated in the NOAA/NIDIS-led tribal engagement training over the last year in the Missouri Basin states. Workshops occurred in Colorado, North Dakota, and South Dakota during 2012, with more being scheduled for the upcoming year. This gives staff an opportunity to interact with local tribes and learn about specific needs and interests. The Center also participates in events such as the American Indian Alaska Native Climate Change Working Group and the Institute for Tribal Environmental Professionals workshops.

State Climate Office 2012 Summaries

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
John Christy, Alabama State Climatologist
Bob Clymer, MS, 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.

2012 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 newsreports. http://nsstc.uah.edu/alclimatereport/ Responses from stakeholders have been universally positive. We now have done so for a second entire year of 2012 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 feature of the climate of 2012 was the warm first half of the year with a very warm January and a near-record warm March. A number of stations experienced the warmest March in their period of record.

A second weather-related event that caused considerable crop loss, was the flash drought beginning in mid-June and ending in early July. Overall the summer was near normal in terms of temperature and precipitation. However, the three weeks of hot and dry weather (dewpoints well below average) were devastating. The soils in Alabama are quite poor for holding water (unlike the deep soils of the Mid-West) so that the common saying here "we are one week away from a drought" is literally true. During these three weeks, which coincided with the corn tasseling stage, the soils and associated plants dried out. There is a way to deal with this problem (see under economic development.)

Drought Monitor

While there had been an informal collaboration-of-opportunity when preparing the Alabama drought level lines of the Drought Monitor each week, but in 2012 we continued to formalize a 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. A bill is being considered in the state legislature this year that will codify the Drought Monitor procedure and identify the State Climatologist as a formal position in State Government.

Historical Climate Network upgrades

Due to NOAA budget cuts, there is considerable uncertainty about the continued funding of the operation and maintenance of the 17 Regional Climate Reference Network stations in Alabama. 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, as of 20 Mar 2012 there were 820, and as of 16 Apr 2013 there were 873. The AOSC is the state coordinator with each NWS WFO serving as Regional Coordinators for their appropriate counties. Again, the cooperation with the NWS WFO's and Southern Region HQ has been superb in promoting this very public service activity. 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. The photo above depicts one of the first ponds to be completed under the AWEP program located in Madison County on the Bragg Farm with Richard McNider (former SC), Dennis Bragg and the current SC.

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. In 2012 a bill initiated by our efforts to enhance irrigation opportunities with tax credits was passed by the state legislature and signed by the governor. Dr. Richard T. McNider of UAH, who was the lead scientist on the project and former State Climatologist, is pictured below to the right of the Governor with the current State Climatologist looking over his shoulder at the signing ceremony.

Various economic interests contacted the AOSC in 2012 for information and speaking engagements related to climate change legislation. The SC appeared before both the House and Senate of the U.S. Congress at hearings on energy and climate (photo below before the U.S. Senate Environment and Public Works Committee, 1 Aug 2012.) The SC also 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 that produces more electricity than it consumes, exporting over 61 million MW-hrs (30%) out of state in 2010. Contrast this export activity versus a state such as California which is dependent on imports of 55 million MW-hrs of electrical power. This export "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

Geophysical Institute, University of Alaska
Annual Report for 2012

The Alaska Climate Research Center (ACRC) is part of the Geophysical Institute, University of Alaska, Fairbanks. It was established by the State of Alaska via Title 14, Chapter 40, Section 085. Specific information can be found in this section.

KEY PERSONNEL:

Gerd Wendler, Director, Professor Emeritus
Martin Stuefer, Assistant Director, Assistant Professor
Kevin Galloway, Webmaster
Blake Moore, Programmer
Liangbiao Chen, Student Assistant (part time)

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

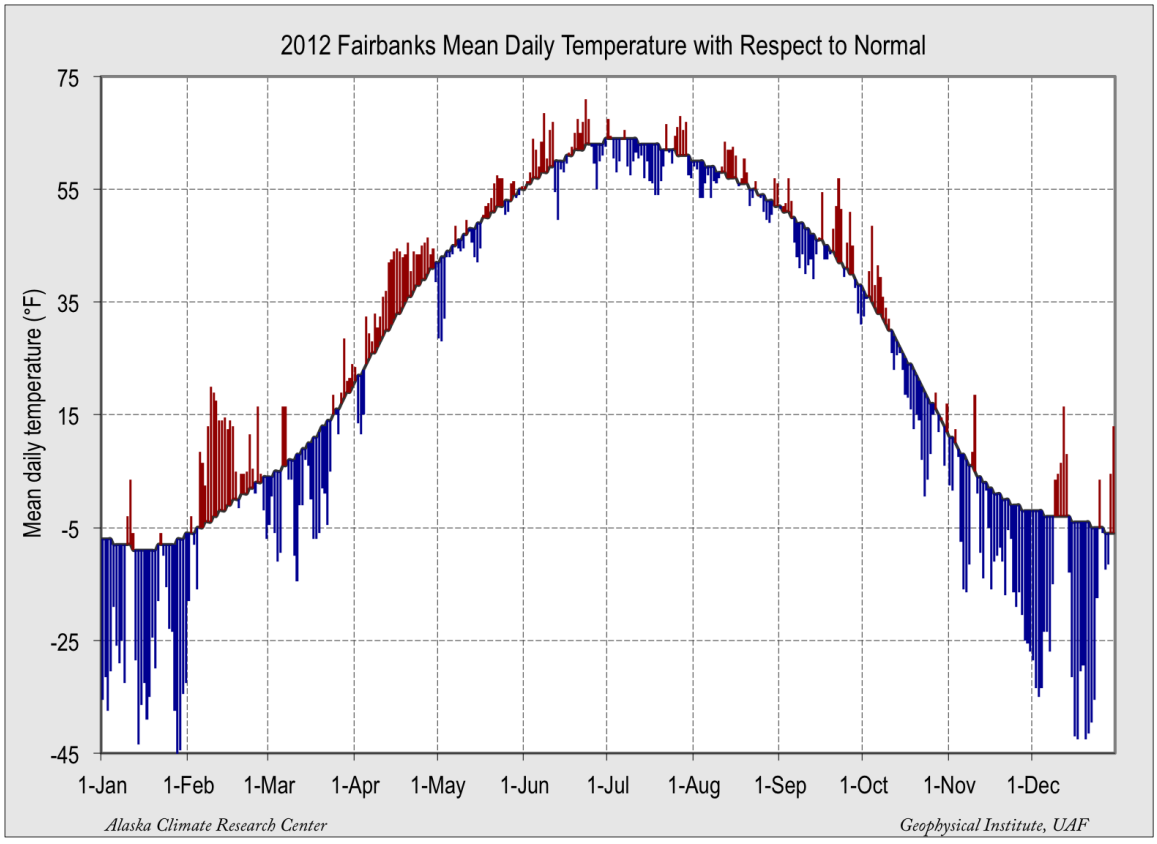
Dissemination:

For nearly 3 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 26,800 hits a day in 2012, a small increase from the previous year. Assuming that the average stake-holder opens 7 pages, this represents some 3800 stakeholders daily. Analyzing by domain, net is the most frequent source of visitors, followed by edu. From the international realm Germany was as in 2011 the country most interested in our data. 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.

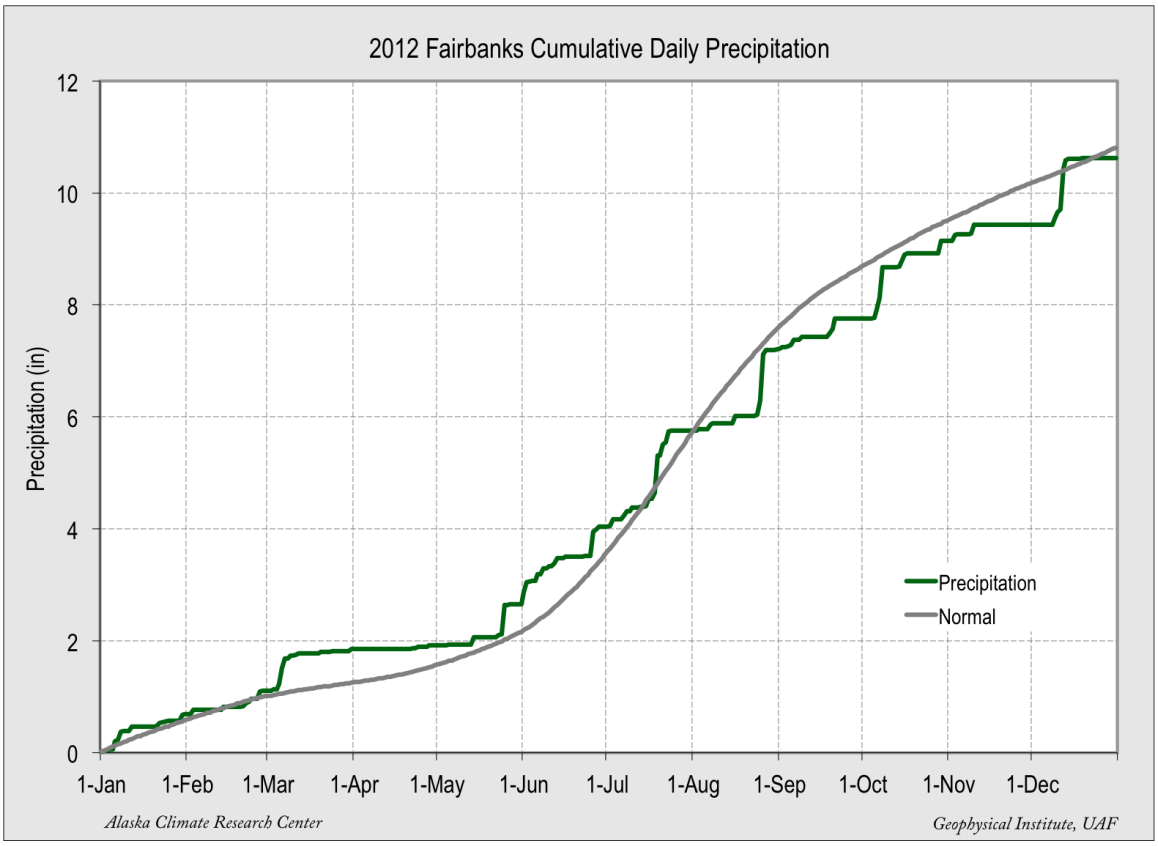
The ACRC website contains many summaries, products, meteorological and climatological information. Furthermore, from our home page, users can select any number of links: Fairbanks weather and climate, our popular webcam and on-campus weather station, climatological data, up-to-date summaries, Alaska 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 2012 for Fairbanks; more details can be seen from our website. The average annual temperature in 2012 for Fairbanks was 24.1°F (see Figure), a negative departure of -3.5°F from normal (1981-2010). It was not only the coldest year in the new century, but also the second coldest year in more than 40 years, with especially large negative deviations in winter. The lowest temperature for the year was observed on the 29th January at –51°F, and there were 26 days observed with minima below -40°F. The long-term mean is 11 days. The highest temperature of the year was 86°F, which was observed on 23rd June. The below normal temperatures continue a slight cooling trend observed over the last decades. The decade of the 1980's was the warmest ever observed in Fairbanks history going back to more than a century, the 1990's were somewhat cooler, and the first decade of the 21st century, was cooler than the 1990's. This trend is connected to the PDO index, which went more negative over the last decades.



The mean annual precipitation (see Figure) was 10.62", which is very close to normal of 10.81". Further, the precipitation followed closely the annual trend (see Figure). Snowfall, was, as expected, also close to normal, recording 61.7" in the calendar year. This is 3.3" below average for Fairbanks.



RESEARCH:

A substantial number of publications on the climate of Alaska and Polar Regions have been produced over the years. In 2012 we published one new journal article, namely:

The First Decade of the Century: a Cooling Trend for Most of Alaska by G. Wendler, L. Chen and B. Moore. *The Open Atmospheric Science Journal*, 2012, 6, 111-116

It can be downloaded from our website. Another paper, on the sea ice and climate change in the Bering Sea, has been submitted. It is interesting insofar, that the sea ice, which melts in summer has increased. A new maximum in sea ice extent has been observed in April 2012. This is in stark contrast to the sea ice extent in the Arctic Ocean, which showed a new absolute minimum in late summer of 2012.

EDUCATION:

We have been giving talks and seminars on the climate and observed climate change in Alaska and Polar Regions, including talks to University of Alaska, Fairbanks students and the Palmer Job Corps. We employed a part time student, whose work was excellent. Hence, he became not only co-author in the paper we published last year, but is co-author again in the above-mentioned submitted paper on climate change in the Bering Sea.

OTHER REMARKS:

We are working on a major overhaul of our website, which is our prime medium to reach our stakeholders. Improvements include improved navigation for the site, as well as an improved interface to request and receive data for our users. This effort should be finished by the end of April.

Further, we established an Advisory Board to our Center, which met in late June. Besides the 4 of us, Sarah Trainer, Director ACCAP, UAF, Peter Olsson, State Climatologist, UAA, Hans Nielsen, Deputy Director, Geophysical Institute, UAF and Tim Brown, Director, WRCC, attended.

Office of the Arizona State Climatologist

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Phone : 480.965.6265
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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 two affiliated faculty in SGSUP (Drs. Anthony Brazel and Randall Cerveny). The office is now a core partner of the Center for Integrated Solutions to Climate Challenges, one of the eight Walton Sustainability Solutions Initiatives, within the Global Institute of Sustainability at ASU. Our mission is still 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, or interview requests, or questions.

We also 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.

Information Services
In 2012 we continued to have most of our data requests through the e-mail resulting from our webpage, with fewer phone requests than in 2011. We also had 20,408 downloads from our website in 2012. The most popular product downloads were the Arizona Climate Extremes, Monthly Climate Summaries, and the monthly climate calendars for six Arizona cities, and the Phoenix rainfall. Data users, other than the web downloads, include university researchers, state and local government agencies the public, private industry, the media, and an increasing number of requests from the legal community. We did 26 media interviews on climate change, monsoon, AZ climate, drought, dust storms, urban heat island, La Niña, and CoCoRaHS, of which 8 were TV, 7 radio, 2 monthly publications, 8 newspaper, and 1 Internet article, and we were involved in 44 legal cases as consultants or expert witnesses. The trend this year is an increase in e-mail, a steady number of phone data requests. This year we produced more summary products for temperature and precipitation records, and started updating the Climate of Phoenix with current data. We produced monthly reports on drought for the Arizona Department of Water Resources webpage, climate summaries for State Climate Office website, AZ temperature and precipitation for State Climate Office website, AZ-NM temperature and precipitation for CLIMAS Southwest Climate Outlook publication, heating and cooling degree days for AZ Commerce Dept.

Research
DOC-NOAA – Co-PI on Evaluation of Drought Risks and its Impact on Agricultural Land and Water use to Support Adaptive Decision-making. PI = Soe Myint $300,000
NASA – co-PI on Using Remote-Sensing to Understand the Impacts of Droughts on Agricultural Land Use and Water Consumption to Support Adaptive Decision-making in Arid Environments. PI = Soe Myint $199,953

Outreach & Service
- Taught summer Weather Camp at the Arizona Science Center July 16-20, 2012. A 5-day hands-on weather class for 8-9th grade level. Co-teachers included Phoenix NWS MIC and WCM.
- Co-Chair of Technical Monitoring Committee of State Drought Task Force
- Recording Secretary of Arizona Flood Warning Multi-AgencyTask Force
- State Coordinator – CoCoRaHS – Community Collaborative Rain, Hail & Snow Network, citizen scientist precipitation observers.
- Member of State Hazard Mitigation Plan Update team
- Navajo County Hazard Mitigation Plan team
- Gila River Indian Community Hazard Mitigation plan team
- Co-President Central Arizona Chapter of American Meteorological Society
- Member of American Meteorological Society Applied Climatology Committee – planning of January 2013 Applied Climatology Conference at the AMS annual meeting.
- Review Board of the Arizona Probable Maximum Precipitation Study conducted by ADWR.
- Member of WERA1012 – a planning committee within the Western Association of Agricultural Experiment Station Directors, with the task of Managing and Utilizing Precipitation Observations from Volunteer Networks
- http://nimss.umd.edu/homepages/saes.cfm?trackID=10636#4

- **Marcus Fund for Physical Geography Award Committee – Association of American Geographers**

Reviewer of papers, chapters, reports for the:

- Bulletin of American Meteorological Society (drought paper)
- Institute of Engineering and Technology Generation, Transmission and Distribution Journal (climate change- energy paper)
- Book Chapter for Urban Ecology (urban heat island paper)
- Natural Hazards Review journal (drought paper)
- State of Nevada Drought plan
- City of Flagstaff Resiliency Plan
- Climate Literacy and Energy Awareness Network (climate paper)
- Presentations: 8 community presentations on drought, climate change, and Arizona climate.
- Knowledge to Action - International Conference on Climate Adaptation Futures, Tucson, May
- Packaging Climate Science - International Conference on Urban Climatology – Dublin, IR, Aug
- Hestia Project – presented to ASU Technical and Scientific Translation Certification Class Oct
- Arizona Climate – Pima County Drought Impact Group – Pima County Public Works Dept. Nov

Monitoring and Impact Assessments

- Reviewer for Probable Maximum Precipitation Study (2009-2013) funded by Arizona Department of Water Resources
- Monitoring temperature and precipitation in the Petrified Forest National Park to inform park archaeologist as to weathering conditions for petroglyphs and other historical cultural assets.
- 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 (829 observers).
- Translating and disseminating climate variability and urban heat island research for policy-makers in the cities and tribes in the Phoenix metropolitan area.

Office of the California State Climatologist

Office of the State Climatologist
California Department of Water Resources
Division of Flood Management
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Email: Michael.L.Anderson@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. 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. A new map-based server for the data is now available for internal use within DWR. As soon as some server upgrades are made, the map server will be released to the public.

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. As the first MOU period nears its end, a second MOU to further explore the network and its operation is being developed.

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. A drought monitoring and prediction workshop hosted by the Western States Water Council was held in April 2013 in San Diego. The California State Climatologist presented at this meeting.

California is now in year 5 of CoCoRaHS. Over 1,000 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 11,000 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 is undergoing a facelift with improvements being developed for data served on the California Data Exchange Center. This effort will continue over the next few years.

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 Mariposa County Integrated Regional Water Management Group and the California Department of Food and Agriculture. 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 Oregon State Climate Office. Discussions were held on gridded data sets and their application in resource management. The State Climatologist presented and participated in the meeting.

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, the national Hydrologic Frequency Analysis Work Group and the National Climate Assessment water management indicators 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 agency, 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 National Climate Assessment water management work group is providing guidance for the NCA on the development of metrics for climate change that are appropriate for water management at the national scale.

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. The contract is up for renewal in 2014.

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 ARSCO Annual Report for 2012

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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 high granularity and as much local detail as possible in a state with great topographic and climatic diversity. 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 2012 were:
1) Drought monitor and early warning. 2012 was the second consecutive full year of moderate to exceptional drought for southern Colorado and was a year of rapid-onset drought for northern Colorado. Destructive wildfires, recreational challenges, water quality issues and agricultural impacts particularly to the livestock industry were issues faced in 2012.

2) Coordinated climate monitoring and research specific to practical needs and applications. This included operating the historic Fort Collins weather station which completed the 124th year of uninterrupted climate monitoring. In addition to drought, 2012 ended up the warmest year on record for the state as whole eclipsing the previous record set back in 1934 by nearly one degree.

Many areas experienced 9 consecutive months of above average temperatures including exceptionally warm conditions in March, June and November. The all-time record daily maximum temperature of 114F was tied at Las Animas in late June. Snow research: Wendy Ryan, with support from the National Weather Service, continued a two-year project improving an algorithm for estimating snowfall from the output of electronic snow depth sensors. Morgan Phillips continued a modeling study exploring winter snow sublimation across a large portion of the Upper Colorado River.

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. The Colorado Climate Trends website serves this information in graphical and tabular formats for the best long-term observing sites in Colorado.

4) Support, coordinate and promote the Colorado Agricultural Meteorological Network (COAGMET) to provide timely local weather and climate information to support the Colorado agricultural industry http://climate.colostate.edu/~coagmet/, http://coagmet.colostate.edu. A few new stations were added in 2012 and for the first time in the 20+ year history of this network, soil moisture monitoring was deployed at several stations.

5) Engage the citizens of Colorado in backyard climate monitoring through the Community Collaborative Rain, Hail and Snow network (CoCoRaHS) and related activities. http://www.cocorahs.org. A focus of 2012 was engaging schools in rain gauge measurement. Hundreds of gauges were donated for school use across Colorado. “Rain Gauge week” was held in fall 2012 and over 100 schools contributed daily precipitation reports from their communities. In 2012, several new features were added to CoCoRaHS including a PRISM tool for rain gauge volunteers to view their local observations in spatial and temporal climate perspective. Evapotranspiration measurements were begun at a subset of observing points across Colorado and the U.S. Several thousand new volunteers were added to the CoCoRaHS community, and educational activities such as the CoCoRaHS WxTalk Webinars were widely promoted. CoCoRaHS continued to expand the use of animations to aid in volunteer engagement and training. CoCoRaHS was the Western Regional winner for the C. Peter Magrath/W.K. Kellogg Foundation Engagement Award from the Association of Public and Land Grant Universities.

6) Broadly disseminate climatic information, expertise and applications, and assist others in applied climate research. The staff of the Colorado Climate Center continued to provide climate services – generally at no cost - to any users requesting climate data and/or expertise. 2012 was a special year – a year proclaimed to be a year for water education and celebration in Colorado. Climate Center staff participated in youth water festivals in all parts of the state, and participated in many meetings and conferences.

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. Weekly climate, water and drought assessment webinars were held over half of the weeks of 2012. 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 also 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:
Information services are central to the function of the Colorado Climate Center. Office staff promptly responds to requests for climatic data and expertise. 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. This year, we teamed with the Cooperative Institute for Research in the Atmosphere to provide monthly climate updates online. 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. 2012 set records over much of the state for the greatest reference ET rates since measurements began and this helped increase the interest and use for this type of information.

The Community Collaborative Rain, Hail and Snow network (CoCoRaHS) first started in 1998, is now a provider of climate information services on a national basis. Various precipitation summaries and raw data access make it very easy to track recent precipitation anywhere in the U.S.

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. This is ongoing work serving the mission of the Center and the needs of Colorado.
2) Drought monitoring and drought early warning. We lead a weekly intensive coordinated process that provides guidance to the U.S. Drought Monitor. Becky Smith is conducting PhD research supporting Upper Colorado River Basin water balance, variability and climate predictability. This work is supported through the National Integrated Drought Information System (NIDIS).
3) Precipitation characteristics and statistical properties. The CoCoRaHS network continues to provide a large and growing 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. Water balance research combining rainfall data with ET references is beginning. In 2012 we began a partnership with the Colorado Water Institute in a detailed study of water resources in the South Platte River Basin. This research is supporting water policy and administration in the basin.
4) Automated snow measurement, snow sublimation, high elevation evapotranspiration (hay meadow consumptive use).
5) Weather Instrument intercomparisons. Thanks to the historic facilities available at the Fort Collins campus weather station, we maintain a number of ongoing studies instrument intercomparisons including 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. Thanks to the Water 2012 statewide water education initiative in combination with statewide drought, we participated in an all-time high of over 100 different public programs ranging from youth water festivals, school programs, weather station field trips and guest lectures at various Colorado universities to AMS and NWS WeatherFests, Conservation District meetings and many workshops and professional conferences. Here are some examples of meetings that we now participate in every year: 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 many other smaller venues.

The Community Collaborative Rain, Hail and Snow network (CoCoRaHS) http://www.cocorahs.org continues as a very large outreach effort through informal partnerships with other state climatologists and the National Weather Service. Approximately 16,000 active participants from all 50 states help measure and report precipitation from across the country. Hundreds of new volunteers are added every month. A similar number of people of all ages are not active data collectors but continue to receive our monthly e-newsletters. We continue to add new training and informational content via the CoCoRaHS YouTube channel http://www.youtube.com/cocorahs/.

Connecticut State Climate Center

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1. Staff

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. Two graduate students (Liqin Qu and Zhao Xue) have been voluntarily working on daily chores of CSCC.

2. 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 Volin, 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 has met a couple of times in the academic of 2012-2013. The CSCC Director, Associate Director, and the board members organized and attended the meetings. The advisory board has broadly discussed the history, function, challenges and action plans for sustainable development. The following recommendations were made and followed 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 and climate information gatekeeper and clearing house for any climate-related research and applications and thus deserves to receive University and State 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.

3. 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. Two graduate students have 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 and other activities.

4. 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.

4.1 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).

4.2 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.

4.3 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 (see the attachment).

5. 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.
- Update our Website following the university style and thus make it more useful and visible.

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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), and the Delaware Environmental Monitoring and Analysis Center (DEMAC). The ODSC provides diverse climate support services to the State of Delaware.

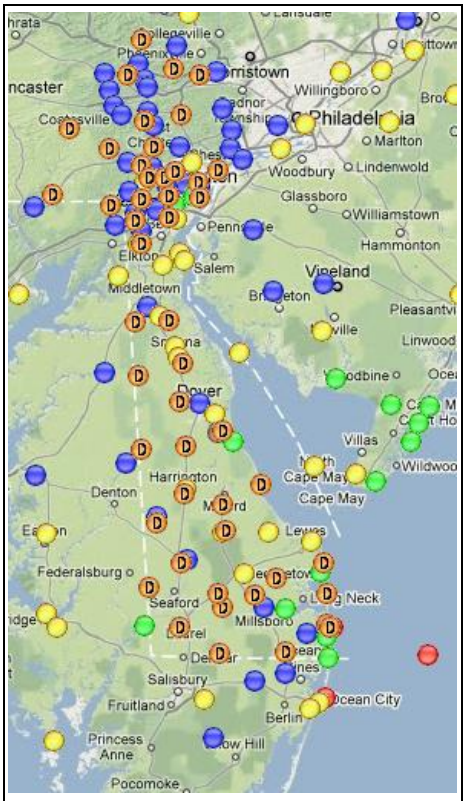
The ODSC is an AASC Recognized State Climate Office (ARSCO) and partners with the National Climatic Data Center, the Northeast Regional Climate Center, and the National Weather Service in Mt. Holly, NJ to provide data and climate services to the citizens of the State of Delaware. As with most State Climate Offices, we provide climate data and expertise to the public and private sector via our web page (climate.udel.edu), 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 environmental observing platforms is 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).



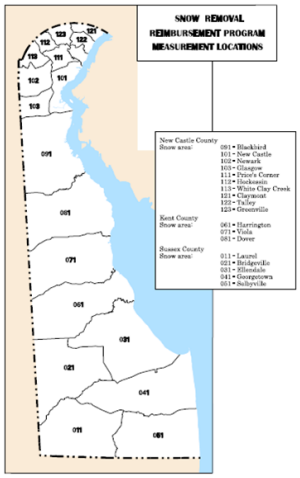
The DEOS GeoBrowser displays the spatial distribution of stations (by type) on the Delmarva Peninsula. The orange symbols with a 'D' in the center are stations maintained by DEOS. http://www.deos.udel.edu/geobrowser.html.

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. The Delaware Coastal Flood Monitoring System (CFMS) now extends along the Delaware coastline from Lewes, DE to New Castle, DE and was used during several nor'easters in 2013 (coastal-flood.udel.edu). 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. In order to ensure that first responders statewide utilize the Coastal Flood Monitoring System, the ODSC and DEOS have 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. Storm total snowfall is available 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 that 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, soybean, and several vegetable crops and is currently was used for over 110 center pivot irrigation systems statewide during the 2012 growing season.

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, Associate 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.

Activities of the ODSC Associated with October 2012 Hurricane Sandy

Although Delaware was spared the catastrophic damage due to Hurricane Sandy that other states saw, it was nevertheless affected greatly by the storm. Both the State Climatologist and Associate State Climatologist served in the Technical Assistance Center (TAC) of the State Emergency Operations Center (EOC) during the event. Working with members of the Delaware Geological Survey, ODSC personnel were responsible for advising emergency managers on evacuations, road and bridge closures and on the general meteorological characteristics of the storm. After the event, a special web page was constructed on the ODSC web site to document the meteorological extremes seen during the storm using DEOS station data. In subsequent months, ODSC staff has given several public presentations on Hurricane Sandy across the region.

Additional State Sponsored Research Projects

The ODSC is currently conducting a State funded research project to document climatic variations across Delaware during the period 1895 through 2012. The major goal of the research is to identify any statistically significant trends in diverse climate variables for Delaware and the Delaware Bay Region. The variables studied include precipitation and precipitation extremes (both rainfall and snowfall), temperature, temperature extremes, drought indices (PDSI, PDHI and Palmer-Z), flood frequency, flood magnitude, and the frequency and magnitude of coastal storms (mid-latitude and tropical systems) and severe weather events (severe convective winds, hail, tornadoes). In addition, several "non-traditional" data sets will be investigated for their efficacy in informing the question of climate change in the Delmarva Region including historic aerial photography, personal journals and diaries, previous refereed literature, etc. The ODSC is also working with the Delaware Department of Natural Resources and Environmental Control (DNREC) Office of Climate and Energy on a Climate Change Vulnerability Assessment that is to be presented to the Governor late in 2013.

Florida Climate Center

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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 leadership to the Florida Climate Center.

The Florida Climate Center is an American Association of State Climatologists (AASC) Recognized State Climate Office (ARSCO) and works in partnership with the National Climatic Data Center (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; use derived quantities and other products
- Charge for services, where applicable
- Certifying 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 Climate Program Office. 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 USA. The goal of this project is to build an effective Climate Extension program in the Southeast USA 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 USA.

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 27 states where more than 7,500 observers take daily measurements of rain, hail and snow. Melissa Griffin, Florida's Assistant State Climatologist, is the State Coordinator for CoCoRaHS in Florida and provided the momentum to initiate the program in this state. 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 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 was proud to host the AASC Annual Meeting last year in Destin, Florida on July 9-12.

Georgia Office of the State Climatologist

Georgia Environmental Protection Division
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Atlanta, Georgia 30354
http://www.gaepd.org/Documents/stateclimatology.html

Bill Murphey, State Climatologist
Nyasha Dunkley, Deputy State Climatologist
Sean Miller, Service Climatologist

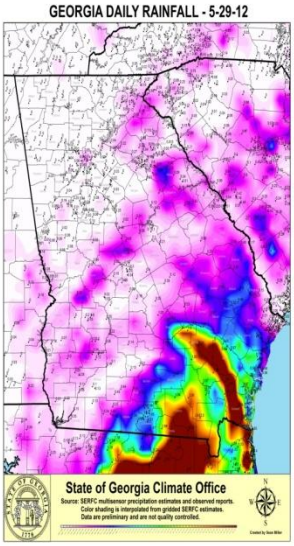
Role

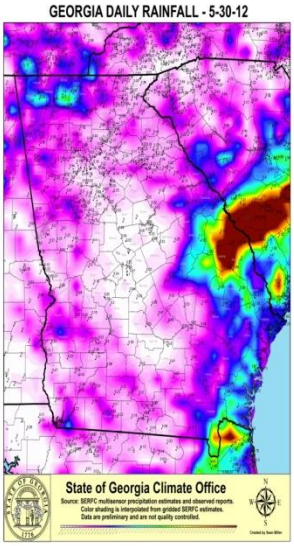
The Office of the Georgia State Climatologist within the Environmental Protection Division functions to collect, disseminate, and interpret climatological and meteorological data. It daily serves the State in responding to public and private entities on issues related to Georgia's climate, as well as 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 is 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 Georgia SCO monitors climate conditions within the state and provides input on droughts and their impacts to the U.S. Drought Monitor.

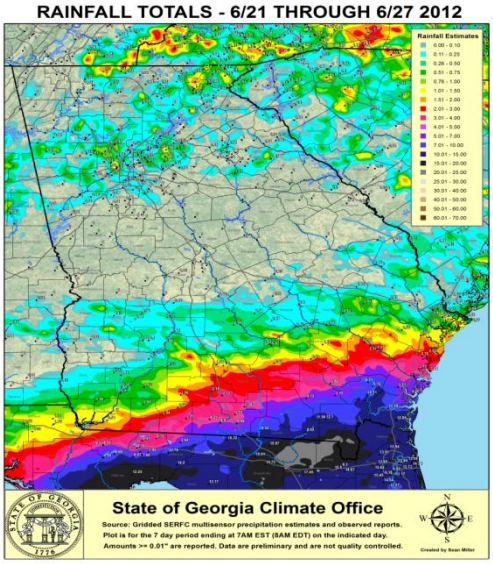
Information Services

The GA EPD climate website contains monthly summaries, meteorological and climatological data resources, and other useful links for public dissemination of information. Specific requests for climatological information and data are received frequently from media, private and public sources and addressed on an ongoing basis. Several hundred media and data requests were fulfilled in 2012 from various sources such as government agencies, law firms, universities and the general public.

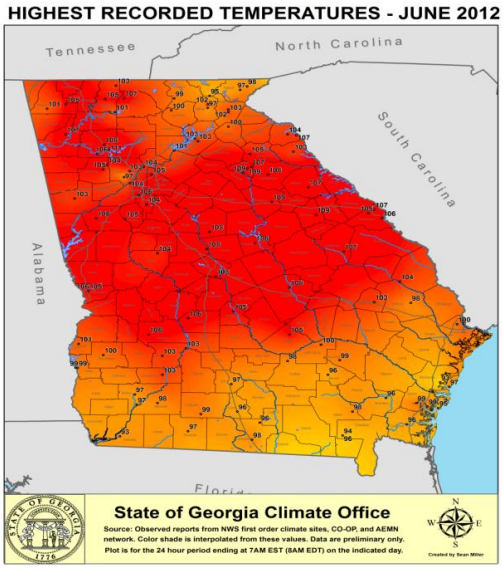
Climate details for 2012 are available through our monthly summaries, highlights of which will be provided here. The long-term drought which began across the state in late October 2010 continued through 2012 with extreme dryness noted in Southwest Georgia and along the Fall Line, from Columbus to Macon to Augusta. Tropical Storms Beryl and Debby provided short-term relief of drought impacts across the southeast and southern part of the state in late May and June, with record rainfall totals.







A record-setting heat wave occurred during the latter part of June, into July, as a strong upper level ridge dominated. Columbus and Atlanta set all time record highs of 106^0F on June 30th, while Athens set a record of 109^0F on June 29th. Macon tied a record of 108^0F, which was last observed in 1980. Metro Atlanta recorded a rare code purple on the Air Quality Index at EPD's McDonough, GA site on June 29th. The concentration reached an 8-hr average of 122 parts per billion by volume (ppbv).



Data Product Development

The Georgia Climate Office is currently making the effort to increase our available data products. Sean Miller successfully generated a GIS display tool for viewing of climate information across the state of Georgia and the Southeast U.S. These plots encompass a number of climate-related parameters, including mean temperatures and anomalies, rainfall amounts and departures, stream flows, archived storm reports, and other specialty plots for high impact weather and climate events affecting Georgia. Our future goals are to include as many of these plots as possible on the SCO website such that members of the public will have access to these data.

Outreach

The State of Georgia Climate office upholds an outreach focus. The office maintains very open communication with news media outlets across the entire state. Data and analyses are disseminated via the internet, email, telephone, regular mail and in person through interviews and presentations. Staff participates, to the extent possible within staffing and budget limits, in as many outreach efforts as possible. These outreach efforts range from elementary school presentations, children 4-H programs, guest lectures at various Georgia universities and participation on climate-related discussion panels. The Climate Office also seeks to take advantage of social media and thus has established a Facebook page.

Hawaii State Climate Office

Pao-Shin Chu, Chris O'Connor, Andre Marquez and Chris Holloway
Hawaii State Climate Office
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May 17, 2013

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 couple of new members to the team, Chris Holloway and Andre Marquez. Chris came aboard in October 2012 as an undergraduate assistant, and recently obtained his BS in Meteorology as of May 2013. He has worked in our office continuously from October to this summer, while preparing to become a graduate student in the Meteorology Department from this coming August for his MS degree. Andre, a PhD student from INPE in Brazil, joined our staff in September 2012 and has been focusing his efforts in our dynamical downscaling project. Andre attended a two-week WRF training course at NCAR in February 2013 to polish his necessary WRF skill set.

A primary goal we strive to achieve at the HSCO is to support others with a variety of weather data requests. The requests that we handled this year came from a wide assortment of fields; from professionals in the community to professors to students. This year our most frequent venture was to provide rainfall data sets in excel document format. On the other hand, we also gave assistance to a few people in need of general climate data. For example, we investigated the typical weather patterns for Haleiwa for June and July.

One of the main focuses of our present endeavors is to perform dynamical downscaling for projecting future climatological parameters for the islands of Oahu and Kauai. We recently obtained funding from the Honolulu Board of Water Supply, in addition to funding from the Kauai Department of Water Supply. Under the supervision of Dr. Pao-Shin Chu, Andre Marquez is leading the effort, teamed by Chris O'Connor, Chris Holloway, and Chris Wrenn. 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 Oahu and Kauai).

Another project of we have been focusing our energy towards involves recent precipitation trends in Hawaii related to the ENSO phenomenon. Chris O'Connor is leading the effort alongside Dr. Pao-Shin Chu, Kevin Kodama of the Honolulu National Weather Service, and Dr. Tim Brown of the Western Regional Climate Center. Funding was obtained from NOAA

through the SCEP program. Traditionally, Hawai'i receives greater than normal precipitation during La Nina years. However over the past few decades we have recorded a reduction in precipitation during the La Nina events. Our research considers the effects of this drying by examining the atmospheric tendencies using NCAR Reanalysis 1 data. Also explored in our research is the Central Pacific and Eastern Pacific El Nino events highlighted by Dr. Jin-Ji Yu of the University of California in Irvine. El Nino typically brings to Hawai'i drier than normal precipitation conditions. Our research shows that Central Pacific El Nino events have the ability to produce wetter than normal conditions for the Hawaiian Islands.

Although Hawaiian weather and climate in 2013 has been interesting, we did not experience anything like the record-size hail storm as we encountered in 2012. In February 2013, Hawai'i did experience a severe wind storm causing $78,000 worth of damage statewide. A strong pressure gradient became established across the islands as a high built far north of the state. Northeast and east trade winds pummeled the area, and they led to damages in several locales from Oahu to the Big Island of Hawai'i. However no series injuries were reported. Persistent drought conditions from 2012 have been reduced in 2013 throughout the state thanks to a good amount of rain received during the wet season. Nevertheless there are still parts of the state under extreme drought conditions, including the western parts of islands of Hawaii and Maui.

References

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

Idaho State Climate Services

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Climatic information is essential to every citizen of Idaho. To help people obtain the climatic and water data and information necessary to planning and every day work, the State Climatologist Program strives to acquire, archive, process and disseminate, in the most cost effect manner possible, 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:

- Collaborate with state and federal agencies responsible for monitoring and forecasting water availability for Idaho
- Assist Idaho weather information users to obtain historical Idaho weather data from the National Climatic Data Center
- maintain a data bank of climatological and hydrological data and information
- Assist data users by formatting climate data into usable forms.
- 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 182 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 Sno-Tel 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:

- Interact with federal and state stakeholders regarding annual climate, and water resources conditions.
- 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).
- 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.

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

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Dr. Jim Angel, State Climatologist for Illinois

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. The office is co-located with the Midwestern Regional Climate Center.

The overwhelming issue for this review period was the 2012 drought. As a result, the SCO was heavily engaged with the local and national media during this event as well as provided regular updated to the Illinois Drought Response Task Force, participated in several NOAA-sponsored webinars, posted regular updates on the web site and blog, and was invited to a number of talks around the state.

Climate Services

The SCO maintains a web site http://www.isws.illinois.edu/atmos/statecli/, a blog http://climateillinois.wordpress.com/ and Twitter account https://twitter.com/jimangel22 devoted to climate data and information on a wide variety of climate topics. The web site covers standard products such as climate maps and datasets while the blog and Twitter accounts provide a means for reporting climate conditions as they develop. Since its beginning in 2011, the 270 posts on the blog have generated 172,000 views.

The SCO is actively engaged in providing information services within Illinois. This past year was especially busy because of the worst drought since 1988. As a result, in the past year the media contacted the office over 200 times. The widespread interest in the drought and the outlook for 2013 led to 56 talks in the last year.

The Illinois SCO engages in a number of outreach activities. The SCO writes regular contributions to the monthly ISWS Water and Climate Summary. The office provides both data and information 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.

The SCO 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, and d) occasional guest on the Illinois Gardener program on WILL-TV.

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

The SCO works closely with the American Association of State Climatologist (AASC) on a variety of climate issues in conjunction with other state climatologists, regional climate centers, the national climate center, and the National Weather Service.

The SC mentored two students from the Department of Atmospheric Science with their senior Capstone projects. One student worked on the 1820s and 1830s temperature data from Fort Armstrong (Rock Island Arsenal) and the other worked on impacts of the 2012 drought.

The SC, Jim Angel, is a member of the American Meteorological Society (AMS) and the American Association of State Climatologists. He is a member of the AMS Applied Climate Committee and an editor for the Journal of Service Climatology.

Research

The Illinois SCO maintains an active research program, with applied research focused on Illinois and the Midwest. Three articles were published in the past year, addressing the topics of extreme climate records as well as survey results on climate change. Recent projects include an examination of climate change issues in the Chicago area and developing climate tools for the USDA Useful to Useable (U2U) project with Purdue University.

References

Angel, J.R. 2012. *The response of Great Lakes water levels and potential impacts of future climate scenarios.* Chapter 11 in "Climate change in the Midwest: Impacts, Risks, Vulnerability, and Adaptation." Ed. S.C Pryor. Indiana Press.

Prokopy, L., T. Haigh, A. Mase, **J. Angel**, C. Hart, C. Knutson, M. Lemos, Y. Lo, J. McGuire, L. Morton, J. Perron, D. Todey, and M. Widhalm, 2013: *Agricultural Advisors: A Receptive Audience for Weather and Climate Information?* Weather, Climate, and Society, Vol. 5, No. 2, 162-167, doi:10.1175/WCAS-D-12-00036.1

Shein, K., D. Todey, F. Akyuz, **J. R. Angel**, T. Kearns, and J. Zdrojewski, 2012: *Evaluating Statewide Climate Extremes for the United States.* Journal of Applied Meteorology and Climatololgy, Vol. 51, No. 11, 2047-2059, doi:10.1175/JAMC-D-11-0226.1.

Shein, K.A., D.P. Todey, F. Akyuz, **J. Angel**, T.M. Kearns, and J.L. Zdrojewski, 2012. *Revisiting the statewide climate extremes for the United States.* Bulletin of the American Meteorological Society, Vol. 94, 393-402. doi: 10.1175/BAMS-D-11-00013.1

Indiana State Climate Office *iclimate.org*

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Dr. 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
Research at *IClimate* continues to focus on landsurface interactions, turbulent fluxes, crop modeling, the urban thunderstorm environment, land-falling tropical systems and applied climatology. Dev Niyogi, Olivia Kellner, and Xing Liu continued with designated research tasks/involvement in the Useful to Usable (U2U) USDA/NIFA funded project working to transform climate variability and change information into tools for cereal crop producers. *IClimate* research findings were presented at several major conferences across the United States and a number of manuscripts covering research findings were submitted and accepted for publication in 2012.

Additionally *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. *IClimate* continues to work on 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

The state executive director of the Farm Services Agency (FSA) led a series of weekly State Emergency Board conference calls to coordinate emergency agricultural responses to the March 2012 tornado tragedy in Henryville IN. *IClimate* provided preliminary storm documentation for use in federal disaster assistance applications and insurance claims as needed.

IClimate continues as the state co-manager of CoCoRaHS Indiana. By the end of our seventh year in 2012 more than 1830 volunteers have joined CoCoRaHS Indiana with an average 450 actively reporting each day. 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.

The Indiana Climate Services Team held three conference calls during 2012. 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.

Ruth Everhart of Seymour, longest serving cooperative observer in Indiana history, passed away on 13 Oct 2012. The state record now stands at 64 years 347 days.

Monitoring and Impact Assessment

IClimate response to the historical drought of 2012 was a comprehensive effort. The news media appetite for updates on the Indiana situation was nearly insatiable. Scores of interviews were given from May through August. *IClimate* participated on a Purdue Media Day panel at the Indiana State Fairgrounds where national and state media gathered for drought question and answer sessions. Weekly Purdue Extension meetings were attended where drought mitigation plans for agriculture were explored. Interactions with federal and state agencies, such as FSA and the Indiana departments of Homeland Security and Environmental Management, were made through state hosted drought action update webinars. *IClimate* made recommendations to the US Drought Monitor weekly map updates. A drought page on the *IClimate* web site featured weekly weather briefings, outlooks, and time lapse photos of impacted crop fields around the state. Farmers and ranchers in Indiana sought individual help from *IClimate* for specific issues, such as animal mortality assessment and future irrigation planning.

IClimate obtained an AASC SCEP grant to compile current weather statistics and impacts into weekly and monthly state climate reports for the year ending July 2013. A highlights version of the monthly summary is 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 2012 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. *IClimate* purchased two new manual reading ETgages that were installed and monitored in 2012 by the NWS offices in Indianapolis (IND) and Northern Indiana (IWX). Their data are posted to the CoCoRaHS RefET web page.

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

Education

Project involvement for the development of the NSF funded "Dynamics of Climate: A Teacher Professional Developmental Toolkit for Climate Science" continued in 2012 with involvement from Dev Niyogi as co-PI and Olivia Kellner as part of the toolkit development team. Several pilot studies were completed in 2012 before the final hosting of the toolkit dissemination conference planned for spring 2013.

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

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Harry J. Hillaker, State Climatologist

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

Information Services:

The Iowa SC office maintains archives of NWS co-op and first order station data back to the beginning of records. This would include the regular NCDC reports such as *Storm Data, Iowa Climatological Data* and *Local Climatological Data*, as well as the original observations. Access to a multitude of federal and state weather and climate data archives are also maintained. With 137 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 data base 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 90ºF or 100º and minimum temperatures at or below 0ºF, dates of last spring and first fall freeze, as well as extreme annual maximum and minimum temperature and maximum daily precipitation amount. 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 and continuing in 2013.

Outreach:

The office maintains very open communication with the news media with a total of 506 news media contacts this past calendar year. This, combined with preparation of Public Information Statements issued in cooperation with the National Weather Service, and weekly and monthly crop-weather summaries prepared for the USDA provides very wide dissemination of climate products and information. A total of 2,382 inquiries were answered during the past year. Most inquiries were received from government agencies (52%), the news media (21%), attorneys (7%) and insurance (5%). Virtually every major branch of State government utilizes the Iowa SC Office data on a regular basis. Total contacts, and especially news media and state government contacts, were up considerably from recent years, owing to interest in the ongoing drought in 2012.

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 and continuing to the present. Occasional special storm event summaries have also been prepared for the MRCC as part of these grants.

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. In January 2012 the Iowa SC became co-chair of the NOAA Data Stewardship Team. Finally, the Iowa SC attended the AASC annual meeting in Miramar Beach, FL in July 2012 and served as the Secretary-Treasurer of the AASC in 2009 and 2010.

Monitoring and Impact Assessments:

The Iowa State Climate Office is a member of the Governor's Drought Task Force and Flood Task Force and the State of Iowa Hydrology Working Group. 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 for the USDA and U.S. Geological Survey and the office is a regular contributor to the U.S. Drought Monitor. As always, there were many notable extremes of the weather in Iowa in 2012. The most significant was the

major drought. The 2012 growing season began about a month earlier than usual owing to a record warm March. Heat was the rule through much of the year with above normal temperatures in all months except August, September and October. July was noteworthy as the hottest month since 1955. Overall this was the warmest calendar year since 1931. Dry weather was particularly acute in early to mid summer with record low monthly precipitation totals over parts of northwest Iowa in June and southwest Iowa in July. Annual precipitation was amazingly uniform across the state with totals at most locations between 23 and 30 inches. Overall 2012 brought the lowest statewide average precipitation total since 1989, but only the 19th lowest among 140 years of records. Severe storms were much less common than usual with an annual tornado total of only 16, the lowest number since at least 1963. The last tornado recorded in 2012 occurred on May 24, making this the earliest end to the Iowa tornado season since at least 1913.

Kansas Climate Office Annual Summary

Weather Data Library
Department of Agronomy
Mary Knapp

Staff

Kansas has now achieved ARSCO status. As part of the activities leading to this, there were significant changes in personnel this year. At the end of June last year, the office had one full-time staff and one half-time position: Mary Knapp as State Climatologist and Fred Caldwell, electronic technician. In July 2012, Fred moved to full-time, with primary responsibilities for station maintenance. We also added a part-time technician position in western KS, again for weather station maintenance. August 2012, we welcomed Brian Petersen as a full-time programmer. Xiaomao Lin joined in January 2013 in a tenure-track faculty position, and pending signatures from NCDC, will be appointed as the State Climatologist. We are in the recruiting process for an operations manager and a post-doc position. Expectations are that by the end of the year we will have moved from a staff of 1 ½ to a staff of 6 ½ positions.

Research

- Dr. Welch (KSU) and Dr. Cynthia Weinig (Wyoming). Modeling the impacts of solar radiation, amounts and quality, on activity of Arabidopsis.
- Dr. Price on the EASAL project, integrating impacts of climate and weather to vegetative responses shown in NDVI map projects.
- Lee Skabelund (Landscape Architecture) the Green Roof Demonstration project
- Loretta Johnson (Biology) on bluestem adaptation to climate variability. Two publications are in review at this time.

Extension

- Responding to disaster situations, participating in workshops/schools,
    - KsEDEN project,
    - provide precipitation summaries for the USDA,
    - respond to numerous requests for information from various county extension agents and Farm Service agents.
    - Weekly radio shows discussing weather and climate trends and their impact in Kansas.
        - Three one-minute weather presentations weekly for use local radio station, and sent to multiple radio stations across the state.

- Expanding Kansas participation in the CoCoRaHS (Community Collaborative Rain Hail and Snow) network.
    - Attendance at annual WERA 1012 conference
    - Recruiting additional observers
    - Coordinating with NWS Regional CoCoRaHS coordinators

- Work with Dr. Cynthia Arnett (KU) and Dr. Rhonda Janke (Horticulture) on (1) the rain gage/water quality project on the Wakarusa with Tom Huntzinger, (2) putting the Citizen Science materials and CoCoRHS online in an easy form for Friends of the Kaw (FOK) projects to use,
- Collaborate with Stacie Minson on Smoky Hill River Kanopolis Lake Watersheds project.

- Worked with Peter Tomlinson (Extension Specialist) to produce climate summary for inclusion in Efficient Crop Water Use in Kansas, MF3066

General Activities

- Support faculty research activities including preparation of datasets and summaries. Projects include annual summaries for the Agronomy fertilizer trial publications, Cattle Day reports, specialty crops (i.e. Cotton growing degree summaries). Additional projects include datasets for wheat quality research, and work on the Green Roof project.
- Provide support for specialist/county agent programs.
  - Over dozen presentations with 2000+ attendees
  - Kids Field Day - ~300 kids at the field day designed to interest children, particularly in urban settings, in the environment and agricultural research at an early age.

- Presentations at various State and multi-State conferences
  - Water Conference
  - International Grains Program
  - No-Till on the Plains
  - Participate in Annual BSA merit badge conference as badge leader.
  - Climate Change workshops at KU, Pittsburg State University and Wichita Science Café

Inter-Agency activities

- Collaboration with the National Weather Service Forecast offices with responsibility in KS.
- Collaboration with National Weather Service Central Regional Headquarters
  - Attendance at Tribal Engagement Conference
- weekly summaries of drought conditions for Kansas Water Office
- participation in Governor's Drought Taskforce
- Monthly climate reports to the High Plains Regional Climate Center

Automated weather network

Highlights of this year have been continued improvements to the automated weather stations. Currently maintaining 40 stations, and archiving data for an additional 18 stations.

- Standardizing the instruments
- Relocate 4 of the KWO stations to more suitable exposures.
- Representative sites have been augmented with barometric sensors
- All stations have now been upgraded to pak-bus data loggers (Cr1000 or 3000), which will enable standardization of programs and quality control.
- Improve power supply
    - Where possible, stations have been put on direct rather than solar power.
    - For stations with solar power, separate batteries with greater capacity have been deployed for communications and data logger operations.
- Upgrade communications to IP base modems, with 5 min call intervals

Kentucky Climate Center

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

The Kentucky Climate Center (KCC) observed its 35th year of operation in 2012. 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 geoscience, meteorology, and computer science.

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 (http://www.kyclimate.org/), 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. 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 emission dispersion. Papers on these topics were published in Bulletin of the American Meteorological Society and Applied Geography. Faculty also contributed to the forthcoming National Climate Assessment Report.

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, Applied Geography Conference. They have also presented papers at number of state and regional professional meetings and workshops. In addition, faculty also made invited presentation internationally.

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. In response to demands during the Drought of 2012, the KCC provided various interviews to the TV, radio, and newspaper media.

KCC representatives were featured speakers at events held or sponsored by the Kentucky County Judge Executive Association and the Kentucky Chapter of the American Planning Association. The KCC also maintained an active working relationship with local schools and with NOAA National Weather Service forecast offices throughout Kentucky.

Monitoring and Impact Assessments

Expansion of the Kentucky Mesonet (KM) continued. Sixty-four 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. Five mesonet stations include probes for monitoring soil moisture and temperature.

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

During the Drought of 2012, the state climatologist led three trips to the drought-stricken portion of western Kentucky to assess impacts and visit with farmers and representatives of the agricultural sector.

The KCC also provided monthly climate impact reports to the Midwestern Regional Climate Center and disseminated those reports through the KCC website.

Louisiana State Climatologist

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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 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 at the following URL: <www.losc.lsu.edu>. This report is also e-mailed to over 100 recipients

across Louisiana, including most television weather-casters in the State, concerned State Office Officials, as well as the National Weather Service Offices that serve Louisiana. The Office also provides a weekly summary of Louisiana Climate Data to the National Agricultural Statistics Service (NASS) that is published weekly in the *Louisiana Crop Weather Summary.* In addition to these weekly products, the LOSC also produces monthly summaries of the State's Climate data, which is also available on the LOSC website. The office also produces event-based summaries for significant weather events that impact Louisiana. The LOSC is also active on the ad hoc committee of the *U.S. Drought Monitor*. 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 2012. In 2012, I was quoted in the following newspapers; *Los Angeles Times* -2, *The Advocate* – 7 (Baton Rouge), *Times-Picayune* - 4, *The Reveille* – 2, *Houma Courrier* – 1, *Biloxi Sun Herald* – 1. I was interviewed at least 71 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 on WBRZ, Channel 2. Interviewed by WBRZ-Channel 2 twice, and WAFB-Channel 9 once. In 2011,I was interviewed by KMAR Radio 15 times, by WJBO Radio 2 times, by the Associated Press 2 times, was on the Moon Griffon Show twice, Louisiana Public Radio twice, and Talk Radio of Baton Rouge (107.3 FM) twice.

Research

Shankman, D., B.D. Keim, T. Nakayama, R. Li, D. Wu, and C. Remington. 2012. Hydroclimatic Analysis of Severe Floods in China's Poyang Lake Region. *Earth Interactions* 16, Article No. 14. DOI: 10.1175/2012EI000455.1

Needham, H.F., and B.D. Keim. 2012. A Storm Surge Database for the U.S. Gulf Coast. *International Journal of Climatology* 32(14):2108-2123. DOI: 10.1002/joc.2425.

Shankman, D., C. Lafon, and B.D. Keim. 2012. Western Range Boundaries of Floodplain Trees in the Southeastern United States. *Geographical Review* 102(1):35-52.

Michigan State Climatological Resources Program:

2013 AASC Annual State Climate Office Report

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The Michigan Climatological Resources Program (MRCP), 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.

ARSCO Qualifications

The MRCP 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 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

There were several major unusual weather and climate anomalies during 2012, highlighted by an unprecedented March heat wave and a severe drought during the late spring and summer. This resulted in an dramatic increase in the number of requests for climate information, interviews, and speaking engagements. The total number of formal public requests for climate-related data and information in 2012 was 121, 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 is up from 102 in 2011. The average amount of payment received per billable request was $40.46. These numbers suggest at least a temporary leveling off of a 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 rapidly, with collectively more than 20,882 hits per day on average in 2012 (an increase of more than 100% from 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 2012, the MCRP staff provided 69 interviews to print, radio, and television media (up from 23 in 2011) and 29 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 2012, 35 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 2012, staff at MCRP authored or co-authored 2 refereed articles, 1 book chapter, and 10 non-refereed articles and technical reports. MCRP was associated with 5 new external grants during 2012 (totaling $31,884), 8 grants in force from previous years, and 12 new grant proposals submitted.

Minnesota State Climatology Office

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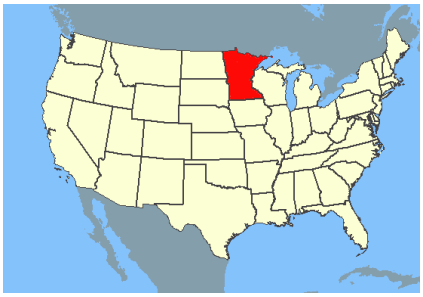

The Minnesota State Climatology Office (MN_SCO) exists to manage, analyze, and disseminate climate information in service to the citizens of Minnesota. The MN_SCO is funded by the State of Minnesota Department of Natural Resources - Division of Ecological and Water Resources, and housed at the University 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 (including the media)
- 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 2012, the MN_SCO was called upon to provide data sets and counsel to numerous researchers investigating topics involving atmospheric science.
- The MN_SCO participates in three advisory committees tasked to provide guidance concerning climate change adaptation research and outreach.

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.

Mississippi State Climatologist
Annual Report for 2012-2013

Effective January 1, 2013 Dr. Charles L. Wax retired from Mississippi State University. Dr. Wax served at a member of the faculty at MSU for 30 years and State Climatologist since 1984. His presence as a faculty member and in the state climate office is greatly missed.

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 20 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 has been working with a group of other MSU faculty on a funded project to increase awareness of the Geosciences, specifically Climate and Weather among under-represented groups. Week-long workshops provide teachers the physical and educational tools necessary to effectively engage middle-school students in the climate sciences.

Outreach activities have focused on helping the public gain a general understanding of Climate vs. Weather and to clear-up common misconceptions related to each. 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. Agricultural interests, who are quite diverse in Mississippi, still command the greatest interest in terms of the number of speaking engagements. A concerted effort is underway to provide a more complete education program to 4-H, boy scouts, girl scouts, FFA, and other youth organizations in the region.

Research activities this past year continued to included the 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.

Many Geoscience faculty, including the SC, at MSU are undertaking a multi-faceted (empirical, modeling, remote sensing) approach to understand the role of the "Delta" forest interface on the climate of Mississippi. Additionally, the SC recently completed a study looking at the probability of a lightning strike at large venue events in the southeast region of the U.S.

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

- Former SC 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 Clarion Ledger, Jackson, MS, on climate and ag in Mississippi
- Presentations on weather to six 4-H Clubs in east-central Mississippi.
- Weather Hazards and Safety presentations to numerous civic organizations.
- "Weather Processes and Stability Classes in Mississippi." Shortcourse for Southern Region Foresters on Prescribed Burning, Mississippi Cooperative Extensive Service, Mississippi State University, Mississippi State University.
- Presentation to Campus – Community Emergency Response Team (C-CERT) on a Disaster Resistant University.

Conference presentations:

- B. Gutter, D. Cox, **M. E. Brown**, 2012. Investigation into Whether Vegetation Discontinuities Related to a Tornado Scar Can Enhance Convection. 10th Southeast Severe Storms Symposium.
- K. Sherman-Morris, **M. E. Brown**, K. Brown, B. Bell, P. Jackson. 2012,. Warning Confirmation and Response in the 2011 Smithville, MS, Tornado, 2012. 106th Annual Association of American Geographers, New York, New York.
- Schummer, M. L., R. M. Kaminski, C. L. Wax, **M. E. Brown**, A. H. Raedeke, A. Petrie, and J. Tirpak, 2012. 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 in Ottawa, Canada.

Grants funded:

- NOAA / COMET: Mesoscale Sounding from GOES and GOES-R during Variable Cloud Conditions.
- NSF: Teacher Education & Activities for Minority Students in the Meteorological, Geologic, and Hydrologic Hazards.

Publications:

- Brown, M. E., and C. L. Wax. 2012. Thunderstorms, Lightning Strikes, and Tornadoes in Mississippi. MAFES Bulletin 1198, Mississippi Agricultural and Forestry Experiment Station, Mississippi State University
- Brown, M. E. et al, 2013. (in press) Lightning Related Risk to NCAA Football Stadiums, Natural Hazards and Earth Systems Science
- Gutter, B and M. E. Brown, (in press) Understanding the role of tornado scars in the development and enhancement of convection, Journal of Operational Meteorology

MISSOURI CLIMATE CENTER 

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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 2012, 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. Throughout 2012, the Missouri Climate Center posted timely monthly weather and climate impact reports for the state of Missouri as part of the State Climatologist Exchange Program.
- An agricultural weather forecast is developed by the undergraduate assistants every morning and e-mailed to all the county extension offices in Missouri;
- Over 4000 lines of data arrays are collected daily from a network of 30 automated weather stations associated with the Extension Commercial Agriculture Automated Weather Station Network. 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.
- Continued development and recruitment for an e-mail delivery agricultural weather product called Horizon Point. Horizon Point is a custom weather analysis system for farmers and provides an opportunity to have specific weather reports sent directly to their e-mail address. Currently over 500 Missouri agricultural producers and agents are enrolled.

Information Services:

- Submitted numerous press releases and updates to the Extension news service related to weather, climate and the environment;
- Serve as an information source for the media including national, state, and local mediums;
- Fulfilled hundreds of requests for climate information and provided climatological expertise to numerous individuals, groups and agencies;
- Submit weather and soil information published in a national bulletin **Weekly Weather and Crop Bulletin:** http://www.usda.gov/oce/weather/pubs/Weekly/Wwcb/
- Run the 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);

Research:

- The Extension Commercial Agriculture Automated Weather Station network has provided opportunities for educational programs, teaching, research, innovation, discovery and service to communities. It has led to the development of state-of- the-art information delivery systems, including transitioning 18 weather stations to wireless telecommunication and real-time weather data dissemination for local, state, and national outlets as well as public, private and federal entities. In 2011, the average number of actual internet visits made to our18 real-time weather web sites was over 337,000 per station, or, over 6,000,000 visits.
- Providing real-time weather status to 18 weather stations in the Commercial Ag Automated Weather Station network for Integrated Pest Management;
- Provide climate data for graduate students and faculty research projects
- Continued participation 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.
- Co-Authored a paper accepted in National Weather Digest. Lupo, A.R., N.B. Smith, P.E. Guinan, and M.D. Chesser, 2012. The long-term climatology of the Missouri Region dew points and the implications for regional climate and human comfort. Accepted *National Weather Digest*. (25%)

- Co-Authored a paper accepted in the Transactions of the Missouri Academy of Science. Dawson, N.W., A.R. Lupo, and P.E. Guinan, 2012. A Long-Term Study of Tropical Systems Impacting Missouri. *Transactions of the Missouri Academy of Science, in press.* (33%)

Outreach: Education, Awareness, and Contact Activities

- Guest lecturer for *Environmental Science 1100*. Dr. Clark Gantzer, Instructor. University of Missouri, Columbia, Sanborn Field tour. Topic: Automated weather station monitoring and application.
- Guest lecturer for *Ag Systems Management* class. Dr. Allen Thompson, Instructor. University of Missouri, Columbia. Topic: Automated Weather Station Application for Irrigation Scheduling.
- Guest lecturer for *Natural Resources 3290, Hydrologic Measurement Techniques*. Dr. Jason Hubbart, Instructor. University of Missouri, Columbia. Topic: Measuring climate and automated weather station monitoring at Sanborn Field.
- Weather presentation to numerous field days across the state;
- Missouri Drought session at MU's Annual Crop Management Conference;
- Gave several "Drought" "Historical Climate Trends" and "Climate Change" talks across the state including Master Gardener and Master Naturalists groups
- Weather updates for MU Extension Quarterly Ag-Marketing Teleconferences;
- 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 North Central 1179 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
- Information resource for the following media outlets: BBC, Weather Channel, NPR, Agri-Talk, Missouri Net, Brownfield Network, Cooperative Video Group, and numerous local television, radio, and newspaper outlets across the state;
- Participated in several NOAA Climate Service and Drought webinars hosted by the National Weather Service Central Region.
- Participated in several NOAA Climate Service and Drought webinars hosted by the National Weather Service Central Region.
- Collaborating Missouri State University Research Professor in Horticulture in accessorizing the Mountain Grove weather station with real-time leaf wetness monitoring at the State Fruit Experiment Station. The leaf wetness data will used by a graduate
- Student conducting research at a vineyard near the weather station.

Nevada State Climate Office

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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.

During the first half of CY 2012, the NSCO was overseen by Dr. Kate Berry, Acting State Climatologist and Director of NSCO. On 1 July 2013, Dr. Douglas P. Boyle was appointed the new Nevada State Climatologist and Director of the NSCO. Dr. Boyle is also an Associate Professor of Water resources and Climate Change within the Department of Geography at the University of Nevada, Reno (UNR). Dr. Boyle was hired in his current position at UNR in July 2010 under the NSF EPSCoR Nevada Infrastructure for Climate Change Science, Education, and Outreach project which aims to create a statewide interdisciplinary program that stimulates transformative research, education, and outreach on the effects of regional climate change on ecosystem services, especially water resources, and supports the use of this knowledge by policy makers and stakeholders. Under this project, Dr. Boyle has become directly involved in a number of research efforts aimed at issues related to water resources and past and future climate change in Nevada, the Great Basin, Tibet, and South America.

ARSCO Qualifications: The NSCO is the AASC-designated state climate office for Nevada. The following activities address each of the Office's ARSCO qualifications.

Communications capabilities

- The NSCO website (http://www.climate.unr.edu) is undergoing a complete redesign. The new page is still under construction but there are now new features available to provide users with information on the current drought conditions, seasonal forecast information, weather conditions and forecasts, and information and reports on the activities of the Nevada State Drought Response Committee. A student hourly has been hired to continue making modifications to the web page to improve our ability to effectively communicate climate information to the public.

- A new 65" monitor and video software system was purchased and installed in the Departmental "glass case" outside the NSCO. A wide range of different climate and weather related information is currently displayed on the monitor and updated regularly.

Information services

- The NSCO has provided numerous interviews regarding the current climate and drought conditions with the Las Vegas Sun, Reno Gazette Journal, Clear Sky Group, and Ruby Radio in Elko, NV, Fox News Channel 11.
- I have provided two separate interviews for UNR Journalism students, Erin Collins and Kathryn Sonner.
- The NSCO has handled many email and phone requests (new system to log each request will be implemented in AY 2013). These were primarily for Nevada State Agencies, prospective wind and solar energy companies, potential greenhouse-based produce companies, and local, state, and federal agencies.
- The NVSCO continues its state mandated responsibility of providing a quarterly state climate summary. For years, certain characteristics of the existing report format have resulted in the quarterly reports being published 2-3 quarters after the reporting period ends. We are currently redesigning the entire report format, content, and scope with the goal of providing a much more timely product on the current climate conditions. We expect the new format to become operational in the 2nd or 3rd quarter of 2013. Ultimately, we would like to move from quarterly to monthly reporting in the future with improved coverage of eastern and southern Nevada.

Research

- A major project was initiated to digitize all of the archived "paper" data sheets and metadata for the historical NSCO meteorological network. Two undergraduates and an intern worked through the entire fall 2012 and will continue through most of CY 2013 on this project. A new GIS database was developed and launched on our server to store the digital information and make it available (eventually) to the general public. While this initial effort is not really considered “research,” when completed, a detailed analysis of all of the historical data will be performed with UNR faculty, students and others to assess the quality, completeness, and quality of the historic information and make recommendations on how to move forward with the NSCO data collection efforts in the future.
- The NSCO began a project designed to simulate the new USDA drought declaration criteria over the entire historic period of the Drought Monitor product. Initial analysis is completed and figures are being made for a publication in an applied climate services journal.
- Efforts are underway to improve our understanding of abrupt climate changes in the past through several modeling studies of pluvial lakes in a north-south transect of the Great Basin.

Outreach

- I participated in a significant number of operational meetings related to flood, drought, and other climate related issues. As the State Climatologist, I actively participated in the Nevada Drought Response Committee (DRC) and we had operational meetings roughly every two weeks at the emergency operations center in Carson City from July through September 2012. The purpose of these meetings was to determine when to recommend declaring drought in different parts of the state based on the Nevada Drought Plan. I also meet with the Nevada Governor's staff regarding the official drought declaration by the Federal Government in July 2012. Separate from the DRC meetings, we also had meetings every 2-3 weeks with the different Drought Task force groups established in the state from July through October 2012.
- In response to the potential for significant flooding along the Truckee River, I represented the NSCO and UNR at the emergency meetings organized by Nevada Emergency Management at the Emergency Operations Center in Reno on 30 November and 1 December 2012. I also attended several emergency meetings organized by the Reno NWS office to discuss and review possible severe weather events in northern Nevada in 2012.
- I made two public presentations on the climate, drought, and impacts to Nevada – one to a local chapter of the Lions Club and one to the local chapter of the American Society of Civil Engineers.
- I worked with a sophomore student at Pershing County High School in Lovelock, NV who has installed thermal activated cameras and climate sensors near wildlife water guzzlers at several remote locations in northern Nevada in order to understand animal behavior and activity. The student was one of two finalists in Nevada this year (2013) at the student state science fair competition and received an all expenses paid trip to compete in the Intel International Science and Engineering Fair in Phoenix, AZ in May 2013.
- I represented the NSCO at the American Society of State Climatologists in Destin, FL, 9-13 July 2012. This was the first time the office was represented at the annual meeting in several years.
- I attended the Great Basin Climate Forum, DRI, Reno, NV, 17 October 2012
- I planned to attend the Annual WERA Meeting, Corvallis, OR, 13-14 November 2012 but, due to a case of the flu, participated briefly over the phone for part of the meeting. I hope to attend the entire meeting in person in 2013.

New Hampshire State Climate Office

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

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

In keeping with this mission, the NHSCO has focused on providing the public with quality and timely information on weather and climate though research, outreach activities, production of online materials, regular media interviews and dissemination of data and analyses to the user community.

ARSCO Qualifications
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, through outreach and academic publiscations, 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. The NHSCO also hosts a Twitter page (@nh_sco) followed by national and state government offices and officials, news and nonprofit organizations, educators, students and weather enthusiasts. These online media outlets and others are the primary venues for publication of state and regional climate summaries, datasets, analyses and graphics as well as formal reports on weather conditions, significant events and impacts.

Information Services:

Throughout the year, the NH State Climatologist provided weather and climate information, including data, seasonal summaries and outlooks as well as expert analysis of severe weather events, to individuals, organizations, state agencies and the public. The NHSCO regularly responds to data requests, produces formal reports, fact sheets, public information statements and website content and has 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 data compilation, analysis and visualization for, as well as writing, press releases. The NH State Climatologist also conducted interviews published in print media and given in person by telephone, Skype, in studio and on location radio and television broadcasts. Top media stories from summer 2012 through the spring of 2013 include: summer 2012 drought and heat waves, Hurricane/Extra-Tropical Storm Sandy, regional climate change impacts and the politics of climate change.

Research:

The NH State Climatologist and colleagues presented results of ongoing research at regional and national conferences and published research results in peer-reviewed literature. The NH State Climatologist is a participant in "Albedo Climate Regulation" research group supported by NH-EPSCoR and co-authored presentations on year one results at the June 2012 Eastern Snow Conference, 2012 Fall Meeting of the AGU, and the AMS 20th Conference on Applied Climatology in January. This work was also accepted for publication by *Hydrological Processes* in the spring of 2013. Results of research on the influence of politics and weather on public perceptions of climate change was published in *Weather, Climate and Society* online in January and in print in May 2013. Results of this research received regional, national and international attention and was covered extensively in both popular and scientific media including *Science Magazine's* "News of the Week."

The NHSCO also collaborated with state agencies, providing climate data and analyses for state environmental management and planning activities. The NH State climatologist remains an active

member of the NH Drought Management Team and worked with NHDES and UNH faculty to revise the state drought management plan. The NHSCO worked with research and field scientists at the US Forest Service Durham Field Office to develop a growing degree-day climatology in support of pest management planning activities. This dataset will be used by the US Forrest Service to plan when and where to spray for harmful and invasive insects in New Hampshire based on when the insects will most likely reach the required stage of development. The NHSCO is also working with the NH Department of Health and Human Services to address heat and human health issues in the Seacoast region of New Hampshire.

Outreach:

Given the importance of community engagement and the public demand for quality, scientific information on climate science issues, the NHSCO has made a strong commitment to community outreach. The NHSCO is very involved a variety of outreach programs and activities

and regularly give presentations to schools, organizations, businesses and academic institutions. The state climatologist is a co-coordinator for NH CoCoRaHS and gave four CoCoRaHS workshops for educators, including two NHSTA presentations, with UNH Leitzel Center faculty. The NH State Climatologist also participating several state and university outreach including serving as a panelist in the fall 2012 Science Café, Women in Science and Technology forum, and the Carsey Institute Media Training workshop sponsored by UNH Media Services. The NH State Climatologist also serves on the Mount Washington Observatory (MWObs) Board of Trustees holding positions on both the Scientific and Technology Advisory Committees.

Monitoring and impact assessment:

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 and launch the NH CoCoRaHS network. In addition to hosting a CoCoRaHS station, the State Climatologist is a NWS COOP observer and is the point of contact for the two NOAA Climate Reference Network (CRN) stations located in southern New Hampshire. The NHSCO also produces weather and climate impact summaries and reports for state agencies and the media.

Office of the New Jersey State Climatologist

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ARSCO Annual Report: June 2012 - May 2013

The Office of the New Jersey State Climatologist (ONJSC) has experienced another successful year of providing climate services to meet the ever-growing needs of the 8.7 million Garden State residents, stakeholders and decision makers. As we serve all within the NJ community and, on occasion beyond, we continue to be mindful of our mission to: 1) gather and archive NJ weather and climate observations, 2) conduct and foster research associated with NJ's weather and climate, and 3) provide critical climate services to all seeking assistance. Our main website is <http://njclimate.org>.

The ONJSC operates the New Jersey Weather and Climate Network, or NJWxNet. This unique network of 56 weather stations http://njwx.org serves as a one-stop Internet resource for New Jersey weather and climate data. The NJWxNet includes 32 NJ Mesonet sites, monitoring a rich suite of atmospheric and surface variables, and 24 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. We also access data from NWS, USGS, NJDOT and other networks to augment our observations.

In cooperation with the Delaware DEOS network, we continue to improve metadata and have begun to upgrade network quality control. We also have a new database and website in beta testing that includes observations from our stations every 5 minutes. Over the past year, support for these activities has come from the NJ Department of Environmental Protection, NJ Office of Emergency Management, US Forest Service, and Global Science and Technology Inc (via a National Weather Service grant). . Using network data, we continue working with NJ agriculture extension colleagues to develop indices for blueberries and apples and with these individuals and others at Cornell on 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 fifth 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. 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, weekly and monthly 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. This included 17 events this past winter, more than double the 7 the previous winter. Despite having just under average seasonal snowfall, the 17 events numbered 3-4 more than the winters of 2009/10 and 2010/11, when twice normal snow fell.

Research endeavors within the ONJSC range from student projects on topics such as climatologies of tropical rainfall and tornadic 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, as will a statewide snowfall climatology. 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 350 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, and published in the "Weather Shelter" newsletter of the North Jersey Weather Observers.

The two big weather/climate stories of the past year were the record warmth of the 2012 calendar year, including the end of a record 21 consecutive month string of above average temperatures in November, and of course Hurricane Sandy. The deadliest and most destructive storm on record in New Jersey, Sandy was a landmark event for the ONJSC. We supplied over 90 interviews to the media prior to, during and in the weeks following the storm. The NJWxNet provided 5-minute data to the governor and others at the state emergency management headquarters, to the NWS, to the media, and to thousands of others via a web dashboard. With the majority of our stations solar powered or at locations with generators (e.g. emergency management offices and state police barracks), with cellular communications mainly remaining operational and with the

emergency generator at the university's computer center remaining fueled, we maintained 5 minute contact with well over 40 of the stations throughout the storm and days afterward. Additionally, the storm readiness of our stations resulted in the loss of only one anemometer during the storm. Almost 200 CoCoRaHS observers provided storm totals and anecdotal information on damage. The over 12" observed by a Cape May County volunteer exceeded totals observed at NWS or NJWxNet stations by at least several inches. Multiple requests each week for data and consultation continue to arrive more than six months after the storm and requests continue to arrive for presentations focusing on the event.

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

Communication capabilities

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

Information Services

- More than 500 specific requests for data and products each year.
- More than 500 unique visits to ONJSC web sites each day.
- Weekly and monthly climate summaries in map and 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, homeland security.
- Student research on topics such as urban heat islands, state snow cover variability, 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 Chapter of the Solid Waste Association of North America, the National Transportation Research Board, the Raritan-Millstone Flood Commission, the NJ Bar Association (and approximately two dozen other organizations).
- 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.
- The NJ State Climatologist is a member of the NJ Drought advisory committee.
- Statewide climate variability and change is being assessed through the NJ Climate Report Card project. <http://climate.rutgers.edu/stateclim_v1/climreportcard/climate_report_card.html>

New Mexico Climate Center

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General Information

The New Mexico Climate Center (NMCC) resides within the Department of Plant and Environmental Sciences at New Mexico State University in Las Cruces, New Mexico. The climate center is comprised of one faculty position, a staff position, and 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, state, and private observing stations throughout New Mexico. Additionally, the NMCC maintains a network of automated weather stations throughout the state that are used primarily for agricultural decision making. Many requests for data and information were also answered by phone and email. In addition, the NMCC provided a variety of web based tools for decision support in the areas of drought, air quality, agriculture, hydrology, construction, and economic development. The Center also supported the Drought Task Force's Drought Monitoring Workgroup during monthly conference calls.

Research

Our research activities in 2012 consisted of applied climate research in which climatic information was used for studies involving drought, crop improvement, irrigation/water management, and air quality studies. The Climate Center continued to be funded with grants and contracts with a continuation of a four year air quality and health study covering southern New Mexico. The Climate Center continued to work closely with the Climate Assessment of the Southwest program at the University of Arizona to continue work in the area of climate services, and seasonal predictions of air quality.

Outreach

Much of our outreach focused on drought and its impacts to NM. In fact every presentation that we gave had some of all of it on drought. We continued our outreach using Twitter (@nmclimate) and Facebook for providing climate and drought information to the public. We maintained our air quality blog and started a new climate blog for our Center. We participated in numerous outreach activities in public schools and community events including Master Gardeners groups promoting climate awareness and CoCoRaHS.

Peer Reviewed Publications

Kavouras, I.G., G. Nikolich, V. Etyemezian, D.W. DuBois, J. King, and D. Shafer (2012). In situ observations of soil minerals and organic matter in the early phases of prescribed fires. Journal of Geophysical Research, Vol. 117, D12313, 2012 doi:10.1029/2011JD017420

Technical Reports

DuBois, D. and E. Ward (2012). Study IIg Distribution of Air Quality Related Chronic and Infectious Diseases 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. June 30, 2012

DuBois, D. and E. Ward (2012). Study IIf Pollen Measures and Dispersion Studies in FY12 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. June 30, 2012

DuBois, D. and E. Ward (2012). Study IIf Studies of Fungal Spore Dispersion from Confined Animal Feeding Operations (CAFOs) in FY12 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. June 30, 2012

DuBois, D. and E. Ward (2012). Study IId Assessment of Air Quality based on Past and Ongoing Monitoring Data in FY12 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. June 30, 2012

DuBois, D. and E. Ward (2012). Fiscal Year 2012 Final Technical Report 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. June 30, 2012

DuBois, D., J.P. Margez, R. Armenta, E. Smith, and M. Bleiweiss (2012). Columbus/Palomas aerosol saturation study: final report. Submitted to the EPA Border 2012 Rural Task Force. June 25, 2012.

Presentations and Posters

DuBois, D. (2012). Evapotranspiration 101. Presented at the New Mexico Association of Conservation Districts 66th Annual Conference, 30 October 2012, Las Cruces, NM

Muhammad, B., J. Nichol, M. Bleiweiss, and D.DuBois (2012). Retrieving MODIS Aerosol Optical Depth in real time at 500 m resolution: urban-scale evaluation over Hong Kong. Presented at the European Aerosol Conference, September 4, 2012, Granada, Spain

DuBois, D. (2012). World Weather and Climate. Presented at the 2012 Chile Pepper Conference, Las Cruces, NM

DuBois, D. (2012). Our Climate: Past, Present & Outlook. Presented at the "Focus on the Future: Water and Energy in Southern New Mexico" Energy and Water Conference, Ruidoso, NM, April 20, 2013

DuBois, D. (2012). Low Cost Options for Air Quality and Meteorological Monitoring. Presented at the US EPA Air Monitoring, Rural Task Force, El Paso, TX

DuBois, D. (2012). Training workshop for the Community Collaborative Rain Hail and Snow network (CoCoRaHS) for the City of Las Cruces, Lush and Lean Workshop Series, Las Cruces, NM

DuBois, D. (2012). Our Climate Outlook. Presented at the Native Plant Society Annual Conference August 10, 2012, Alamogordo, NM

DuBois, D. (2012). Multi-Sectoral Impacts of the Current Drought in Southern Great Plains. Presented at the Spring 2012 Southern Great Plains Drought Assessment and Outlook Forum April 26, 2012, Lubbock, TX

DuBois, D. (2012). Summer 2011 Wildfire Response from the NM State Climate Office. Presented at the Southwest Fire Ecology Conference, Santa Fe, NM

DuBois, D. (2012). Long Term Weather Outlook. Presented at the Southwest Beef Symposium January 18, 2012, Roswell, NM

DuBois, D. and M. Bleiweiss (2012). Dust plume identification for human exposure of regional dust events using remote sensing. Presented at the Third Symposium on Environment and Health during the 92nd American Meteorological Society Annual Meeting, New Orleans, LA. January 25, 2012

DuBois, D. (2012). Dust and Valley Fever work in New Mexico. Presented at the Valley Fever and Airborne Dust Forecasts and Simulation Workshop. Tucson, AZ, January 12, 2012

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Mr. John McGuire, Environmental Meteorologist & Developer
Ms. Heather Dinon Aldridge, Applied Climatologist
Ms. Rebecca Cumbie, Extension Climatologist
Mr. Greg Deleruyelle, Administrative Support Specialist

A comprehensive annual report is available at:
http://www.nc-climate.ncsu.edu/PDFs/office/reports/SCO_Annual_Report_2013.pdf

Climate Information Services

Requests for Services: Direct requests from clients via email and phone during 2012-2013 resulted in a **17% decrease** in time spent directly responding to requests for services from clients as compared with the previous year.

Website Usage: The volume of unique visitors **increased by 49.4%** (392,850) over the previous year. Overall, the SCO website has received over half a million visits (521,887), **an increase of 39.2%** from the previous period last year.

Climate Database Usage: Users requested more than 4.7 million data queries through the CRONOS interface – an increase of 600,000 over the previous year. With over 46000 stations in the CRONOS database, we are currently archiving and providing access to over 210 billion observations. We are averaging about 2.5TB of internal climate data transfer each month with 1.25 billion data records selected, updated, or inserted each month.

CRONOS API: An application programming interface (API) continues to be developed to allow authorized users to access CRONOS data without going through the web interface. This tool allows for development of web services that will facilitate internal and external data use, allowing staff, students, and collaborators access to data for research and product development

without requiring SQL expertise. In the past year, there were over 3 million API queries, which represent an increase of 1.4 million over the previous year.

Environment and Climate Observing Network (ECONet) - the NC Mesonet

Station Maintenance: 64 site trips were made over the past year to perform routine or emergency maintenance covering nearly 15,000 vehicle miles.

New / Upgraded Sensors: Wind sensors at 6-meter heights were added across the network National Fire Danger Rating System requirements. New, more robust precipitation gauges were also installed across the network in the past year. Leaf wetness sensors have also been installed at 18 locations with additional deployments in the summer of 2013. Multi-depth soil temperature and soil moisture probes were installed at 12 locations. The soil temperature probes were developed in-house, as no commercial version of this sensor currently exists. If these prove robust, additional sensors will be installed in later years.

Climate Support for Agriculture

In 2012, we continued our support for operational Peanut Disease Advisories, Thrips Risk assessments, Late Blight monitoring in potatoes and tomatoes, and dispersion and technology support for the national ipmPIPE for Cucurbit Downy Mildew. Each of these projects were in collaboration with partners in NCSU Plant Pathology. We also continued our weekly drought monitoring to support water and agricultural management.

Climate Support for Forest and Natural Resource Management

Fire Weather and Smoke Guidance: With support from NC Forest Service, SCO has developed a Fire Weather Intelligence Portal that includes map-based web tools to visualize fire risk using the National Fire Danger Rating System and inputs from all CRONOS observations. In addition, SCO has tested a preliminary tool to provide improved smoke dispersion guidance based on previous research and effort on the ipmPIPE for Cucurbits. This tool was released in June 2013 for broad fire community testing and use.

PINEMAP: 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 serves 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.

DOI Climate Science Center: NCSU hosts the DOI/USGS SE Climate Science center that focuses on climate research focused on impacts to ecology and conservations. In 2012, we began work to summarize the utility of downscaled climate change projections with emphasis on the needs of ecological applications in the southeastern US. This initial report, created with the input of ecologists across the Southeast, led to a workshop hosted in May 2013.

Climate Decision Tools for Water Resources

Precipitation Monitoring and Alerts for DOT Stormwater Management: NC DOT continues to support the SCO to provide radar-based precipitation alerts and monitoring tools. There are currently 418 active user accounts for this product with 1,310 active sites monitored. This partnership with NC DOT has received 3 state and national awards.

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 Dr. Arumugam. With funding from the NC Water Resources Research Institute and the Urban Water Consortium, SCO focused this past year on automating and delivering monthly and seasonal forecasts for reservoir inflow and storage.

Applied Research

Presentations and Publications

- 3 manuscripts were successfully published in peer-reviewed journals
- 6 manuscripts are in development or currently in submission
- 10 presentations were given at 4 scientific conferences
- 5 staff and students attended 4 scientific meetings and conferences
- Joseph Taylor won best oral presentation at the 20th AMS Conference on Applied Climatology

Predicting observed soil moisture using statistical modeling: In order to improve quality control of ECONet soil moisture data, and prediction of missing data, a statistical ARIMA model has been developed to predict an observed value. The research done in this project is currently being implemented into a quality control routine for soil moisture for the ECONet soil moisture data. This research received awards from the NCSU Undergraduate Research Symposium, Sigma Xi, and the American Meteorological Society.

USDA High-Resolution Drought Triggers: A Standardized Precipitation Index (SPI) algorithm that uses Multi-sensor Precipitation Estimates (MPE) in its calculation was developed by Texas A&M University (TAMU). SCO was awarded a project with partners at TAMU and Purdue University to produce a routine SPI product based on MPE. This product is now available in an experimental form and has undergone beta testing since winter 2012. Two additional gridded drought indices, the Palmer Drought Severity Index and the Standardized Precipitation Evapotranspiration Index, are planned for addition to the tool in 2013. Collaborators are John Nielsen-Gammon (TAMU) and Dev Niyogi (Purdue).

Localized Climate Extremes Index: A localized version of the Climate Extremes Index that also includes severe weather events, winter weather events, and tropical activity was developed. This localized index will also be flexibly crafted to allow for adaptation for other states. Currently the index methodology has been evaluated for North Carolina, Florida, and South Dakota. Collaborators include Melissa Griffin and David Zierdan (Florida Climate Center) and Laura Edwards (South Dakota State University Extension).

Educational Outreach

Undergraduate & Graduate Student Training

- SCO supported 9 undergraduate and 4 graduate students over the past year.

Invited Presentations and Visitor Programs

- Total Direct Educational Outreach Contact Hours: 38,674
- SCO staff provided 20 presentations by invitation
- SCO provided tours and programs for 24 visitor groups.
- SCO participated in several large group events, including StormFest, the NC Science Festival, and NC Science Olympiad

Climate Science Communication via Social Media

- In 2012, we transitioned from a monthly newsletter to an online blog containing news and updates sent out on a more frequent basis.
- 525 individuals and group listservs are currently receiving notifications of new entries via email and Twitter.

Centennial Campus Magnet Middle School Internship: SCO hosted two 8th grade student interns from Centennial Campus Magnet Middle School (CCMMS) from mid-October 2012 through early March 2013. This is the 10th 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.

Community Collaborative Rain, Hail & Snow Network (CoCoRaHS):
We led the establishment of CoCoRaHS in North Carolina in 2007 and over the past year we have been trying to recruit new volunteers for the program, especially encouraging participation from local schools and areas with data gaps.

North Dakota State Climate Office

Dr. Adnan Akyüz, State Climatologist, North Dakota
Assistant Professor of Climatology
231 Walster Hall, North Dakota State University
Ph: 701-231-6577/ Fax: 701-231-7861
E-Mail:Adnan.Akyuz@ndsu.edu
Web: http://www.ndsu.edu/ndsco

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

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

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

Peer Reviewed Publications

1. Shein, K. A., D. P. Todey, F. A. Akyüz, J. R. Angel, T. M. Kearns, J. L. Zdrojewski, 2012: Revisiting the Statewide Climate Extremes for the United States. Bulletin of Atmospheric Science. AMS. DOI: 10.1175/BAMS-D-11-00013.1 (In Print)
2. Shein, K. A., D. P. Todey, F. A. Akyüz, J. R. Angel, T. M. Kearns, and J. L. Zdrojewski, 2012: Evaluating Statewide Climate Extremes for the United States. Journal of Applied Meteorology and Climatology. November 2012. Vol. 51, No. 11. 2047-2059.
3. Rijal, I., X. Jia, X. Zhang, D. D. Steele, T. F. Scherer, and A. Akyüz. 2012. Effects of Subsurface Drainage on Evapotranspiration for Corn and Soybean in Southeast North Dakota. J. of Irrigation and Drainage. DOI: 10.1061/(ASCE)IR.1943-4774.0000508.
4. Leelaruban, N., P. Oduor, A. Akyüz, S. Shaik, G. Padmanabhan. 2012: Leveraging a Spatio-Temporal Drought Severity and Coverage Index with Crop Yield Modeled As a Stochastic Process. International Journal of Hydrology Science and Technology (IJHST) Vol. 2 No. 3, 219-236.

Conference Proceedings and Abstracts:

1. Leelaruban, N., F. A. Akyüz, G. Padmanabhan, P. Oduor, S. Shaik. 2012: A Study of Drought Impact and Severity Based on Developed County Wide Drought Severity and Coverage Index in North Dakota, USA. H073. Advancing Drought Monitoring and Prediction with Applications to Decision Making. AGU Fall 2012. Session December 3-7, San Francisco, CA.

Popular Extension Publications

1. Akyüz, F. A., and B. Mullins, 2012: 2012 Growing Season Weather Summary for North Dakota. Electronic: http://www.ndsu.edu/ndsco/publication/gss/2012.pdf.
2. Akyüz, F. A., and B. Mullins, 2012: North Dakota Quarterly Climate Bulletin. Summer 2011-2012. V.6, No. 3. Electronic: http://www.ndsu.edu/ndsco/publication/ndsco/bulletin/summer12.pdf.
3. Akyüz, F. A., and B. Mullins, 2012: North Dakota Quarterly Climate Bulletin. Spring 2012. V.6, No. 2. Electronic: http://www.ndsu.edu/ndsco/publication/ndsco/bulletin/spring12.pdf
4. Akyüz, F. A. 2012: "ND Wins Community Collaboration Rain Hail and Snow (CoCoRaHS) Network Observer Recruitment National Contest". The Dakota Thunder. http://www.crh.noaa.gov/images/bis/2012_Summer_CoCoRaHS.pdf. V. 1. No. 3. Pp.
5. Akyüz, F. A., and B. Mullins, 2012: North Dakota Quarterly Climate Bulletin. Winter 2011-2012. V.6, No. 1. Electronic: http://www.ndsu.edu/ndsco/publication/ndsco/bulletin/winter12.pdf .
6. Akyüz, F. A., and B. Mullins, 2012: North Dakota Quarterly Climate Bulletin. Spring 2010-2011. V.6, No. 2. Electronic: http://www.ndsu.edu/ndsco/publication/ndsco/bulletin/spring12.pdf
7. Akyüz, F. A., and B. Mullins, 2012: North Dakota Quarterly Climate Bulletin. Summer 2010-2011. V.6, No. 3. Electronic: http://www.ndsu.edu/ndsco/publication/ndsco/bulletin/summer12.pdf
8. Akyüz, F. A., and B. Mullins, 2012: North Dakota Quarterly Climate Bulletin. Winter 2010-2011. V.6, No. 4. Electronic: http://www.ndsu.edu/ndsco/publication/ndsco/bulletin/fall12.pdf

9. Akyüz, F. A., and B. Mullins, 2012: 2012 Growing Season Weather Summary for North Dakota. Electronic: http://www.ndsu.edu/ndsco/publication/gss/2012.pdf

Invited Presentations:

1. "Synopsis of 2012 Weather and Outlook into the 2013 Growing Season in ND". Ag Improvement Meeting. December 12, 2012. Valley City, ND.
2. "Climate Update". ND Crop Improvement and Seed Association Regional Meeting. December 10, 2012. Casselton, ND.
3. "Tornado, Coriolis Force, and Climate Forecast". NDSU Family Showcase. October 13, 2012. NDSU.
4. "Climate/Weather Impacts on Horticulture". Master Gardener. September 28, 2012. NDSU (Broadcasted throughout the State).
5. "How to Use NDWN for your Agricultural Needs". McLean County Ag Improvement Association Workshop. June 29, 2012. Garrison, ND.
6. "North Dakota Agricultural Weather Network Overview". McLean County Ag Improvement Association Workshop. June 29, 2012. Garrison, ND.
7. "North Dakota Agricultural Weather Network Agricultural Applications". New (County) Agent Training. June 5, 2012. NDSU, Fargo, ND.
8. "Climate Change: Is it Real?" North Dakota Community Action Partnership Conference. May 9, 2012. Fargo, ND.
9. "Advancements and Recent Technology Deployment in North Dakota Agricultural Weather Network". Ransom County Crop Improvement Association Board Meeting. March 27, 2012. Lisbon, ND.
10. "Climate Change and the Agricultural Implications in the Northern Plains". Growers Meeting. March 8, 2012. Moorhead, MN.
11. "Misconceptions in Climate Change" SNR Seminar. March 7, 2012. NDSU, Fargo, ND.
12. "North Dakota Agricultural Weather Network: A Faculty Perspective at School of Natural Resource Management". March 6, 2012. NDSU, Fargo, ND.
13. "Climate Change with Regional Perspectives". High Tunnel Workshop. March 6, 2012. Moorhead, MN.
14. "Successful Gardening Working with North Dakota Agricultural Weather Network" Master Gardener Annual Workshop. January 28, 2012. NDSU.
15. "Global Climate Change and its Local Implications in the Northern Plains". Clay County Crop Improvement Association: Crop Update. January 17, 2012. Moorhead, MN.

K-12 other Educational Activities:

1. "Meteorological Misconceptions". NRM 150 Guest Lecture. September 24, 2012. NDSU.
2. English Language Learners' (ELL) Summer Camp. "Hands-on Meteorological Experiments for K-through- 5". June 8, 2012. NDSU, Fargo, ND.
3. "Tornado Education and Safety". Kennedy Elementary School. May 1, 2012. Fargo, ND.
4. Expanding Your Horizons. "Meteorological Observations Part 2: Tornadoes and Severe Weather". April 14, 2012. NDSU. Fargo, ND.
5. Expanding Your Horizons. "Meteorological Observations Part 1: Precipitation". April 14, 2012. NDSU. Fargo, ND.
6. NDSU Family Weekend Showcase. October 13, 2012. NDSU.

8. Pre-Engineering Education Collaborative (PEEC) - Pipeline for Tribal Pre-Engineering to Society (PTiPS) Workshop to Develop Science Instructors of ND Tribal Colleges. "Techniques and Advancements in Teaching Large Classes Even Beyond Classrooms". July 26, 2012. NDSU, Fargo, ND.
9. 2012 NATURE Summer Camp. "Corn Maturity Estimation Model". June 11-15, 2012. NDSU, Fargo, ND.
10. 2012 NATURE Summer Camp. "Natural Forces Forming Severe Weather". June 7, 2012. NDSU, Fargo, ND.
11. ND Science Olympiads. "Meteorology". April 21, 2012. NDSU, Fargo, ND.
12. Faculty-in-Residence Mentoring. "Climbing and Clim(b)atology". February 7, 2012. NDSU.
13. Faculty-in-Residence Mentoring Meeting with NDSU Pavek Hall Student Resident RAs. February 2, 2012. NDSU.
14. Faculty-in-Residence Mentoring Meeting with NDSU Pavek Hall Student Residents. January 24, 2012. NDSU.
15. Tornado Formation Demonstration. Electrical and Computer Engineering Students. January 23, 2012. NDSU.

List of radio and TV presentations and spots made:

There were total of 62 media appearances made in 2012.

Oklahoma State Climate Office

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

Shafer served as Coordinating Lead Author and McPherson as Lead Author for the Great Plains chapter of the National Climate Assessment, due to be published at the end of 2013. McPherson served as the science lead at the University of Oklahoma (OU), in collaboration with colleagues at OU, Oklahoma State University, University of Tulsa, and Sam Roberts Noble Foundation (NSF), for the successful submission of a $20 million research infrastructure improvement proposal to the National Science Foundation. The vision of this project is to significantly advance our understanding of how socioecological systems can adapt sustainably to increased climate variability caused by a changing climate. The team will develop an innovative research platform to center on a first-of-its-kind statewide tightly coupled human and natural systems observatory, with integrated measurement, modeling, and prediction capabilities and downstream decision-support systems. In addition, the Oklahoma State Regents for Higher Education provided a cost share of $5 million.

Nationally and internationally, OCS participated in the American Association of State Climatologists conference, annual meetings of the American Meteorological Society (AMS) and the Association of American Geographers, the AMS Summer Community Meeting, the Canadian Meteorological and Oceanographic Society Congress, meeting of the World Meteorological Organization, the Swiss Summer Climate School, Applied Climate Information System (ACIS) Web Developers Workshop, National Severe Weather Workshop, the spring workshop of the Soil Moisture Active Passive (SMAP) – Marena Oklahoma In Situ Sensor Testbed (MOISST) program, and the Inter-Tribal Emergency Management Coalition Conference.

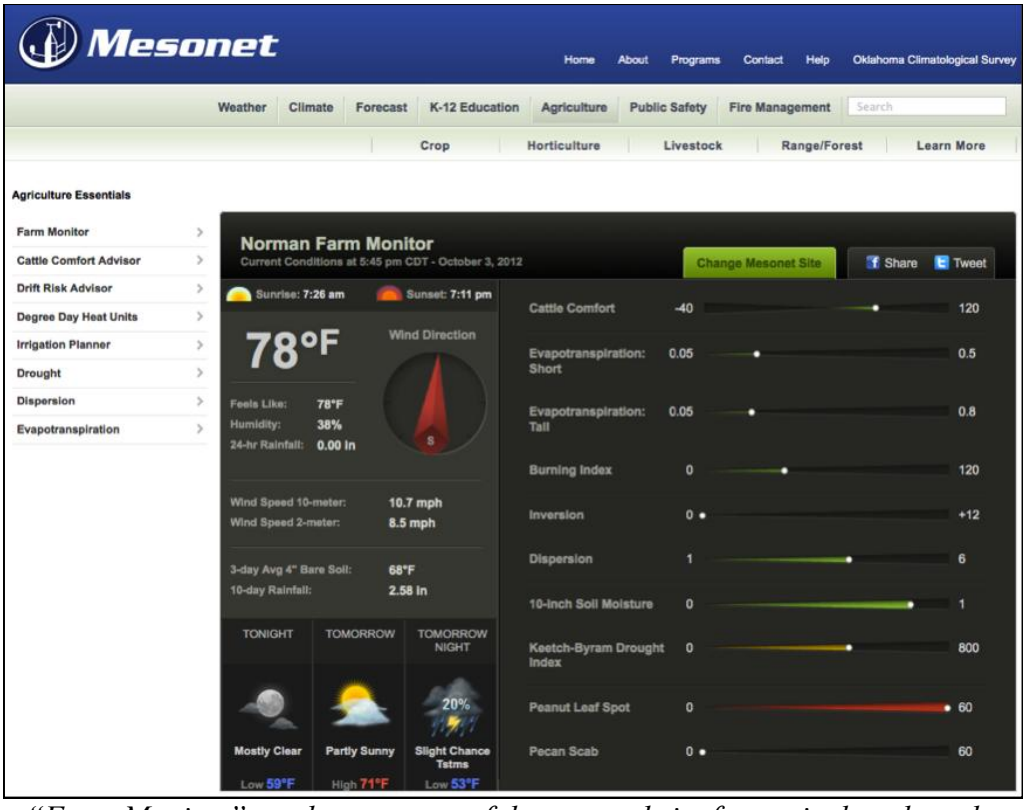
New research funding in 2012 included *The Impact of Uncertainty Information on Tornado Warning Response* by the National Weather Service, *Utilization of Regional Climate Science Programs in Reservoir and Watershed Impact Assessments* by the U.S. Army Corps of Engineers, and *Drought Monitoring: a System for Tracking Plant Available Water Based on the Oklahoma Mesonet* by the Oklahoma Water Resources Research Institute. OCS received funding from various sources to operate the Oklahoma Mesonet, including the Oklahoma State Regents for Higher Education and Oklahoma Department of Public Safety. OCS was funded by the USDA Agricultural Research Service to operate the Little Washita and Fort Cobb Micronets; by the Société de Protection des Forêts Contre les Insectes for software development; by the National Severe Storms Laboratory for calibration of sensors; and by the National Mesonet Pilot Project. At the end of 2012, OCS employed 37 professional staff, 6 graduate students, and 15 undergrads. We administered 28 financial accounts with a fiscal year (7/1/2011 to 6/30/2012) budget totaling $4.8 million.

Information Services

In 2012, OCS customers requested 39.7 Terabytes of information from 2.2 billion hits to our web pages. OCS's Southern Climate Impact Planning Program (SCIPP) produced monthly newsletters called the *Southern Climate Monitor*. We also fulfilled 443 data requests, generating $52,821 in revenue.

OCS launched a new website for agricultural producers that integrates crop, animal, and prescribed burn products. It showcases a new "*Farm Monitor*" product that gives producers a quick look at weather conditions and forecasts related to farming decisions. We also launched a new Mesonet iPhone app that was downloaded over 12,000 times from Apple's iTunes Store. The app displays current Mesonet observations, maps, radar, and forecasts from the National Weather Service. For users with non-iPhone devices, we upgraded our mobile Mesonet website to incorporate location detection services.

OCS released new versions of its RadarFirst and WeatherScope visualization software (primarily to incorporate new dual-polarization radar products) as well as its iPad application for Mesonet field technicians to use during site maintenance. We also developed new, web-based tools, including long-term (decadal) maps of Mesonet data, plant available water products, and an alfalfa weevil advisor.



The "Farm Monitor" product, as part of the new website for agricultural producers.

Research

Mesonet data were used in over 50 peer-reviewed journal articles in 2012. Examples of scientific publications and reports include the following:

Boone, K. M., R. A. McPherson, M. B. Richman, and D. J. Karoly, 2012: Spatial coherence of rainfall variations using the Oklahoma Mesonet. *Intl J. Clim*., **32**, 843-853.

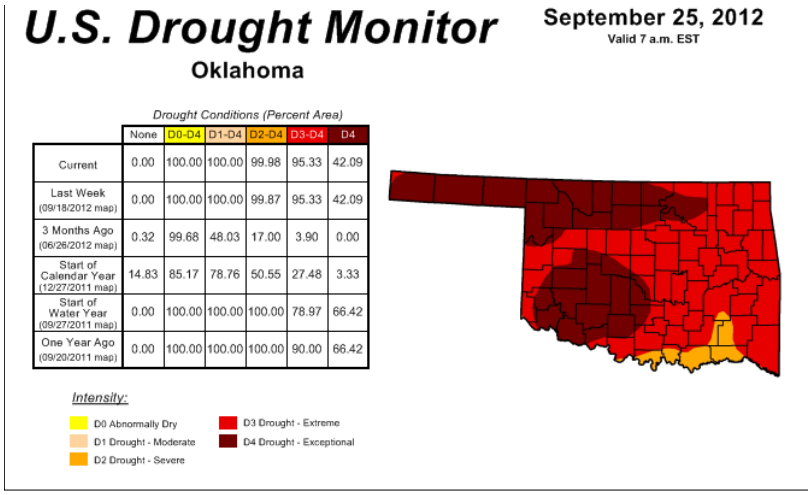
Basara, J. B., and M. Rowell, 2012: Mesoscale observations of an extended heat burst and associated wind storm in central Oklahoma. *Meteorological Applications*, **19**, 91-110.

Liu, L., Y. Hong, C. Bednarczyk, B. Yong, M. Shafer, R. Riley, and J. Hocker, 2012: Hydro-climatological drought analyses and projections using meteorological and hydrological drought indices: A case study in the Blue River Basin, Oklahoma. *Water Resources Management*, **26** , 2761-2779.

Monitoring & Impact Assessments

NOAA's National Climatic Data Center calculated that Oklahoma's statewide average temperature was 63.0 degrees for 2012, breaking the previous record of 62.8 degrees from 1954. As a result, 2012 was Oklahoma's warmest year on record (records began in 1895). It also brings the two-year (January 2011-December 2012) statewide average to 62.3 degrees, breaking the previous record for two-consecutive calendar years of 62.1 degrees from 1953-1954.

Even with a record 52 tornadoes in April 2012 (beating the old record of 50 set in April 2011), only 63 tornadoes were confirmed for the year, a slowdown from our totals of 103 and 119 in 2010 and 2011, respectively. Oklahoma was beleaguered by drought impacts again during 2012, with 100% of the state in severe-to-exceptional drought during part of the year.



Severe-to-exceptional drought continued to grip Oklahoma during 2012, following a year of exceptional heat and drought during 2011.

OCS's Southern Climate Impacts Planning Program (SCIPP), in conjunction with the NOAA Regional Climate Services Director for the Southern Region, the National Integrated Drought Information System, the National Drought Mitigation Center, and the American Association of State Climatologists, hosted a series of forums, workshops, and webinars during 2012 to address the current drought situation in the southern plains and promote planning and preparation for future drought conditions. This *Managing Drought in the Southern Plains* initiative brought

together various state and local agencies, federal officials, and many others tasked with managing drought conditions.

Since 1994, OCS has operated and maintained weather and climate stations for the Oklahoma Mesonet and the Agriculture Research Service. In 2012, we completed 2,603 laboratory calibrations of sensors. To maintain our remote sites and sensors in the field, we conducted 718 site visits to our remote stations in the Oklahoma Mesonet and ARS Micronets. We resolved 3,604 trouble tickets in these networks, consisting of sensor repairs and rotations.

Outreach

Through the Southern Climate Impacts Planning Program, OCS recorded bi-weekly webinars to help decision makers in the south-central U.S. manage the historic drought. The webinars had more than 700 views on YouTube during 2012.

Through OCS's outreach programs, our staff participated in dozens of K-12 activities and public safety workshops. In total, we trained 269 emergency managers through 16 workshops across Oklahoma. We also worked with over 900 K-12 students through various field trips, science fairs, and job shadow events. We also held our second annual Mesonet Summer Camp, which attracted 21 middle school students from eight states to our week-long camp.

OCS issued 17 press releases during 2012 and provided interviews to hundreds of media entities. Over 150 *OCS Mesonet Ticker* emails were sent out to media, state agencies, and weather enthusiasts, and 12 Mesonet Connection electronic newsletters were provided to Mesonet users. As a result, OCS was mentioned in the Oklahoma City and Tulsa newspapers over 571 times during 2012. We continued to produce weekly Mesonet Weather Report segments for the SUNUP television program.

Oregon Climate Service

Oregon State University
College of Earth, Ocean, and Atmospheric Sciences
326 Strand Ag Hall
Corvallis, OR 97331

Staff:
Philip Mote, Director
Kathie Dello, Deputy Director
Darrin Sharp, Faculty Research Assistant
Rachel Calmer, Faculty Research Assistant

Performance period: 5/1/2012 - 4/30/2013

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 (CIRC).

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. OCS staff are sometimes asked to review climate pieces of documents produced by state and federal agencies.

Highlights

State-level Activities
With drought conditions developing in Oregon during the Spring of 2013, OCS is hosting a weekly drought coordination call for the purpose of submitting input to the US Drought Monitor.

Kathie Dello is assisting the Oregon Department of Land Conservation and Development (and other agencies) with an update to the Oregon Hazard Mitigation Plan.

Columbus Day Storm 50th Anniversary - October 12, 2012
OCS participated in several activities commemorating the 50th anniversary one of Oregon's most significant weather events in recorded history, including media appearances and public presentations on the history and development of the event, as well as reducing vulnerability to future hazardous weather events.

Pacific Northwest heat waves
The Office of the Washington State Climatologist and OCS joined forces to study heat waves in the Pacific Northwest (Bumbaco et al. 2013). 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, along with research by the Oregon Health Authority was the impetus for forming a group with the inland Northwest National Weather Service Offices (Pendleton, Spokane, Boise, and Medford) to standardize heat criteria across the region based on health-related impacts. NWS is using this group's research to consider their criteria nationally.

CoCoRaHS
Kathie Dello assumed the State Co-Coordinator role for Oregon CoCoRaHS, after the 2012 WERA 1012 meeting in Estes Park, CO. The remainder of 2012 was focused on recruiting new observers. In the last 12 months, we recruited 235 new CoCoRaHS observers and usually surpass the the 300 reports/day threshold. The most popular recruiting times were in a friendly contest against Washington in October, and after an OSU-coordinated press release that we sent out in November. 2013 will focus on cultivating and engaging observers, as well as recruiting efforts in sparsely populated areas that are lacking observations.

Climate Science Day
Kathie Dello was invited by the American Meteorological Society to participate in Climate Science Day (CSD). CSD is an event organized by 15 professional and scientific societies to connect scientists with Members of Congress for the purpose of providing access to scientific information on climate science. Team Oregon (Dello, NEON's Andrea Thorpe and NOAA's Laura Petes) visited every office in Oregon's congressional delegation (5 House/2 Senate) to talk about recent climate, climate change, and climate research happening in the state of Oregon.

WERA 102 committee meeting
OCS hosted the WERA 102 committee meeting on climate for natural resources and agriculture at Oregon State University in Corvallis, OR on November 13-14, 2012. We had participation from most of the Western State Climate Offices, PRISM Climate Group, Western Regional Climate Center, and Federal Agencies.

2014 AASC Annual Meeting Planning
OCS is excited to co-host the 2014 Annual Meeting with the Office of the Washington State Climatologist at Skamania Lodge in Stevenson, WA.

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. The project was delayed one school year when the graduate student who was assigned to it left to pursue other opportunities.

Atmospheric Rivers and Debris Flows
Kathie Dello is participating in an NSF-funded study on Atmospheric Rivers and Debris Flows on Mt. Hood and Rainier with OSU faculty Anne Nolin and OCCRI assistant professor Heather Lintz.

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

- **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, the general weather/climate-interested The popularity of the OCS twitter increased over past year. Contextual tweets 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. Weather and climate stories featuring OCS leadership are often cited in the daily OSU media digest. 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 second wettest spring on record in the Willamette Valley, the very dry summer, Columbus Day Storm, post-Sandy interviews on
- **K12:** OCS staff participated in Benton County Girl Scout Camp in July 2012. The theme was weather-based. 100 students K-12 learned about weather - both typical to Oregon and beyond. OCS staff gave presentations to other K12 groups as requested.

Relevant papers:
Bumbaco, K.A., K.D. Dello and N.A. Bond, 2013. A historical analysis of Pacific Northwest heat waves: synoptic evolution and trends. J. Appl. Meteorology and Climatology, in press

Selected presentations:
- **Dello, K. and P. Mote.** Pacific Northwest Climate Services. USDA National Water Conference, Portland, OR (with Dennis Todey, South Dakota SC). May 22, 2012.
- **Dello, K.** What's new with OCS? Oregon Chapter of the American Meteorological Society, Portland, OR. June 12, 2012.
- **Mote, P.** Opportunities for partnering with the RISA Program. Western States Water Council Meeting, San Diego, CA. August 1, 2012.
- Kathie Dello taught incoming College of Earth, Ocean, and Atmospheric Sciences graduate students about the climate of Oregon on the Cascadia Field Trip.
- **Dello, K.** The Columbus Day Storm, 50 years later. Corvallis Science Pub. Corvallis, OR. October 8, 2012 and Tigard Public Library, October 12, 2012.
- **Mote, P,** Future Climate: Considerations for Natural Resource Managers (discussed OCS), Great Basin climate forum, Klamath Falls, November 30 2012.
- Kathie Dello was invited to speak on the public sector panel of the AMS Annual Student Conference in Austin TX. January 5, 2013.
- **Dello, K.,** M. Green, A. Bair and M. Wister. Standardizing Heat Criteria in the Inland Northwest. AMS Annual Meeting, Austin, TX. January 8, 2013.
- **Mote, P.**, Overview of regional climate issues and resources. Town Hall, National Climate Assessment, Portland OR Marc

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The Pennsylvania State Climate Office database continues to incorporate observations from more than a half dozen separate networks within the Commonwealth. During the last year, the database has been reorganized allowing for the incorporation of more tools to the web interface. 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 2012, over 650 volunteer observers had enrolled and typically, about 200 faithfully report each day.

Information Technology Capabilities:

• About a dozen 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 12/31/12. This constitutes a 33-year data set. We have added the CFSv2 global analysis (1979-2011).

Communication Capabilities:

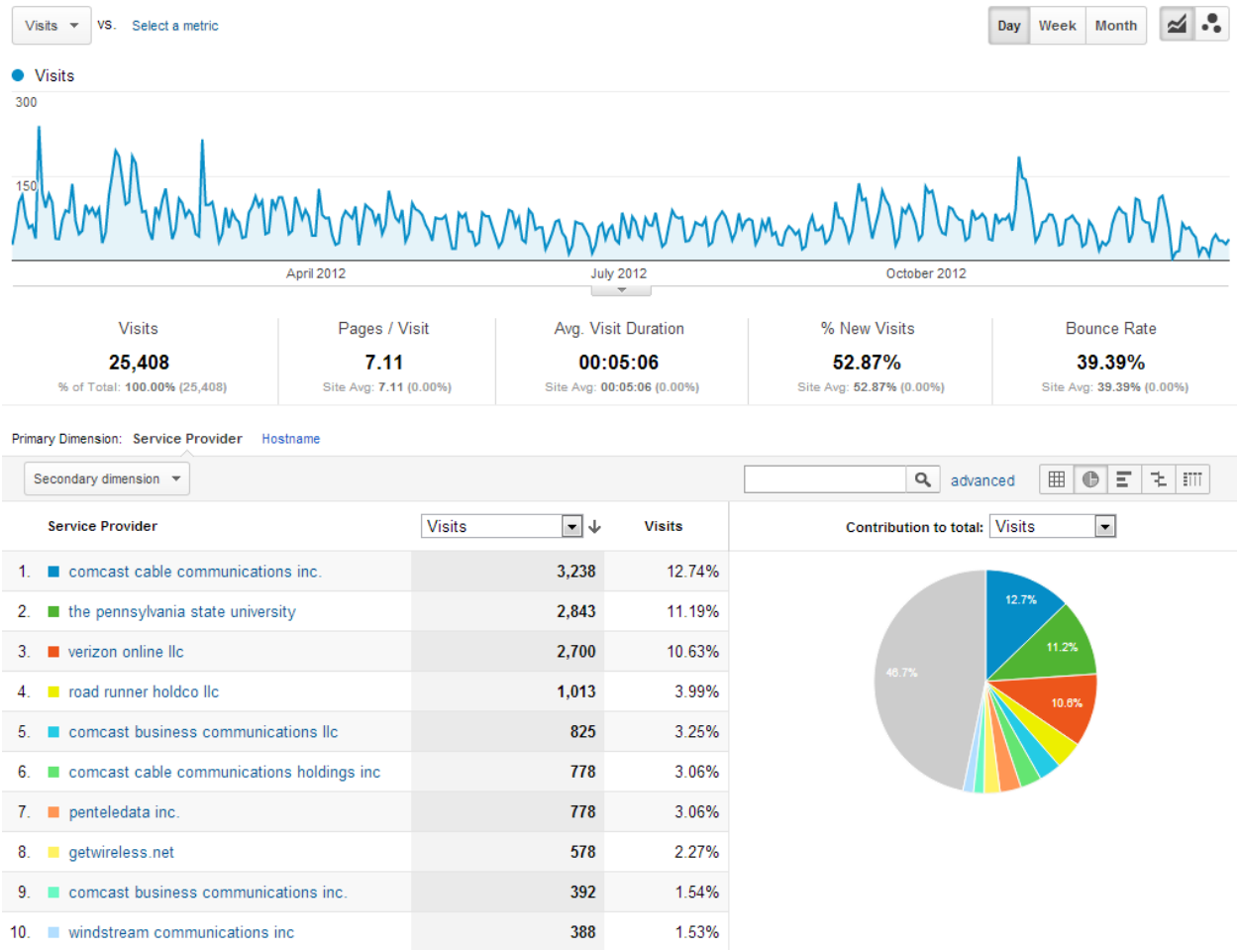
- The web server is now separate from the database host to increase the capacity of numerous web inquiries simultaneously. Development of new products has mainly focused on grant-related items, such as those connected with a data inventory and display. Our web server had a security breach due to ambiguous Php code causing the climate office to suspend its web services for a few weeks at the end of 2012.

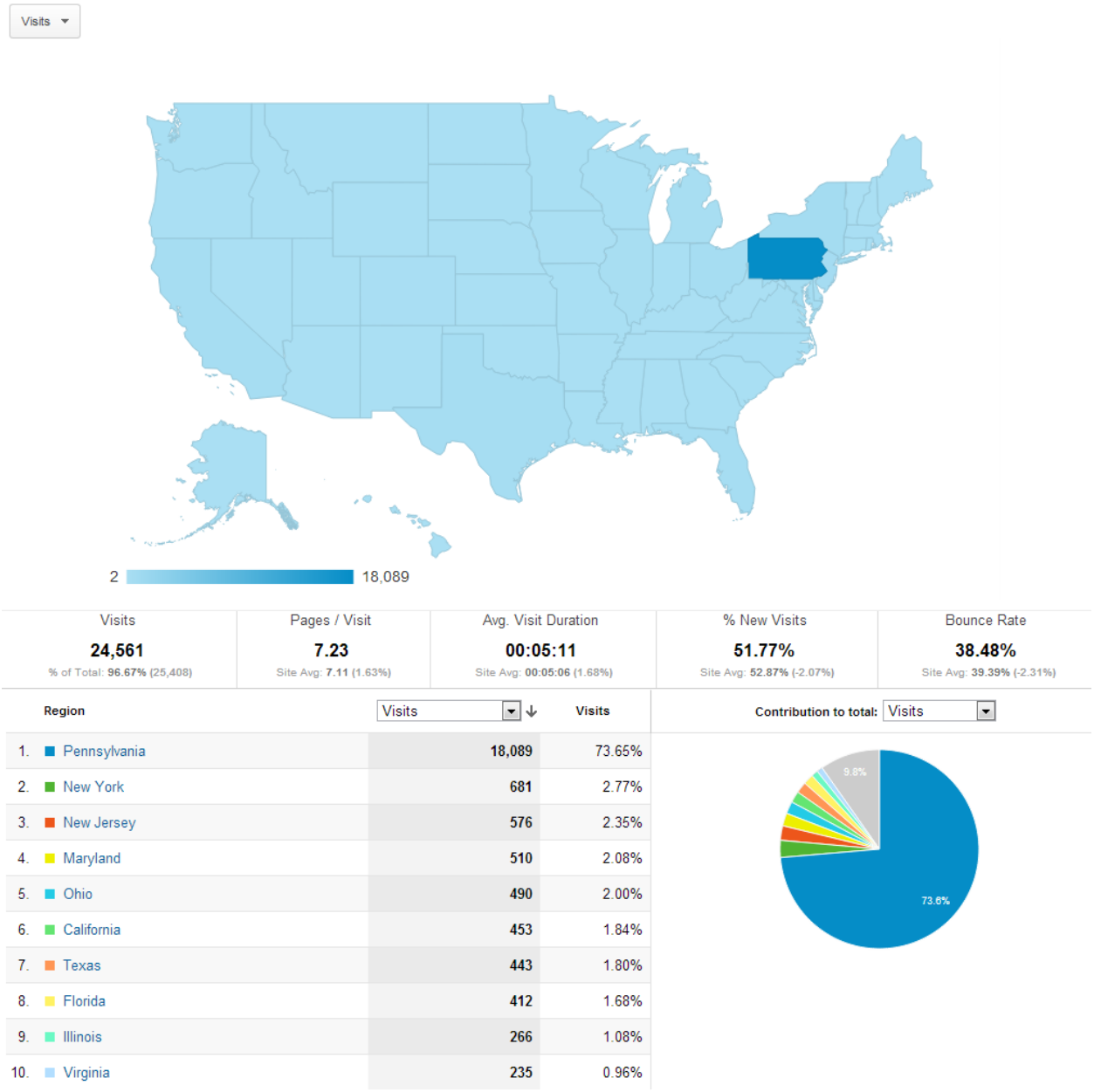
Information Services:

- 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 Assessment:

- The number of sites accessed is notably lower compared to the past year. The following charts show the 2012 user volume, distribution and domains:





Data Quality Control/Assurance:

- The PA Climate office takes advantage of the sophisticated DQ control routines provided by MADIS on CWOP. Other data is manually QA 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 eighth 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 being updated.

Special Projects:

- Collaboration with experts at Kansas State University continues with the refinement of environmental data monitoring systems for a Wheat Scab project
- 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.
- 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 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. This project has added 4 weather stations to the sub-hourly network.

SCEP:

- The Pennsylvania State Climate Office contributed monthly state weather summaries including its societal impacts to the Northeast Regional Climate Center during all of 2012 as per Task 2.1 of the 2012-2013 NCDC-SCEP agreement.

South Carolina Office of Climatology

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

The SCO provides a unique service to the state by archiving and distributing climate and meteorological data, reports, and research that 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 2012:

Communication Capabilities:

- The office expanded the SCO website (http://www.dnr.sc.gov/climate/sco). Products were updated as needed such as extending the SC Tornado Climatology through 2012.
- The office expanded the email notification system focused on severe weather notification and tropical advisories. The address list increased from 978 in 2010 to 1,506 in 2012. The breakdown of subscribers is Agriculture 2%, Commercial 10%, Education 5%, Government 50%, Health 2%, Medical 1%, Personal Interest 29%, and Utility 1%.

Information Services:

- During 2012, the SCO averaged 40 monthly phone and email requests for climate data and 36,000 information retrievals from the SCO web site.
- Staff assisted SCDNR Law Enforcement and SC Highway Patrol with 43 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 26 special weather event summaries during 2012. Examples include the heavy rains and flooding along the SC coast on August 28-29, low temperatures of April 12, high temperatures of March 15, the cold front and high winds of Jan 12-13, and the unseasonable warmth of Jan 24-26
- 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 2012, the SC Drought Response Committee was convened six 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.

Outreach:

- The SCO conducted a series of three workshops across the state of South Carolina titled "The Climate Connection Workshop Series: Climate Variability and Impacts to South Carolina's Natural Resources". The purpose of these workshops was to increase awareness and utilization of climate knowledge to improve natural resource management. At each workshop, discussion was facilitated regarding the relationship between natural resources and climate, including the need for new approaches and partnerships to cope more effectively with climate variability. The workshops were held in Charleston, SC on September 13, 2012, Columbia, SC on October 24, 2012 and in Greenville, SC on December 5, 2012. The series attracted a total of 151 participants including representatives from federal, state and local government, scientists, land and water resource managers, utility representatives, NGOs, media, private companies and other interested stakeholders. The workshops were funded by a grant from the Carolinas Integrated Sciences and Assessment (CISA), a local program supported by NOAA's Regional Integrated Sciences and Assessments (RISA).
- The SCO provided approximately 40 annual presentations to various governmental, private sector, and civic organizations.

- Staff attended state and national conferences such as the 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 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).

Monitoring and Impact Assessment:

- The SCO and Columbia, SC National Weather Service Office conducted a joint evaluation of the state record high temperature of 113 degrees observed on June 29, 2012 at Johnston, SC and USC Columbia campus. This effort to authenticate the record value was required by the NCDC State Climate Extremes Committee, made up by members that included the NWS Eastern Region, the NOAA SE Regional Climate Center, NCDC, Columbia SC NWS and SC State Climatology Office. Both NWS COOP stations were examined for instrumentation accuracy, exposure, history and observation standards within the recommended guidelines. The USC Columbia value was approved by the committee and provided to Tom Karl, Director of the National Climatic Data Center in Asheville, NC for official recordkeeping. http://www.dnr.sc.gov/climate/sco/Publications/SCStateTemperatureRecord2012.pdf
- 155 volunteers provided daily observations for the COCORAHS network reporting at least 300 or more days. Forty-five observers reported observations 360 days or more and 14 observers provided reports every day. Through a Harry Hampton grant the office distributed 106 complimentary rain gauges to new CoCoRaHS observers.
- 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, the Hurricane Season After Action/Lessons Learned Review Conference, and the Governor's and the SC Adjutant General forecast products briefing. The Severe Weather Liaison issued 5 weather outlooks, 17 strong thunderstorm/tornado advisories, 42 tropical advisories/updates, and 3 winter weather advisories. He issued customized forecast information for the DNR Governor's Cup Billfish Tournaments, the SC Forestry Commission, and the University of South Carolina's Event Planning Department. The Severe Weather Liaison participated in 10 conference calls for TS/Hurricane Sandy

South Dakota Office of Climate and Weather

Dr. Dennis Todey – State Climatologist/Associate Professor
Laura Edwards – Extension Climate Field Specialist – SDSU Extension
Nathan Edwards – Network Engineer
Ryan Vanderleest – Data Management

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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 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 tneth year in this position. Dr. Todey also served as the past-president of the American Association of State Climatologists.

Laura Edwards completed her first full year as extension climate field specialist in the Aberdeen Regional Office. She helped coordinate SDSU extension activities and reporting with the state climate office particularly with the agricultural community. She has also become co-state coordinator for Cocorahs.

Nathan Edwards was officially named as the network engineer 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.

Ryan Vanderleest has accepted the position managing database management and processing for the office helping transition to new data transfer streams and helping redeveloping the climate web site along with mobile data applications. Several undergraduate students (mainly with computing background) filled non-permanent positions in maintaining and processing data from weather stations, fixing computer issues and developing some new products.

Reporting

The state climate office was at the forefront along with SDSU extension during the drought of 2012. Weekly reporting on drought conditions and bi-weekly meetings with the state drought task force updating on conditions and outlooks were a large time consumer during the summer.

Dennis Todey and Laura Edwards were heavily involved in regional work in conjunction with NOAA, USACE, USGS and other states on developing a report on the need for soil moisture and snow pack monitoring in the Plains of the Upper Missouri (WY, MT, ND, and SD). The outcome of this work was a draft report on needs and costs for improving this monitoring. This report is currently being utilized for potential federal appropriation on monitoring and as a guide for USDA work on soil moisture monitoring nationwide.

The state climate office continued to supply data and create reports through a contract with South Dakota Agricultural Statistics Service. This data is used for official reports weekly during the growing season and monthly during the off-season. This ended early in 2013 because of shifting budgets in the USDA-NASS.

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, weather and climate impacts on potential fire issues.

The state climate office managed, archives and supplied data from a 35 station automated weather station network across the state. In 2011 the main activities were trouble-shooting to stabilize poor-reporting stations and beginning work longer-term station management planning.

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

Media traffic was particularly heavy during the summer and fall because of severe drought conditions throughout the state. Laura Edwards and Dennis Todey did numerous radio and TVE interviews and well as creating weekly press releases. Many were part of the SDSU extension created a network called iGROW radio to deliver daily information via radio across the state. Dennis Todey and Laura Edwards collaborated on weekly weather/climate updates for iGROW radio.

The SCO did over 100 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.

Research

Dr. Todey was part of two other ongoing USDA-funded projects during 2012. These were funded to do work on climate change issues and the corn system across the Midwest. The Corn CAP through Iowa State (www.sustainablecorn.org) 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. The 2nd project through Purdue (www.agclimate4u.org) is working on surveying of climate attitudes, tool development for ag producers and also some climate education. 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). Laura Edwards worked on the extension portion of the Corn CAP conducting farmer interviews for the project.

Laura Edwards conducted field research on drought-tolerant corn through a grant with Pioneer looking at components of the water balance.

The SCO contributed to a study relating various climate measurements on snow melt run-off into the Upper Missouri Basin through the US Army Corps of Engineers. This was an outgrowth of work from the Flood of 2011 on the Missouri looking at potential future issues on streamflows. The SCO continued work 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.

Outreach

Dr. Todey has been very active in collaborating with NOAA Central Region on regional climate activities including continued work on regional drought webinars. Documenting impacts and conducting several of the webinars were activities during the year. Working with several other SCs, RCCs and federal agencies we have developed 2 page drought impact and outlook publications for decision-makers.

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. Various issues with campus IT have delayed development and deployment of a new version of the web site.

The web site and individual responses continue to supply data for various users in the state and outside the state. Over 50 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 75 talks in the state and region including talks in MN, IA, NE and ND during the year.

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. During the recent wet period South Dakota has had over 250 reports on various days, over half the "active" reporters.

Education

Dr. Todey conducted part of teacher education classes through the South Dakota Discovery Center and though a watershed group. The sessions focused on water cycle and climate and student climate activities.

Dr. Todey also presented to a summer climate camp at Iowa State university as part of the Iowa State USDA Corn CAP grant.

AASC Presidency

Dr. Todey served as past-AASC president in 2012-13. He represented AASC at meetings with the Climate Prediction Center, coordinating with new states and discussion with NOAA and interactions between AASC, USDA and other federal agencies.

Texas Annual Report, 2012

Highlights

The Texas State Climatologist received two awards for outreach activities during 2012, and the office unveiled a new website.

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
David Coates	Graduate Research Assistant
Matthew Raper	Graduate Research Assistant
Andrew Cook	Undergraduate Assistant

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:

The OSC, with major assistance from information technology staff and students from the College of Geosciences, unveiled a new web site in 2012. This web site came with a new URL: http://climatexas.tamu.edu. A good sense of what's available at the web site is given by the banner categories: drought, monthly reports, data, resources, publications, about us, FAQs, news, and search. The web site averages about 170 unique visitors per week.

Items regularly posted on the web site include monthly climate summaries for the state and the Bryan/College Station area, monthly climate impacts reports, weekly objective drought indicators, and weekly summaries of drought coordination conference calls.

In 2011, the OSC received and fulfilled over 300 individual requests for climate data and information. Requests are fielded by telephone or email.

Research:
Two peer-reviewed articles from the OSC were published in 2012.

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.

Nielsen-Gammon, J. W., 2012: The 2011 Texas drought. Texas Water J., 3(1), 59-95.

This paper grew out of a presentation to the Texas legislature. It describes the chronology, spatial distribution, and impacts of the most severe one-year drought on record for the state of Texas.

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 investigates 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:
In addition to the regular reports posted on the OSC web site, and responses to requests for climate data, the OSC conducts outreach through speaking engagements, press interviews, and blogging.

The ongoing drought conditions in Texas have led to widespread interest in location-specific weather and climate information. The number of fulfilled invitations for speaking engagements remains high. The State Climatologist gave 54 invited speeches to audiences in Texas and elsewhere in 2012, amassing over 13,500 highway miles in the process. Three presentations were in the form of testimony at hearings of the Texas Legislature.

A newer form of outreach is the blog ClimateAbyss, hosted by the Houston Chronicle and located at the URL (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.

The OSC's outreach activities were the subject of two awards made during 2012. The John C. Freeman Weather Museum named him a 2011 Weather Hero for outreach related to the Texas drought. Later in the year, the Texas A&M College of Geosciences awarded him a Dean's Achievement Award for Service.

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://atmo.tamu.edu/osc/socimpacts as well as on http://www.stateclimate.org.

Utah Climate Center Annual State Climate Office Report

Research

Article (Refereed Journal)

(Student, Climate Center Staff and Post-Doctoral contributions are underlined)

2012

1. **Gillies, R. R.,** S.-Y. Wang, Y. Sun, and O.-Y. Chung, 2012: Supportive empirical modeling for the forecast of monsoon precipitation in Nepal. *International Journal of Climatology* (in press).
2. Wang, S.-Y., and **R. R. Gillies**, 2012: Influence of the Pacific quasi-decadal oscillation on the monsoon precipitation in Nepal. *Climate Dynamics* (in press).
3. **Gillies, R. R**., S.-Y. Wang, and M. R. Booth, 2012: Observational and synoptic analyses of the winter precipitation regime change over Utah. *Journal of Climate*, 25, 4670-4698.
4. Wang, S.-Y., **R. R. Gillies**, and T. Reichler, 2012: Multi-decadal drought cycles in the Great Basin recorded by the Great Salt Lake: Modulation from a transition-phase teleconnection. *Journal of Climate*, 25, 1711-1721.
5. Wang, S.-Y., **R. R. Gillies**, R. Martin, R. E. Davies, and M. R. Booth, 2012: Connecting subseasonal movements of the winter ridge in western North America to inversion climatology in Cache Valley, Utah. *Journal of Applied Meteorology and Climatology*, 51, 617-627.
6. **Gillies, R. R.**, S.-Y. Wang and W.-R. Huang, 2012: Observational and supportive modeling analyses of winter precipitation change in China over the last half century. *International Journal of Climatology*, 32,747-758.

Scholarly Paper Presentation

2012

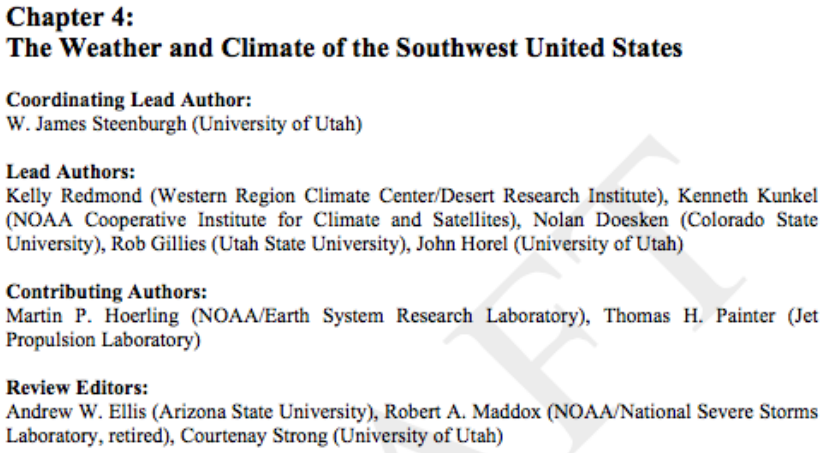
1. Wang, S.-Y., **R. R. Gillies**, H. van den Dool, 2012: On the yearly phase delay of winter intraseasonal mode in western North America and its link with the NAO. 37th Climate Diagnostics and Prediction Workshop, Fort Collins, CO, Oct 22-25, 2012.
2. Schroeder, M., S.-Y. Wang, **R. Gillies**, 2012: Depiction of the Trend and Variability of Pineapple Express Events by Seven Global Reanalysis Datasets. 37th Climate Diagnostics and Prediction Workshop, Fort Collins, CO, Oct 22-25, 2012.
3. **Gillies, R. R**., S.-Y. Wang and J.-H. Yoon, 2012: Climate Vulnerability of Nepal and Links to Decadal Variability and Teleconnection (AS40-A014), AOGS - AGU (WPGM) Joint Assembly, Singapore, 13-17 August, 2012.
4. Wang, S.-Y., R. E. Davies, **R. R. Gillies**, J. Jin, 2012: Changing Monsoon Dynamics and Extremes: Example of the Pakistan Flood (AS16-42-A008). AOGS - AGU (WPGM) Joint Assembly, Singapore, 13-17 August, 2012.
5. **Robert R. Gillies**. 2012: Weather in the Odyssey: What It Is, How It Functions, and Why It Occurs—Part I. 15th Annual Mediterranean Studies Congress. Juraj Dobrila University of Pula, Pula, Croatia, May 30 - June 2, 2012

6. Schroeder, M., S-Y. Wang, **R. R. Gillies**, 2012: Depiction of the Trend and Variability of Pineapple Express Events by Seven Global Reanalysis Datasets. Spring Runoff Conference, Logan, Utah, April 3-4, 2012.
7. Booth, M., S-Y. Wang, M. Schroeder and **R. R. Gillies**, 2012: Utah Freeze Date Prediction Utilizing Weather Station Climatology and the Climate Forecast System Model. Spring Runoff Conference, Logan, Utah, April 3-4, 2012.
8. Wang, S-Y. and **R. R. Gillies**, 2012: Decadal and Paleo-climate Research Leading to Longer-term Prediction for the Great Salt Lake Hydrological Cycle. Spring Runoff Conference, Logan, Utah, April 3-4, 2012.
9. **Gillies, R. R**., Wang, S.-Y., "A comprehensive data & information webpage of the Utah Climate Center", 10th Annual Climate Prediction Applications Science Workshop, NOAA, Miami, FL. March 13-15, 2012.
10. Wang, S.-Y., **Gillies, R. R**., "Decadal climate research leading to longer-term prediction for the Great Salt Lake hydrological cycle", 10th Annual Climate Prediction Applications Science Workshop, NOAA, Miami, FL. March 13-15, 2012.
11. Wang, S.-Y., **Gillies, R. R.**, Hipps, L. E., Jin, J., "Connecting the Pacific to Regional Climate for Decadal Prediction: A Successful Case in the Western U.S.", 92nd American Meteorological Society Annual Meeting, American Meteorological Society, New Orleans, LA. Januray 22-26, 2012.
12. Wang, S.-Y., Davies, R., Huang, W.-R., **Gillies, R. R**., "Changes in Monsoon Extremes Affecting Climate Prediction—Example of the 2010 Pakistan Floods", 92nd American Meteorological Society Annual Meeting, American Meteorological Society, New Orleans, LA. January 22-26, 2012.

Extension: *Articles*

2012

1. 2013 National Climate Assessment (Southwest climate assessment) (http://www.globalchange.gov/what-we-do/assessment).



Chapter 4:
The Weather and Climate of the Southwest United States

Coordinating Lead Author:
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2. Climate Advisory work with Utah Department of Health — The UCC continued technical assistance to the Utah Department of Health regarding climate change and public health. UDOH completed a document, Climate Change and Public Health in Utah, found at:

http://health.utah.gov/enviroepi/publications/Climate%20Change%20Booklet%20WEB%20compressed.pdf

Scholarly Paper Presentation (invited, selected, reviewed)

2012

1. **Robert R. Gillies. 2012**. **Harnessing U.S. University Partnerships For Agriculture, Food Security, And Nutrition: The USAID-Funded Collaborative Research Support Program (CRSP),** World Food Prize, **Des Moines Room, October 17, 2012.**
2. **Robert R. Gillies. 2012**. *Utah's Water Future? The Symphony that is Utah's Climate. Sponsored by Environmental Issues Committee, Weber State University, Ogden, Utah. September 10, 2012*
3. **Robert R. Gillies. 2012**. *Exploring Opportunities for the Next 25 Years.* ***25th Annual Utah Rural Summit***. Southern Utah University, Cedar City, Utah. August 9 – 10, 2012.
4. **Robert R. Gillies**. 2012. Utah's Changing Climate Regime – Cycles within Cycles. Focus on the Climate. *Park City Lecture Series*. Park City. Utah. April 11, 2012.
5. **Robert R**. **Gillies**. 2012. Earth's Changing Climate - Nepal. *Center for Epidemiologic Studies Seminar Series*, Utah State University, Logan, Utah, January 30. 2012
6. **Robert R. Gillies**. 2012. Earth's and Utah's Changing Climate. *Annual Chapter Meeting of Idaho/Utah Chapter of the American Society of Farm Managers and Rural Appraisers*. Logan. Utah. January 27, 2012.

Meteorological and Climate Monitoring Networks

National

1. The National Atmospheric Deposition Program (United States Department of Agriculture)
2. UV-B Monitoring and Research Program (United States Department of Agriculture)
3. COOP (National Weather Service - NWS) – 2 stations (Logan; Utah State University (1893 to present) & 5 SW Experiment Farm (1969 to present)
4. National Phenology Network

State & Local

1. The Fruit Growers Network (FGNet), Utah, http://climate.usurf.usu.edu/traps.php FGNet is a network of 20 weather stations (ref., insert LHS) located in fruit orchards and sensored to provide critical measurements for fruit crop management. Three new stations in Utah county orchards were added to the networkin 2012 using a new station design that will be the model for future stations

and station retrofits. In addition to the new stations, this rugged design was used to rebuild an existing station at Payson, Utah when the former station was destroyed in a microburst.

2. The Agricultural Meteorological Network (AgWxNet), Utah, http://climate.usurf.usu.edu/agweather.php

   a. The most significant expansion to the UCC's extension activity in 2012 has been the addition of the Agricultural Weather Network (AgWxNet). Utah's AgWxNeT is a network of 23 automated weather stations operated by the Utah Climate Center to provide weather data and estimates of evapotranspiration (ET) to help Utah municipalities, farmers and ranchers, and those managing turfgrass make informed water management decisions. Additionally, several stations provide data critical to university and state agency research. The network (e.g. station shown) has a statewide distribution with stations sited in irrigated and dryland agricultural, turfgrass, fruit, and native riparian vegetated areas. Stations are sensored to measure solar radiation, wind, relative humidity, air and soil temperature, precipitation and soil moisture. ET is estimated by the ASCE standardized reference ET equation (ASCE-EWRI 2005) often referred to as the Penman-Monteith method.

   b. The UCC was asked to assume responsibility for this network of stations upon the retirement of its originator, Professor Bob Hill. We've created an advisory board comprising stakeholders in the network and set about standardizing instrumentation.

   c. We have also initiated collaboration with the U.S. Bureau of Reclamation's AgriMet network — a network similar is scope to the Utah AgWxNet. This collaboration is still evolving, but is on track for full implementation in 2013. The collaboration brings with it the possibility for further upgrade of the AgWxNet instrumentation, and implementation and standardization of QA/QC protocols.

Vermont State Climate Office

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The Vermont State Climate Office (VTSCO) received its ARSCO recognition in June 2005. The office is housed within the Department of Geography at the University of Vermont (UVM) & State Agricultural College, a land-grant institution that 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 AY2012-2013. One intern earned academic credit in Fall 2011, while another three received similar credit in Spring 2013.

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. A NOAA SARP grant was submitted in November 2012to 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.
- Invited participant, Expert Witness Training Academy, William Mitchell College of Law, St. Paul Minnesota, July 29 – August 3, 2012
- AMS (American Meteorological Society) Applied Climatology Committee member – national liaison to the NOAA Regional Climate Centers and the American Association of State Climatologists
- Provided free data, expert opinions and recommendations via the telephone, facsimile, electronic mail and regular mail.

Information services:

- Provided FOX44 Television (winter outlook newstory), Vermont Public Radio (VPR) about the 2012 drought; New York Times about the 2011-2012 winter snow season
- Special profile in the April issue of the Seven Days weekly paper entitled "Weathering Heights", highlighting my daily responsibilities as the Vermont State Climatologist <http://www.7dvt.com/2013work-lesley-ann-dupigny-giroux-vermont-climatologist>
- 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:

- Secured NOAA PACE (Postdocs Applying Climate Expertise) funding for a 2-year Postdoctoral Fellow (Dr. Evan Oswald) who will join the University of Vermont in August 2013 to work on climate change research related to forest health, air quality and human health. This will in conjunction with the Vermont Department of Health and the Vermont Agency of Natural Resources.
- Used SCEP funding to visit Drs. Ken Kunkel, Anthony Arguez and Matt Menne at the NCDC. An undergraduate student who was performing Readings and Research scholarship accompanied me to work on the extreme precipitation research across the Northeast for different return intervals. This work expanding the studies performed by Dr. Kunkel in support of the National Climate Assessment (NCA).
- CDMP-related data collection of weather and climate data in personal diaries from the mid-1970s from a farm in upstate New York. Databases of the contacts, findings and progress of visits around the state were updated.

Outreach:

- 9 public presentations on Vermont's perspective in terms of climate change and one-year anniversary of Tropical Storm Irene
- Conducted a Service-Learning activity with my advanced seminar class (Climatology and Natural Hazards) on rewriting the atmospheric hazards sections of the FEMA-mandated State Hazard Mitigation Plan for submission to FEMA in May 2013.
- Expanded the Vermont Weather and Climate Research group to 69 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, 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 NOAA SARP grant proposal to pursue research needs identified.
- Lake Champlain Watershed Analysis Technical Workgroup - worked with the EPA and VT Department of Environmental Conservation on the development of the revised Vermont Lake Champlain phosphorus TMDL.

University of Virginia Climatology Office

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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 part of the center's Technical Advisory Committee.

The office provides information and conducts research on the atmospheric environment and the impacts 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 users.

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 acquired real-time lightning detection capabilities (recently expanded), 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. The office's monthly video production *Climate Advisory*, a brief discussion of relevant topics regarding the climate of Virginia, was televised statewide on Public Television, public access channels and agricultural information networks. This collection is made available through the YouTube website.

Research

The office was a long-term integral participant in the ShenAir Institute Research Program, which focused on the Shenandoah Valley of Virginia. Under this program, the office was involved with air quality climatology, development of an asthma alert system and demographic relationships to respiratory health. After the formal conclusion of the contract period, the office is continuing follow-up discussions, publications and impact planning based on this work.

At the request of a local law enforcement agency in Virginia, this office has begun a program of research into relationships between crime and weather conditions, including influences from geographical location, demographics and other factors. This office has been training and involving students in this work. Though in the preliminary phase, useful results have already been developed.

Additional significant research efforts of the office include:

- Examination of the relationships between climatic regimes and exacerbation of respiratory distress in collaboration with researchers at the U.Va. Health Sciences Center.
- Investigation of the relationships between large-scale atmospheric teleconnections and tropical cyclone impacts in over the Mid-Atlantic region.
- Investigation into the definition of and potential secular changes in the timing of seasonal transitions.
- Drought and drought impact research and monitoring.
- 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 increasing emphasis on its web site 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 at numerous locations around the state on an ongoing basis. This includes core instruction requirements for the program's many 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 community groups regarding 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.

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 continues for ongoing updates to the plan and proposed projects for mitigation and response are undergoing review and recommendation.

Papers Published in 2012:

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 / Review:

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.

Stenger, P.J., T.M. Sullivan, B.R. Kennett, A.M. Milligan. Relationships Between Crime Occurrences and Weather in Hanover County, Virginia.

2013 Annual AASC Report - May 2013

Personnel: Nicholas Bond: Ph.D, State Climatologist
Karin Bumbaco: MS, Assistant SC
www.climate.washington.edu

This report summarizes the Office of the Washington State Climatologist (OWSC) activities during the last 12 months (May 2012 through April 2013). 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 their outreach and support activities in the last 12 months. One of our most popular products, the monthly climate newsletter that summarizes the previous month's weather events and puts them into a climatic context, now has over 280 regular recipients. OWSC has maintained their website (www.climate.washington.edu) with links to climate and weather information, and has remained a reputable source for climate data and information requests (over 70 in the last 12 months).

OWSC continues to be involved in the Community, Collaborative, Rain, Hail and Snow (CoCoRaHS) program. OWSC was a co-organizer with the Oregon Climate Service of a local competition between states for the most new observers during October 2012 – when the Pacific Northwest typically experiences an increase in precipitation. OWSC also maintains a Facebook page in an attempt to engage the public, which currently has over 150 "likes". In addition, OWSC has continued the weekly guest segment of the State Climatologist on KUOW – the Seattle affiliate of National Public Radio.

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

- Outreach demonstrations: Disabilities, Opportunities, Internetworking, and Technology (DO-IT) Summer Scholar Program (July 2012), Girl Scouts of Western WA GirlFest (October 2012), Mercer Slough Environmental Education Center (March 2013), Paws-on-Science at Pacific Science Center (April 2013), Adams Elementary (April 2013)
- Scientific presentations: PNW American Waterworks Association (May 2012), NWS Emergency Management Workshop (October 2012), PNW Climate Science Conference (October 2012), PNW Weather Workshop (March 2013)
- Numerous climate and climate change talks to the general public, including: Beachwatchers (October 2012), Pacific Lutheran University (November 2012), Department of Fish and Wildlife (January 2013), University of Washington Student Association for Green Environment (April 2013)

Research: Pacific Northwest Heat Waves, Optimal Network Design, Cascade Mountain Climate, and WA Coastal Waters

OWSC's research efforts in the last 12 months have been fruitful. A collaborative research effort between OWSC and the Oregon Climate Service on historical western WA and OR heat events is now in press (citation below). We found that regional nighttime heat events have been increasing, and these events are generally associated with higher humidities when compared to daytime events. Further work on the health implications of increasing overnight events is currently being pursued with new collaborators.

OWSC has been involved with research on designing optimal observing networks for several years. A revised manuscript testing the sensitivities of this technique is now in review on an online forum (citation below), and this research has also resulted in additional funding for related research to supplement a small portion of OWSC salary.

In collaboration with the University of Washington's Climate Impacts Group, OWSC also assisted with analysis of weather and climate stations within the borders of the North Cascades National Park and Mount Rainier National Park for the National Park Service. This work was included in a report for the National Park Service on the Cascade Mountain climate and trends. Finally, OWSC is contributing to an effort towards compiling climate and other indicators for characterizing the coastal waters of Washington State. This project is under the auspices of the WA Department of Ecology, and involves collaboration between academic, state, and federal government scientists, and representatives from tribes and other organizations.

Publications:

Bumbaco, K.A., K.D. Dello, and N.A. Bond, 2013: History of Pacific Northwest Heat Waves: Synoptic Pattern and Trends. J. Appl. Meteor. Climatol. [in press]
Mauger, G.S., K.A. Bumbaco, G.J. Hakim, and P.W. Mote, 2013: Optimal design of a climatological network: beyond practical considerations, Geosci. Instrum. Method. Data Syst. Discuss., 3, 193-219, doi:10.5194/gid-3-193-2013 [in review]

AASC Activities

OWSC received SCEP funding (February-June 2011) to catalog AASC-developed web tools into a database (http://stateclimate.org/productsurvey/list.php) and write a monthly feature article on a tool in the database. While a majority of the work on the database was completed in 2011, the monthly feature article series was completed in December 2012 after OWSC wrote 12 articles. With OWSC's commitment to the project complete, the AASC executive board is deciding the future direction of the project.

West Virginia State Climate Office (WVSCO)
2013 Annual Report for Calendar Year 2012

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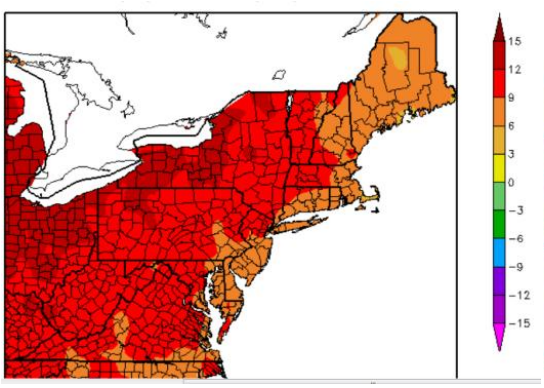
Dr. Kevin Law, State Climatologist

The West Virginia State Climate Office (WVSCO) fulfilled its mission by consulting and helping deliver climate products to professional stakeholders and advising them in making informed decisions. In addition, the office has participated in climatic education by speaking with media outlets and educational groups/institutions whenever possible. In February, the office met at WVU with officials representing the Northeast Climate Assessment and local stakeholders to discuss potential impacts of climate change to West Virginia. The information gathered will be used as part of the regional climate assessment. The office also spoke with a local 4-H group and performed fun activities with the kids such as making "snow" and having a rain gauge contest by seeing which group could squirt the most water into the gauge. The office has been invited to speak at the WV Science, Technology, and Research Symposium describing the climate history and climate forecasts for the state.

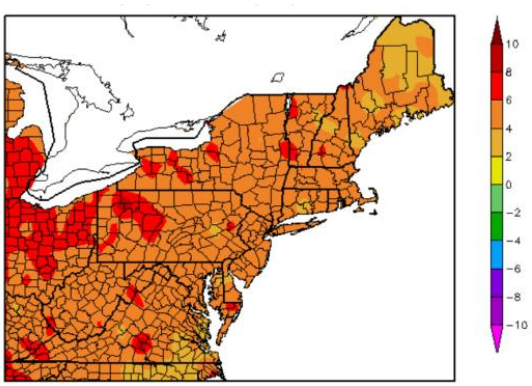
The WVSCO continues to remain active with the CoCoRaHS network and plans to cooperate with the National Resources Conservation Service to expand rain gauges and evapotranspiration gauges throughout the state. The office has been in collaboration with the National Weather Service office in Charleston to help Marshall University become "StormReady" and to further promote the StormReady program.

2012 Weather in Review- ***Warm and Dry (with some unusual events)***

The year of 2012 continued to be extremely warm and was the 3rd highest in state history. It was 2.1°F above the 1981-2010 normal. However, precipitation was much lower than the previous year running 2.6" below the 1981-2010 normal. March began with a rare tornado outbreak in an area that is unaccustomed to such extreme conditions. EF 2 and EF 3 tornadoes entered the area and damaged counties in the southern part of the state. March was also an extremely warm month as the average temperature was 52.3°F setting a brand new record that stood since 1921. This caused trees to "spring" very early but April started to turn a little cooler creating late frosts damaging trees that "budded" too soon. Despite the slightly cooler temperatures in April, May temperatures rebounded substantially and statewide records were set again for meteorological spring (March, April, and May). Even though the heat was record breaking, precipitation was relatively normal during the spring.

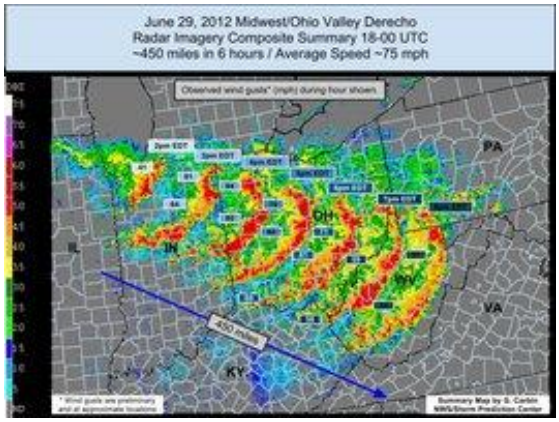


March 2012 Departure from Normal Temperatures (F)

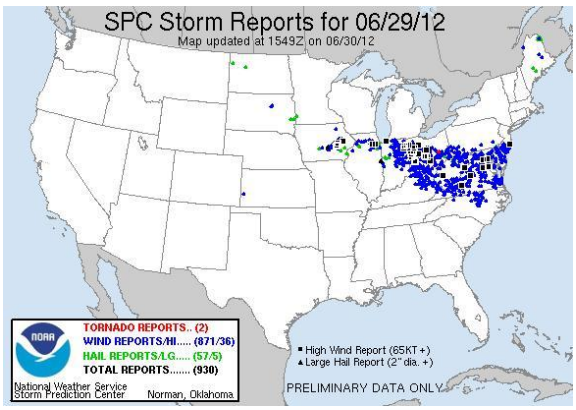


March – May 2012 Departure from Normal Temperatures (F)

The situation reversed during the summer as the temperatures returned somewhat to normal, but the precipitation became unusually low. Dry conditions prevailed in June (10th driest) as many lawns were turning brown especially toward the end of the month as a heat wave hit the region. Daytime highs eclipsed the 100°F mark across the state for several consecutive days. The hot, dry conditions helped trigger the Mid-Atlantic Derecho on June 29 that originated in the Midwest but quickly raced across West Virginia causing widespread damage and power outages. Winds were measured at 78 mph at Charleston's Yeager Airport and approximately 700,000 customers around the state lost their power. Almost 75% of the state lost power after the event and some people were without electricity for as much as two weeks. Hot temperatures continued to complicate things as many people evacuated to emergency "cooling stations" until power was restored.



Progression of the Derecho on June 29, 2012

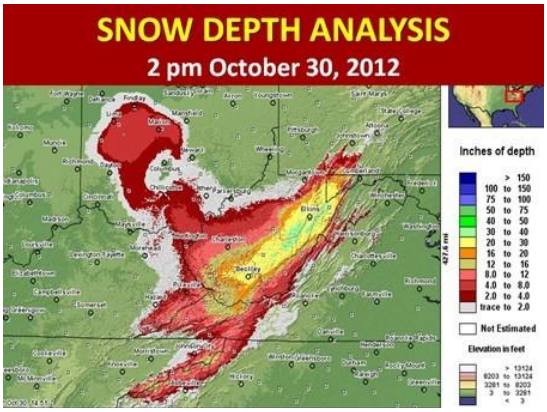


Data hole over WV due to the lack of power to report

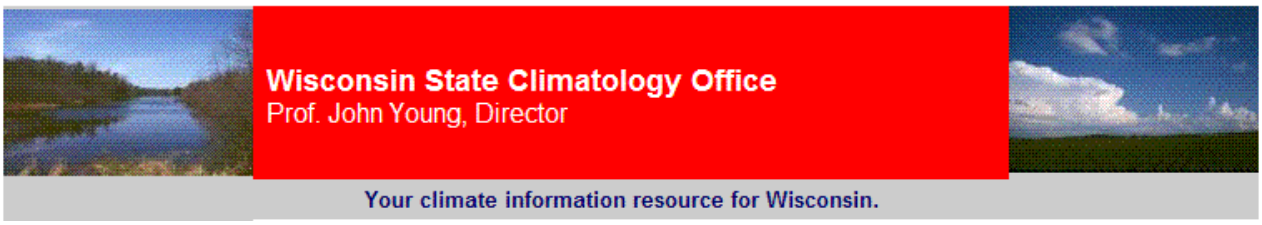
Temperatures finally started to subside during the fall, which was a welcome sight since the year had been so warm. Precipitation was also somewhat normal making the autumn relatively uneventful, until a seemingly harmless "weak" hurricane started to make its way along the east

coast. Hurricane Sandy had maximum sustained winds of 75 mph but a "blocking high" pressure near Greenland prevented it from going out to sea. Instead Sandy started to turn toward the west making landfall in New Jersey. A deep trough was located to the west placing very cold air over West Virginia. Sandy had been undergoing the extratropical transition and actually was intensifying by interacting with the trough. The tropical moisture "fed" into the upper level trough setting the stage for a remarkable event. Incredibly heavy snow fell across the state as many locations reported up to 2 feet of accumulation. The snow was extremely wet and heavy (after all it was tropical moisture) as snow-to-water ratios approached 5:1. This caused roofs to collapse and many trees to break. With the tree limbs breaking, widespread power outages occurred again across the state. Many places were without power for several days and some were without for almost two weeks a second time in the year. However, this time the power outages occurred with colder temperatures and snowfall. Interestingly, the snowfall from the remnants of Hurricane Sandy was the most all season as the winter was relatively mild.

Power outages from the remnants of Hurricane Sandy



Snow depth (in) after the remnants of Hurricane Sandy



The Wisconsin State Climatology Office (SCO) is affiliated with the Department of Atmospheric and Oceanic Sciences at the University of Wisconsin-Madison and is a partner with the Midwestern Regional Climate Center. The SCO distributes and analyzes data for climate monitoring, provides climate information and interpretation to residents of Wisconsin, develops "value –added" climate for a wide user community, and conducts applied climate research with University and State collaborators. The part-time office staff consists of Lyle Anderson (office manager, data management), Dr. Edward Hopkins (data access and analyses, website graphical products), and Emeritus Professor John Young (Director, scientific analyses and liaison to University researchers).

INFORMATION SERVICES

Website: The SCO maintains its website http://www.aos.wisc.edu/~sco that provides an expanding variety of graphical climate information, data, and links for citizens, scientists and clients in the government and private sector. Recent progress on the site includes:

- Climate History: Graphics that demonstrate observed climate variability by year and locations through the state are routinely updated for separate seasonal pages. Extensive records for seven cities illustrate interannual and interdecadal fluctuations and recent climate trends.
- Probabilities of temperature, precipitation and extreme events are being expanded.
- Climate Watch- month-to-month climate anomalies for most recent year-long interval.
- Continued development of sections on Water, Energy, and Agriculture applications.

Data Services: The SCO staff answers questions and fills data requests made by telephone, fax, email and office visits. Advice is also provided on web links to climate data and maps from regional and national centers. Nearly 300,000 contacts are made annually from the public, media, private sector (e.g., legal, insurance) and governmental agencies. These consisted of more than 280,000 website visits, 600 email requests, and 250 telephone inquiries in 2012. Most requests made by the public are answered without charge. A minimal service charge plus staff time costs is assessed for special data requests that require significant time or scientific effort.

OUTREACH

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

University of Wisconsin- John Young continues to be liaison with the Department of Atmospheric & Oceanic Sciences (AOS) and campus science groups. In addition to AOS, he participates in the weekly Physics Department's Chaos and Complexity Seminar, is now an invited member of the "4th Tuesday" dinner group of senior campus scientists, and interacts with climate-related research faculty in other departments. In 2012 he also gave an AOS research seminar on Probabilities and Extremes, and spoke on Chaos in Weather and Climate to the graduating AOS seniors. Ed Hopkins' role as "Dr. Data" has expanded to include assistance to student researchers from several departments, and consultation on data issues with the Center for Climate Research.

Climate Change and Variability- In 2012, Young spoke on regional change, extremes, and impacts to 10 public and university groups. He gave three television and four newspaper interviews. Special attention in 2012 was on (a) trends in lake ice cover and winter temperatures in Wisconsin, (b) the exceptional warmth of many months in 2012, and (c) the intense and prolonged drought for the last 6 months of the year. Young interacted with Extension affiliates of the University of Wisconsin on the drought issue, including assessment of both short-term and long-term aspects and the impact of frozen soil on spring snow melt. Hopkins gave four talks on Wisconsin climate to groups in southern Wisconsin.

WICCI- In 2008, the SCO was recognized as a collaborator within the developing Wisconsin Initiative on Climate Change Impacts, a multidisciplinary program involving university and government scientists that issued a major report in 2012. Young currently serves on the WICCI Outreach Committee. This collaboration is likely to lead to an expanded SCO mission in Wisconsin climate change science applications in the future. Young served on a UW review committee for research on the local watershed in the changing climate.

State Emergency Board-In 2012 the SCO provided weather information and advice on the extreme early spring heat, drought and freeze events as ex-officio members of the State Emergency Board for the USDA Farm Services Administration.

National Weather Service- SCO regularly interacts with staff members in three NWS offices regarding weather/climate extremes and climate issues.

RESEARCH

Young is developing plans to expand the probabilistic content of our data analyses, which will provide a clearer starting point for analysis of climate extremes and their trend. Particular attention is being paid to the recurrence probabilities for heavy multi-day rains. In 2012, Young's one-year collaboration with NCDC scientists K. Kunkel, T. Karl, and K. Redmond of WRCC on future changes in Probable Maximum Precipitation resulted in an article published in *Geophysical Research Letters*. Continuing related work is done on campus with Prof. J.C. Sprott regarding power laws in chaotic precipitation records.

The SCO continues to collaborate with WICCI scientists from across the campus. Ed Hopkins is analyzing weather extremes reported at individual stations throughout the state and is a member of the State Climate Extremes Committee. He assisted S. Temple with the data basis for his

heavily cited paper on phenological changes linked to climate trends. Preliminary collaborations included (a) using SCO precipitation data for careful river basin water budget changes with Prof. S. Kung, and (b) solar and climatological data for driving crop growth models for dairy industry applications.

PROJECTS AT END OF 2012 –

- Create a more formal relation of the SCO with the University: improvement of our minimally funded office with one salaried individual.
- Major changes will occur in 2013, with a new Chancellor and a Letters &Sciences College Dean: questions of improved funding opportunities in an era of decreasing State support.
- Establish ARSCO status.
- Partner with local, state and federal government agencies on matters relating to climate services and long-term climate change.
- Continue expansion of website information, smoothed graphics, & probabilities.
- Expand collaborative research with campus and state in WICCI.

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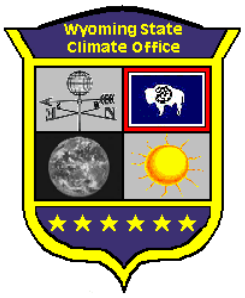
UNIVERSITY OF WYOMING



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Tony Bergantino	Service Climatologist
Barbara Muller	Librarian and Archivist
Michelle Ogden	Data Services/Research Associate
Jodi Preston	Office Administrator and Data Manage

The Wyoming State Climate Office (SCO; http://www.wrds.uwyo.edu/sco/climate_office.html) 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

Snake River Basin Water Plan Update. The Snake River Basin Water Plan was last updated in 2003 and the projections of available streamflow under wet, dry, and average conditions are being updated to reflect the last decade, much of which had Wyoming experiencing drought conditions.

- Digitization of daily Diversion records for the Bear River Basin. These data are made available to resource managers for determining available flow during various hydrologic conditions.
- CoCoRaHS participation helps to address one of the key problems within the state which is a lack of precipitation monitoring sites in many areas. Through various outreach methods, we have significantly increased the number of new stations and also the number of reports coming in from existing stations. We are using these data to supplement

National Weather Service (NWS) COOP data when responding to requests for precipitation data for a particular area. The high density of stations that we have in some parts is allowing for much more detailed interpolations of rainfall in some urban areas.

Coordinating and supporting the collection of weather and climate data

Over the past year, WRDS/SCO has continued to be involved in supporting and enhancing weather/climate data collection platforms in the state. In 2012/2013, in partnership with the NWS, the automated streamflow monitoring station that was re-established on the Laramie River at Laramie was further enhanced with the addition of water-temperature, precipitation, and air temperature sensors. In further partnership with the NWS and the State Engineer's Office, an automated evaporation monitoring station was established at Hawk Springs in southeast Wyoming while upgrades were made to other Collection Platforms around the state.

WRDS/SCO continues to maintain and enhance the NWS COOP station (485435, Laramie 2NW) which it has done for more than 45 years. Working with the NWS, this station was upgraded with the installation of an automated Fischer-Porter rain gauge in the spring of 2013.

CoCoRaHS continues to play an important part in operations at the WRDS/SCO. During the second half of 2012 and early 2013 efforts to reinvigorate observers who had gone inactive continued and interaction with observers to stress the importance of their participation increased. This outreach and interaction resulted in about a 9% increase in the number of daily reports being entered (completely independent of any additional stations being added).

With an effective March Madness campaign, 75 new stations were added to the network in Wyoming during that month. The total number of active stations was increased again in April and May with continued outreach and promotion of the network. These new stations resulted in additional participation in the network which increased the number of daily observations entered by about another 20%. This level of participation is the highest in Wyoming CoCoRaHS' 10-year history.

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 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 visitors being up just over 2% from last year.
- Although numbers have declined by a little less than 10% from last year, much as a result of having more and more information available online, 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. Over the past few years WRDS/SCO has undertaken efforts to digitize portions of the

collection for online access making more than 2000 historical documents available as PDFs. This process is continuing with the recent digitization of Instream Flow documents.
    - http://library.wrds.uwyo.edu
- Various interviews with media organizations regarding drought and snowpack with the associated potential for flooding.
- A spin-off of the intense CoCoRaHS promotion in March was an overall increase in visibility of WRDS/SCO and resulting invitations to speak to multiple groups and organizations not only on CoCoRaHS but also on general climate and drought topics.

Representative Publications

Service/Outreach Publications

- Nicholson, C., Bergantino, T. & Pavlica, J. 2013. *GIS Modeling of Environmental and Recreational Stream Flows in the Snake-Salt River Basin, Wyoming.* Presented at the 2013 Society for Conservation GIS Annual Meeting, Monterey, CA.; Presented at the 2013 GIS in the Rockies Conference, Denver, CO.; Presented at the 2013 GeCo West Conference, Laramie, WY.

- Nicholson, C. 2012. *Climate Data Retrieval.* Presented at the Wyoming Geographic Organization 1st Annual Conference, Cheyenne, WY.

- Nicholson, C. & Bergantino, T. 2012. *Characterizing Wyoming's Climate: Using Spatially-Gridded PRISM Climate Data to Visualize Climate Patterns in Wyoming's River Basin Plans. P*resented at the 2012 GIS in the Rockies Conference, Denver, CO.

- Nicholson, C. 2012. *Data Services and Online Mapping Tools for Delivering Wyoming's Hydroclimatic Resources.* Presented at the Wyoming Engineering Society, 92nd Annual Convention, Sheridan, WY.

- 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.* Presented at the 2012 American Water Resource Association Specialty Conference, GIS and Water Resources VII. New Orleans, LA.

Compiled by Tony Bergantino

AASC Current State Climatologists/Office Directors:

State	State Climatologist/Office Director	ARSCO
Alabama	John Christy	Yes
Alaska	Peter Olsson (SC), Gerd Wendler (Director)	Yes
Arizona	Nancy J. Selover	Yes
Arkansas	Michael J. Borengasser	No
California	Michael Anderson	Yes
Colorado	Nolan Doesken	Yes
Connecticut	X. Harrison Yang	Yes
Delaware	Daniel J. 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	Xiaomao Lin	Yes
Kentucky	Stuart Foster	Yes
Louisiana	Barry Keim	Yes
Maine	George L. 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	Kelsey Jencso	No
Nebraska	Allen Dutcher	Yes
Nevada	Douglas P. Boyle	No
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 C. 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	Nick Bond	Yes
West Virginia	Kevin Law	Yes
Wisconsin	John Young	Yes
Wyoming	Tony Bergantino	Yes