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The RCC Report

NEWSLETTER OF THE REGIONAL CLIMATE CENTERS

SPECIAL ISSUE

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2011: A Year of Extremes

Even though 2011 is not yet over, it will be known as a year of extreme weather events. There was record cold in the eastern states during winter and spring along with several blizzard events; severe to exceptional drought from Arizona across the southern states to Florida; record heat in Texas and Oklahoma; historic tornado numbers and deaths in the Midwest and Southeast; extensive flooding on the Missouri and Mississippi rivers; and catastrophic flooding in the Northeast U.S. from Hurricane Irene. Already, ten of these extreme events have each exceeded \$1 billion in costs. Since the beginning of the year, there have been over 16,000 record high temperatures set, over 10,000 record lows set and over 20,000 record precipitation events. During the spring, nearly half of the country was either abnormally wet or dry.

The Regional Climate Centers (RCCs) are keepers of weather and climate extreme data. RCCs maintain seamless integration and storage of National Oceanic and Atmospheric Administration (NOAA) data, along with data from non-NOAA sources, and provide this information with robust and efficient computer infrastructure and database architecture. The RCCs are sources of real-time climate data, allowing the monitoring of national and regional climate conditions and identification of extreme events.

WeatherCoder III, a system developed by the National Weather Service, is an RCC operational component that serves as the primary means of daily weather data entry by observers. This input helps to quickly determine when extremes are occurring. The RCCs provide numerous real-time products for the temporal and spatial display of climate data such as temperature and precipitation. These products allow for viewing of regional extreme events and comparing them on a historical basis. □

Wildfire

Wildfire activity across the southwestern, southern, and southeastern states has been well above normal due to exceptional drought across these areas largely related to La Nina. As of the end of July, 5.3 million acres have burned in the southern and southwestern states combined, which is nearly 90 percent of the total area burned for the entire U.S. April and May were particularly notable given that these two months set consecutive records for area burned.

Since November 2010, the Texas Department of Forestry has responded to over 16,000 fires, totaling nearly 3.5 million acres burned. The combined Texas drought and wildfire have exceeded \$1 billion in costs. Arizona and New Mexico have each experienced at least one large fire of national newsworthiness. The Wallow fire at the Arizona/New Mexico border burned over 500,000 acres

alone, destroyed over 70 buildings, and was also known for significant public health smoke impacts. The Las Conchas fire in New Mexico burned over 150,000 acres and

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*Los Conchas wildfire very close to the Los Alamos Medical Center
(Source: KRQE News 13, Albuquerque)*

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Tornadoes

The U.S. experienced an extraordinary number of tornadoes during the first half of the year, highlighted by two major outbreaks in April as well as the Joplin, MO EF-5 tornado in May, the single deadliest tornado in the modern record (since 1950). On April 16, there were 30 tornadoes reported across North Carolina, resulting in 24 deaths. This set a state record for most tornadoes in a single outbreak and was the second deadliest in North Carolina history.

On April 25–28, a major outbreak occurred from Texas to New York, killing approximately 317 people. This exceeds the 310 fatalities associated with the 1974 Super Outbreak, the largest outbreak in U.S. history. There were 314 fatalities observed on April 27 alone, mostly in Alabama and Mississippi, making it the deadliest single tornado day in the modern record. One of the more notable tornadoes from this event was an EF-5 that tracked over 130 miles from northwest Alabama

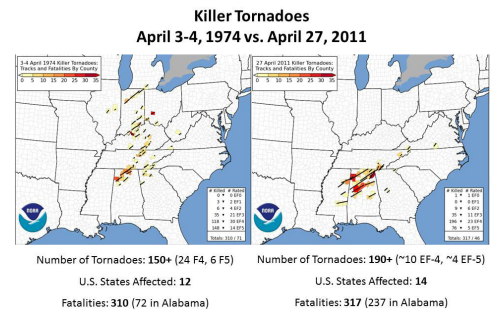
to southern Tennessee, killing 78 people.

Another violent tornado tore through the cities of Tuscaloosa and Birmingham, killing 65 people and destroying over 5,700 structures in Jefferson County alone. Total losses from this outbreak may approach \$10 billion. Across the U.S., 753 tornadoes were recorded in April, which ranks as the most active tornado month on record. Still, the



Complete destruction of a neighborhood in Joplin, MO following an EF-5 tornado on May 22. (Source: KMOV News 4, St. Louis)

most indelible memory of the 2011 tornado season may be the devastation in Joplin, MO, where an estimated 151 people were killed. These outbreaks, in addition to the over 1,300 other tornadoes that have occurred across the U.S. through early August, have resulted in 536 fatalities, making 2011 the deadliest tornado year since 1950. □



A comparison of killer tornado tracks: The April 3-4, 1974 Super Outbreak and the April 27, 2011 Outbreak. (Source: Greg Carbin, NOAA's Storm Prediction Center)

Spring Flooding in the Midwest

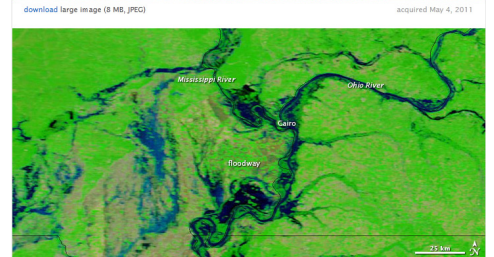
A higher than normal and persistent snowpack across the upper Midwest resulted in spring flooding on many rivers in the upper Midwest, including the Red and Mississippi Rivers. During the second week of April, moderate to major flooding was reported on many Minnesota and Wisconsin rivers and along the Mississippi River to St. Louis. Rainfall totals the third week of April were two to five times normal in Illinois, Indiana, and Ohio, along with northern Kentucky and Lower Michigan. More than 300 daily precipitation records were set. Precipitation totals were over 3 inches for a large part of the Ohio River Valley with amounts exceeding 4 inches in the Cincinnati, Ohio area. Runoff was considerable over saturated soils, and numerous rivers in the Ohio basin were at or above flood stage and still rising. Flooding continued on the Red River in Minnesota, but levels were dropping as the crests moved into Canada. Flood crests on the

Mississippi River continued to move south.

Major flooding along the Ohio River and its tributaries resulted from frequent heavy rain at the end of April and in early May. Rainfall was three to four times normal from April 1 through May 4. Cairo, Illinois, just a few miles north of the confluence of the Mississippi and Ohio Rivers, was evacuated as the Ohio River headed to a record crest of 61.72 feet on May 2. The top of the flood wall at Cairo is 64 feet.

On the night of May 2, the U.S. Army Corps of Engineers blew an 11,000-foot hole in the Bird's Point, MO (Mississippi County) levee to release water into the New Madrid Floodway and relieve pressure on the flood walls at Cairo, IL. The levee breach flooded more than 130,000 acres of farmland and required the evacuation of more than 300 homes. Within 24 hours of the breach, the river at Cairo had dropped more than a 1.5 feet. The high water levels on the Mississippi River, along with record

flooding on the lower Ohio River, led to persistent and record flooding on the lower Mississippi River from the confluence of the two rivers to the Gulf of Mexico. □



These two photos show the Bird's Point floodway after the levee was breached (top), and before the levee was breached (bottom). Credit: NASA Earth Observatory

Record flooding in the Missouri Basin

The Missouri Basin encompasses a large portion of the Central Plains, nearly 530,000 square miles, with tributaries originating in the Rocky Mountains and watersheds

draining portions of 10 U.S. states. Historically, this basin has experienced flood conditions due to springtime snowmelt runoff, excessive summertime rain, or both.

Conditions in 2011 have resulted in extreme flood conditions of the Missouri River with an extensive area affected and

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Drought

Since the start of the United States Drought Monitor Map (USDM) in January 2000, only two brief periods occurred in which the southern region was entirely drought-free: from November 16, 2004 to April 5, 2005, and more recently, February 16, 2010 to April 13, 2010 (Figure 1a). In total, these periods account for approximately only 5 percent of the time from January 2000 to the present. There are some droughts, however, that scientists and citizens alike come to remember for a very long time. This will certainly be the case for the current drought that continues to devastate the southern region.

The current drought started on April 20, 2010. It began as a small area covering part of northern Louisiana and has continually grown to be one of the most severe events on record. A rather bizarre twist to this drought involves the Mississippi River flood of May, 2011. Flood waters ran straight through drought-ridden Louisiana, threatening both Baton Rouge and New Orleans. Upstream, the Morganza Spillway was opened to divert water into the

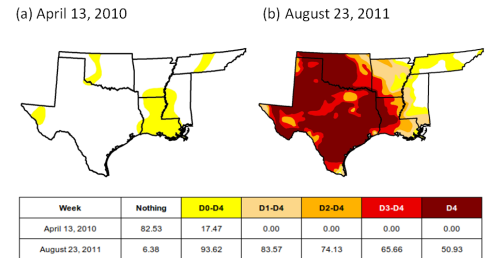
Atchafalaya basin as a means to prevent flooding in Louisiana's two largest cities.

As of August 23, 2011, approximately 84 percent of the southern region experienced drought, with approximately 51 percent of the region classified as Exceptional Drought (D4), the worst drought category designated by the USDM (Figure 1). Prior to this drought, the highest percent areal coverage of D4 drought in the southern region (since the start of the USDM) was 9.5 percent in August 2009. Much of the southern region has received only a small percentage of its expected precipitation since the start of the year.

There have been numerous impacts. In Louisiana, soybeans and rice crops are well behind schedule. An exhaustive list of Texas drought impacts may be found at: <http://atmo.tamu.edu/osc/socimpacts/socjun11.htm>. According to the Texas Office of State Climatology, the current drought (as of late July) ranks third amongst all recorded droughts in state history, and nearly all counties have been declared as disaster areas.

To make matters worse, drought

conditions have been amplified by anomalously high temperatures. This past July was the warmest July on record for both Texas and Oklahoma. Oklahoma's July average temperature was 88.9 degrees F, which was not only their warmest July on record, but also the warmest month on record for any state in the entire country. Furthermore, many stations in Oklahoma and Texas have set records for the number of days with temperatures in excess of 100 degrees F. □



United States Drought Monitor maps for (a) April 13, 2010, and (b) August 23, 2011. Maps are taken from the United States National Drought Mitigation Center.

Snow

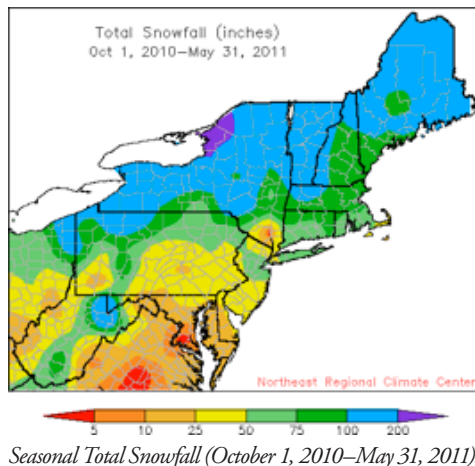
Across the northeast, the 2010-2011 winter brought excessive snow and cold temperatures. December 2010 ended an 11-month streak of above normal regional temperatures. It also brought the first of several major snowstorms to the region.

Early in the month, a narrow, but intense, lake-effect snow band over western New York buried the Buffalo area under 1 to 3 feet of snow. A general 30 to 40 inches fell in about a five-mile swath through southwestern Buffalo.

The second December storm was a post-Christmas blizzard along the coast. Snow totals of 6 to 12 inches covered New England, eastern New York, and western New Jersey, with up to 2 feet in eastern New Jersey, metropolitan New York, and western New England. Holiday travel was severely impacted as flights were cancelled out of LaGuardia, Kennedy, and Newark Airports, leaving travelers stranded at the airports for days. Travel was hazardous and many stores were unable to open. ShopperTrak, an organization which records retail sales and customer traffic, estimated a retail loss for the two-day period at \$1 billion.

January also saw two significant snowfall events. Each storm dumped at least 6 inches of snow along the I-95 corridor from

Philadelphia, PA to Portland, ME, with many areas reporting over 2 feet. Both storms resulted in thousands of cancelled flights, public transportation delays, school closings, and numerous fender benders. The storm on January 26 and 27 caused travel nightmares in the Washington, DC area with reports of commuters stuck for up to eight hours. At least six weather-related deaths were reported in Maryland, Delaware, and New York during this storm. As the snow piled up, reports of roof collapses started coming in at month's end. State and municipal snow removal budgets, strained after the late



Seasonal Total Snowfall (October 1, 2010–May 31, 2011).

December blizzard, were depleted with half the winter left on the calendar.

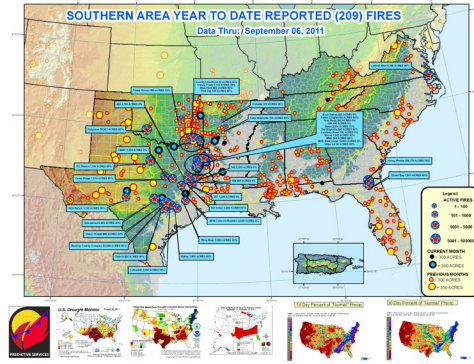
The record-breaking winter storm that paralyzed Chicago and the Midwest late in January also impacted the Northeast. When the storm cleared out on February 3rd, eastern New York and New England had amassed an additional 6 to 12 inches of new snow on top of the 12 to 18 inches on the ground from storms in January. In addition to the usual problems associated with a major storm, the accumulated snow, sleet, and freezing rain caused ice dams on roofs, numerous roof collapses, and dangerous conditions from snow and ice falling off roofs in downtown areas. Damage to buildings and their contents from leaks and collapses were estimated to be in the millions.

As winter drew to a close, an early March storm brought up to 30 inches of snow to upstate New York and northern New England. Whiteout conditions from this storm closed Interstate 89 in Vermont for several hours, while ice-jam flooding closed roads in Connecticut. To the south, this storm brought as much as 1 to 2 inches of rain. Additional rain on March 10–11, along with the record winter snowfall, put many waterways, including the

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Wildfire continued from page 1

threatened the city of Los Alamos and the Los Alamos National Laboratory, invoking memories of a devastating fire in 2000. □



Locations and size of fires in southern U.S. since beginning of the year. Blue boxes indicate current fires as of the map date.

Snow continued from page 3

Allegheny, Delaware, Raritan, Passaic, and Susquehanna Rivers over their banks.

The Northeast Regional Climate Center (NRCC) provided data and information regarding the record snowfall of this past winter, including information used in validating and negotiating snow removal contracts. A notable request came from the Architect of the Capitol who, in crafting a solicitation for Facility Management services, needed data to set contractor expectations about how much snow to expect and when it was most likely to occur. Upon receiving the necessary data the Architect's office responded, "The information was extremely helpful and your response time

was...refreshing." Other significant requests focused on the numerous roof collapses that affected the region. NRCC's applied research has been instrumental in developing building codes that account for expected roof snow loads and incorporate drifting. □

Missouri flooding continued from page 2

record peak flows. The impacts have been severe agronomically and economically. The Rocky Mountain snowpack conditions during the winter and spring were far above normal for much of the area. Record-setting precipitation in Montana coupled with unseasonable high snowpack in Montana and Wyoming led the Army Corps of Engineers to increase releases from dams along the Missouri River. For example, Billings, MT received 9.54 inches of precipitation in May, which broke the old record by nearly 2 inches and represents 385 percent of normal. The water equivalence in the May snowpack was more than 300 percent for portions of the Rockies, a product of heavy snows and lower than normal temperatures that allowed for little melting to take place.

Some significant impacts were felt across the region in June. Sandbagging efforts at Eppley Airfield in Omaha, NE focused on the airport terminal, the Federal Aviation Administration towers, and circuit protectors. Construction of 70 dewatering wells began to help keep the airport dry. During the first week of June, about 3,000 residents of Pierre and Fort Pierre were asked to leave their homes. Residences and property located outside of the city limits and reinforced

levees were flooded and damaged.

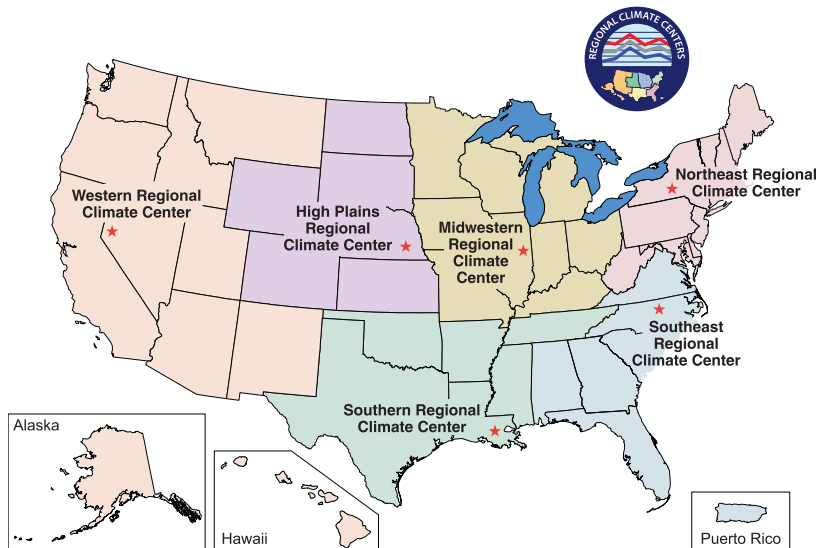
The community of Dakota Dunes, SD was another main focus for flood relief and prevention efforts. As crews built emergency levees to protect the community, nearly all of the 2,500 residents packed up and left. In Fort Thompson, SD, the water treatment plant had to deal with increased sand and sediment clogging up the intake filters, causing concerns about supplying drinking water.

June rainfall amounts were more than 200 percent of normal in central portions of the basin, exacerbating the ongoing problems. Gavins Point Dam on the Nebraska – South Dakota border saw flows of 160,000 cubic feet per second (cfs), nearly 100,000 more than the previous record set in 1997. By mid-summer many towns were evacuated, hundreds of thousands of acres of cropland were inundated, and many roads were closed, including parts of I-29 in Iowa, Missouri, and South Dakota. After months of being underwater, damage is expected to be high.



Farmland and home are inundated by floodwaters near Hamburg, Iowa on June 15, 2011. Image courtesy of Nebraska City News-Press and Dan Swanson.

For more than twenty years NOAA's Regional Climate Center Program has been recognized by Congress as vital to the efficient, coordinated delivery of NOAA climate services from national to local levels. The mission of the six centers is to provide quality data stewardship, improve the use and dissemination of climate data and information for the economic and societal good of the U.S., and conduct applied climate research in support of improved use of climate information.



BY THE NUMBERS

April 1-June 30, 2011

Total Web hits:	18,904,999
Data Requests/contacts:	1,995
Media requests:	117

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Midwestern RCC (217) 244-8226
University of Illinois, Champaign, IL

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Cornell University, Ithaca, NY

Southeast RCC (919) 843-9721
University of North Carolina, Chapel Hill, NC

Southern RCC (225) 578-5021
Louisiana State University, Baton Rouge, LA

Western RCC (775) 674-7010
Desert Research Institute, Reno, NV