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The RCC Report

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Taking the Pulse of Midwest Weather

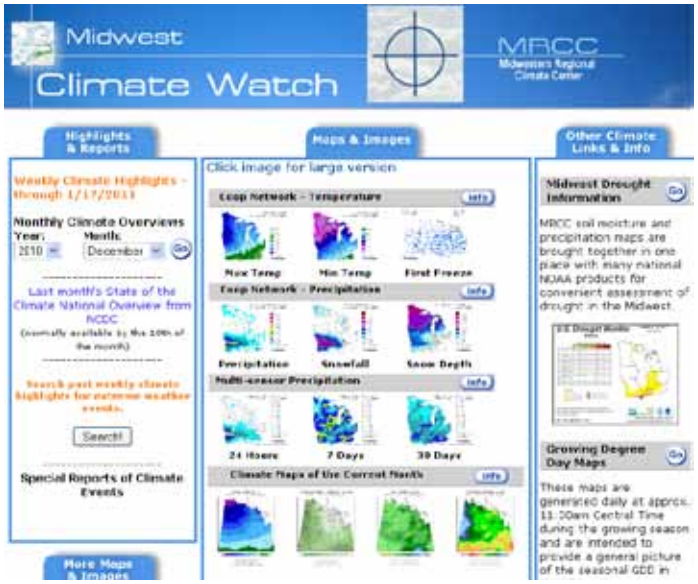
For more than 10 years the Midwestern Regional Climate Center (MRCC) has been documenting the climate and significant weather events of the Midwest. What initially began as a monthly summary of climate conditions and extreme events has evolved into a comprehensive set of webpages that provides up-to-date maps of various climate parameters and a weekly narrative of significant weather across the region.

The Midwest Climate Watch webpage is the entry point to a wealth of current information on Midwest climate. The Climate Watch includes month-to-date maps of temperature, precipitation, snowfall, snow depth, and growing degree days. Maps for prior months and seasons are also accessible from the page. Users are also able to access drought information for the region and maps of temperature and precipitation for individual states in the region.

Each week the MRCC posts a narrative of the previous week's temperature, precipitation, and weather events. The narrative describes the impacts of these events, generally gleaned from news accounts, and includes links to other sources of information and additional charts, maps, and graphics. The narratives are archived and are searchable by event type and state. For example, a user could search for all summaries that included tornadoes for Michigan.

"The Midwest Climate Watch page is the most accessed page on our website," said Steve Hilberg, MRCC Director. "We have made a number of improvements in the past year and have more planned for the spring."

Two major additions this year were a 24-hour county-level precipitation map produced using data from the National Weather Service Advanced Hydrologic Prediction Service and a map tracking the occurrence of the first freezing temperatures of the fall across the central U.S. MRCC will soon debut a map depicting the last occurrence of freezing temperatures along with growing degree day information that will help assess the vulnerability of spring vegetation (see story on page 2). □



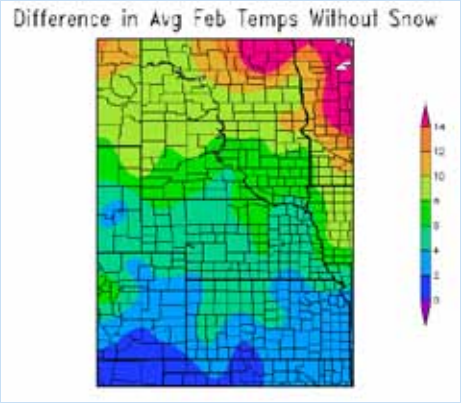
RESEARCH

The Influence of Snow Cover on Air Temperatures in the High Plains Region

Operational forecasters consider multiple factors besides model output when developing their forecast products, including knowledge of local topography, model biases, or analogous events. Research at the High Plains Regional Climate Center shows snow cover of at least 1 inch is another feature that can be used to help improve accuracy when making a temperature forecast. Not only is air temperature significantly affected by a layer of snow on the ground, but also the associated wintertime energy demands are impacted.

For the High Plains region, 50 years of daily temperature and snow cover data were analyzed to determine air temperature differences with and without snow cover. One would assume categorical differences in air temperature based on the presence or absence of snow, but to date there is no quantitative assessment to determine the extent of these differences. The core winter months of December, January, and February were considered for 79 non-mountain locations.

Study results show that a substantial difference exists between the 30-year normal temperature and the average temperatures categorically for days with snow cover and days with no snow cover. The plains of Colorado, Kansas, Nebraska, and southeastern Wyoming can experience an average temperature that is 6° F to 14° F colder when 1 inch of snow is present. A similar, but positive, difference exists for the northern states when there is a lack of snow cover on the ground. The Dakotas can see average daily temperatures 6° F to 14° F warmer than normal. □



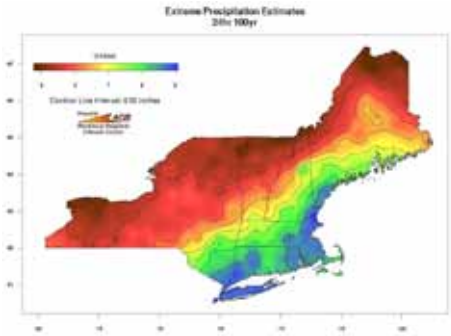
February temperature departure from normal, aggregate mean for all days with no snow on the ground.

Extreme Rainfall Statistics for Northeast Updated

The increasing trend in extreme rainfall frequency across the United States has been greatest in the Northeast. In cooperation with United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) offices in New York and in the New England states, the Northeast Regional Climate Center (NRCC) has developed updated extreme rainfall return period statistics for this region. The analysis is meant to complement the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 extreme rainfall study that was completed in 2006, covering states to the south and west. Although analysis methods used in New York and New England differed, the resulting rainfall data are statistically similar based on reanalysis of extremes using NRCC techniques for stations in Pennsylvania and New Jersey.

The NRCC atlas replicates Atlas 14, which allows files from the NOAA and NRCC to be directly input into NRCS hydrologic software. Access to the products will be available through a dedicated website which is in the final stages of a beta test phase. Users will be able to access data and products using a Google Maps interface for station selection and a menu of products. Products are both tabular and graphical. The website will include a user guide and several technical documents when beta testing is completed.

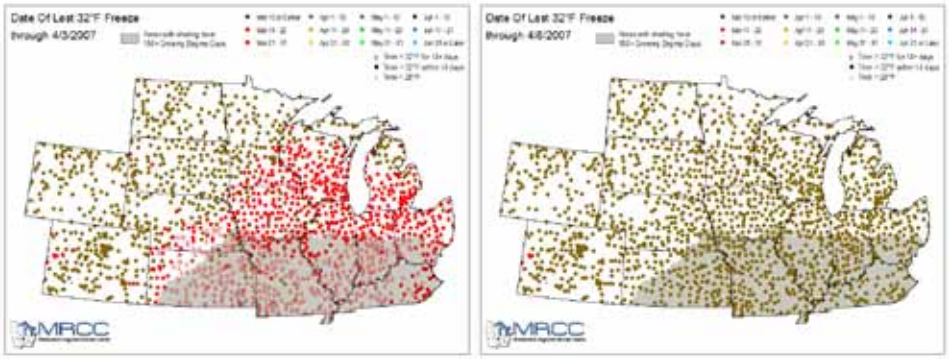
Over the past several months, the NRCC and NRCS have given a set of seven user outreach presentations, one in each state covered by the atlas. These were attended by state agencies, private engineering firms, and academics. Access to workshop presentations and a recorded webinar will also be available on the website. □



Example of a regional map showing the 100-year 24-hour rainfall across New York and New England

New Map Product Helps Assess Potential Vulnerability of Vegetation to Late Spring Freeze

In the spring of 2007, unseasonably warm weather the last ten days of March and the first few days of April was followed by record-breaking cold weather. While freezing weather is not unusual in early April, the warm weather of late March promoted rapid development of plants and tree buds. Temperatures remained below freezing in some areas for several days, and a hard freeze (temperatures below 24° F) occurred over the entire region on April 7, with subfreezing temperatures well south of the



The graphic on the left shows the map for April 3, 2007 prior to the devastating freeze. The open red circles across the southern half of the region indicate locations where it has been at least 14 days since the last freezing temperatures. The gray shading shows the area where 150 or more growing degree days have accumulated. The dark brown dots on the map on the right for April 8, 2007 indicate that freezing temperatures have occurred since April 3.

Ohio River. The damage and impacts to agriculture in the eastern half of the country exceeded $2 billion.

The Midwestern Regional Climate Center has created a new map product that will track freezing temperatures in the spring combined with baseline growing degree day (GDD) information. The map is available on the Midwest Climate Watch page (http://mrcc.isws.illinois.edu/cliwatch/watch.htm), and is updated daily. Each station on the map is marked by a small black dot. As long as a station records a minimum temperature equal to or less than 28° F, it remains a small black dot. Once a station records at least one day with a minimum temperature greater than 28° F, it is marked by a large dot filled with a color determined by the date of the last freeze. If a station has recorded a minimum temperature greater than 32° F in each of the past 14 days, the station is marked by an open circle with the color representing the date of the last freezing temperature.

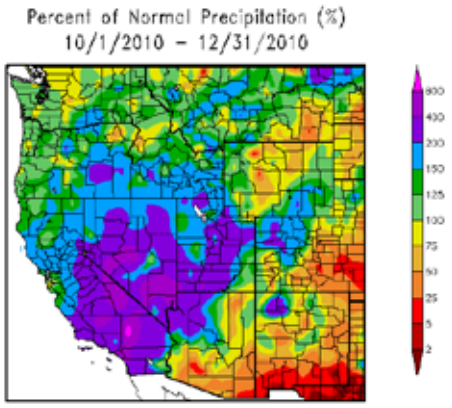
The changing station symbology is intended to deemphasize the areas that are still freezing every day and those that have been above freezing for a period of time. It also makes it easier to determine if it has been some time since the last freeze. The map includes shading to indicate those areas that have accumulated 150 GDD. The implication is that plant development may have occurred in these areas to the extent that another freeze could cause damage to vegetation. □

Interesting Start to the Winter Weather Season in the West

La Niña (a cooling of sea surface temperatures in the equatorial Pacific Ocean) typically is associated with below average precipitation in the Southwest, and above normal precipitation in the Northwest during the winter months based on historical observations. This year, La Niña is the strongest observed since the mid-1970s, according to the Multivariate ENSO Index, so one might expect a typical precipitation response across the West.

The period October–December 2010 indeed turned out to have unusual weather leading into winter. Much of the West was well above normal in precipitation, including, for example, southern California where it would normally be dry. Blue and purple areas on the associated map show places where precipitation exceeded 150 percent of normal during the three-month period.

Much of Arizona and New Mexico remained dry as might be expected, but a number of large storms caused unusual wetness across the West. These storms were also responsible for a number of climate impacts, including damaging tornadoes and hail in Arizona in October, flooding and mudslides in California in October and December, and in Washington in December. Wind events exceeding 100 mph occurred in the Sierra Nevada in October and December. November saw major winter storms in Washington, Montana, Idaho, and the Sierra Nevada along with a deadly avalanche in Colorado. An exceptionally unusual freezing rain event occurred throughout Alaska in November, causing numerous problems. Strong storms continued to impact the West in December, including Washington, California, Nevada, Utah, and a portion of Arizona. California, Nevada, Arizona, and Utah saw record rainfall and flooding.



Percentage of normal precipitation for the period October 1–December 31, 2010 for the western U.S.

Whether each of these storms was directly associated with La Niña is difficult to say, but it is not unusual to see enhanced weather patterns when La Niña occurs. This tropical Pacific Ocean phenomenon tips the odds towards having more interesting weather in the West as well as some other parts of the country (as does El Niño), and indeed this was the case to end 2010. □

PARTNERSHIPS & COLLABORATIONS

Using Weather and Climate Information to Predict Zoo Attendance

The Southeast Regional Climate Center (SERCC) is working with the North Carolina Zoo in Asheboro, North Carolina and Zoo Atlanta in Georgia to determine how weather and climate affect visitor attendance. By coupling daily attendance and visitor profile data with temperature, humidity, wind speed, precipitation, and various biometeorological indices, predictive models are being developed to assess the conditions that have the greatest effect on zoo attendance. In addition, monthly climate variables and their anomalies are being analyzed to assess the utility of seasonal forecasts in forecasting attendance several months in advance.

The U.S. Department of Commerce estimates that more than $3 trillion of the U.S. gross domestic product is affected by weather each year. The Weather Risk Management Association states that 80 percent of global businesses are impacted by weather. The tourism and recreation industry is no exception. This sector relies heavily on weather information because many of its activities take place outdoors. This exposure contributes significantly to the sustainability of a business which must adapt and respond to various weather conditions.

The predictive models developed by the SERCC will help the two zoos predict consumer demand, thereby allowing them

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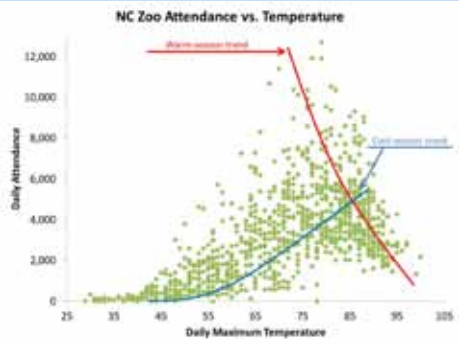
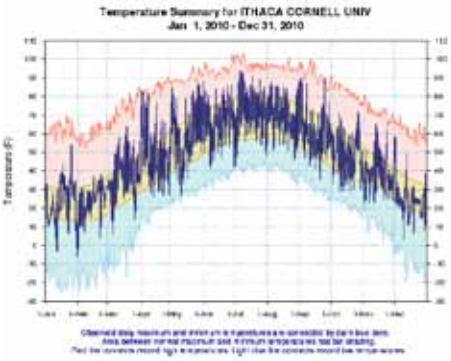


Daily NC Zoo attendance on dry weekends plotted against daily maximum temperature. Attendance increases with temperature during the cool season (September-May) and decreases with temperature during the warm season (June-August).

New Graphical Products for xmACIS

Two graphical products have been added to xmACIS, the interface to the Regional Climate Center Applied Climate Information System (ACIS) used internally by National Weather Service Forecast offices. One plot shows a time series of observed daily maximum and minimum temperatures relative to normal and to historical extremes. The graph (right) illustrates warm conditions experienced at Ithaca in 2010. Record maximum temperatures occurred in early April. During the summer, both maximum and minimum temperatures were consistently above normal. The colder than normal December is also evident.

The second graph focuses on precipitation. It shows the accumulation of daily precipitation through time. Users can select whether they would like the graph to show the observed precipitation accumulation relative to either the normal accumulation, the precipitation observed in the wettest or driest year of record, the rainfall in a user-specified year, or a combination of these options. □



Time series of daily maximum and minimum temperatures at Ithaca, NY for 2010 using the Temperature Graph routine on xmACIS.

HPRCC Develops Regional Climate Change Bulletin

The High Plains Regional Climate Center (HPRCC) has developed an informational bulletin to increase awareness and understanding of climate change and variability at the regional scale. The five-page fact sheet, titled "Climate Change on the Prairie: A Basic Guide to Climate Change in the High Plains Region," was written for a broad audience. Individuals that would find this bulletin useful include Extension educators, agricultural producers, natural resource managers, research scientists, and government officials. Several topics are summarized in the bulletin, including global climate change, climate change in the U.S., historical regional trends, future projections, and possible impacts of change. Readers are able to see temperature and precipitation trends analyzed both geographically and temporally, including a breakdown by season and state.

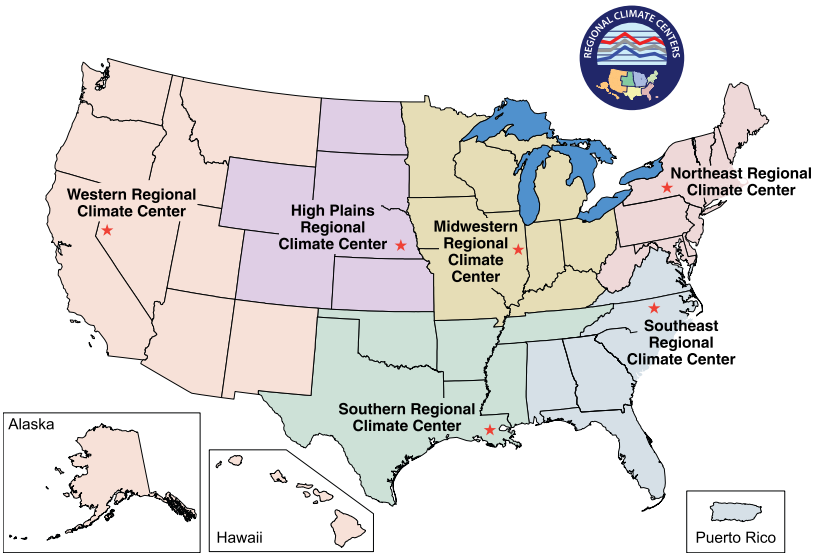
An overall warming is clearly evident for the High Plains region, with winter and spring warming at a greater rate than summer and autumn. With the warming projected to increase in the future, some of the key regional areas affected include water resources, extreme event frequency, pests and habitat fragmentation, and demographic shifts.

The Intergovernmental Panel on Climate Change and U.S. Global Change Research Program were used as sources for the bulletin. Historical statewide trends from 1895 to 2009 were obtained using data from the Historical Climatology Network at the National Climatic Data Center. The bulletin is featured on a new climate change webpage at HPRCC and is available for download.

Weather and Climate continued from page 3

to develop business and marketing systems with the weather in mind. Additionally, differences in zoo layout and visitor demographics between the Atlanta and North Carolina zoos may provide further insight into the role of weather and climate in the decision-making process. For example, it is hypothesized that visitation at the more shaded and compact Zoo Atlanta is less affected by exceptionally warm temperatures relative to the sprawling North Carolina Zoo. □

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

October 1-December 31, 2010

Total Web hits:	16,519,237
Data Requests/contacts:	2,313
Media requests:	117

High Plains RCC University of Nebraska, Lincoln, NE	**(402) 472-6706**
Midwestern RCC University of Illinois, Champaign, IL	**(217) 244-8226**
Northeast RCC Cornell University, Ithaca, NY	**(607) 255-1751**
Southeast RCC University of North Carolina, Chapel Hill, NC	**(919) 843-9721**
Southern RCC Louisiana State University, Baton Rouge, LA	**(225) 578-5021**
Western RCC Desert Research Institute, Reno, NV	**(775) 674-7010**