



SERVICE TO STATE CONTINUES TO GROW

In 2017, the Nebraska State Climate Office gave 73 talks, with nearly 4,300 people in attendance – an increase of nearly 1,700 people over the previous year, and it fulfilled nearly 700 data information requests.

2017 was busy, a good omen for the four-person office that officially turns 2 on Jan. 1. It's a sign Nebraskans recognize the value in having trained climatologists serve

as an official source of climate information, both historical and projections, and recognizes that the office strives for the highest quality possible.

"We are a small office that stays busy," said Martha Shulski, climate office director. "We are dedicated to serving the needs of Nebraskans and beyond."

The office has gotten good at juggling the projects that fund

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Martha Shulski speaks during a planning workshop in 2017. Photo by Tarik Abdel-Monem



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them with the needs of Nebraskans and its organizations and groups seeking information. Included in the list of projects that fund their office are several that focus on delivering climate observation data collected by the Nebraska Mesonet to help aid water managers with Natural Resource Districts and the Department of Natural Resources. It also includes delivering data to the National Oceanic Atmospheric Administration for weather forecasts and forecast verification. And it includes working with 10 cities across the Midwest to provide personalized climate reports to aid city planners in making infrastructure decisions related to expected climate conditions 50 years out.

In between all that, Shulski and Al Dutcher, extension climatologist with the office, met with agriculture producers, statewide ag boards, elementary students and Legislators, among others, to give talks on the Nebraska Mesonet and on climate change and to provide climate outlooks. Presentations were only given upon request, only on the topic requested and were personalized based on audience.

"The increase in audience at our talks is telling on how many people are seeking knowledge on different aspects of weather and climate," Shulski said. "People are trying to understand what is currently happening, what are the emerging issues — if any, and what does the future hold.

"We are able to summarize a complex topic into something that is informational and usable."

Most often, ag producers are looking for a seasonal outlook to inform on-farm planning decisions. They want to know historical climate trends, so they know whether they should change their management plan. They want to know future projections of climate for the same reason. And during growing season, they want to know current climate details related to crop water use, irrigation, disease, pest management and even when to plant, a decision based on soil temperature.

The office fields plenty of calls from media outlets as well, often to provide context for a recent climatological event.



NSCO

This illustrative version of one of the Nebraska State Climate Office's presentations was created during the Institute of Natural Resources Growing Nebraska Summit in November 2017. The focus was on Nebraska's climate and what expected changes mean for Nebraskans.

"Perhaps there's been an extreme event and they want to know the historical ranking or trends over time," Shulski said. "They also like to know WHY something happened; can we put a fingerprint on an event?"

Sometimes it's as simple as wanting to know, "Will there be a white Christmas?" (This year? Probably not, and statistically, it's only white about 33 percent of the time.)

The other major request — 178 of them to be exact — are in secondary education, teachers and schools reaching out to the climate office to provide quality historical meteorological data, to help grow climate understanding beyond tomorrow's expected temperature.

"Climate covers all time and space scales, and we handle all levels," Shulski said.

The most important part of what the office does, though, is turning data and information into something that is usable by people across the state. In 2017, the office streamlined its monthly climate report; released more timely and relevant stories on climate, such

as the first frost assessment and the influence of La Nina; and created a new webpage dedicated solely to making available Nebraska-specific information on the Total Solar Eclipse. The page, still available at eclipse.unl.edu, offered live-streamed viewing of the eclipse and now has a time-lapse video available.

With 2017 nearly in the rearview mirror, the state climate office is looking ahead to 2018 and continuing to improve the services they offer.

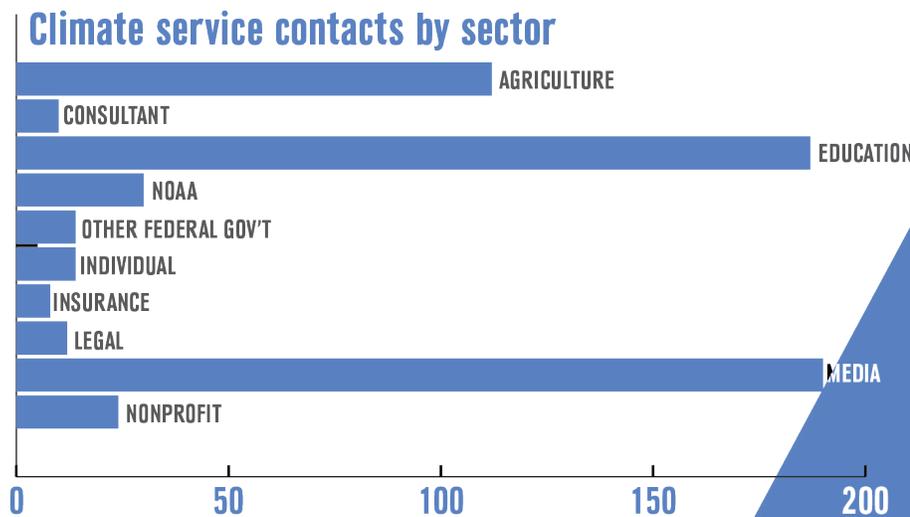
"We'll be enhancing access to Mesonet data to allow viewers the ability to find more historical information," Shulski said.

They'll also be giving the website, nscounl.edu, a facelift, with enhanced products and services, including historical trends for temperature and precipitation seasonally for the state's eight climate divisions.

The focus, as always, will be on improving their products for the Nebraskans they serve.

**SHAWNA RICHTER-RYERSON,
COMMUNICATIONS**

NSCO
YEAR IN REVIEW




694
DATA
ORDERS

73
TALKS


4,296
PEOPLE IN
ATTENDANCE

LA NINA PATTERN COULD MEAN DRY WINTER

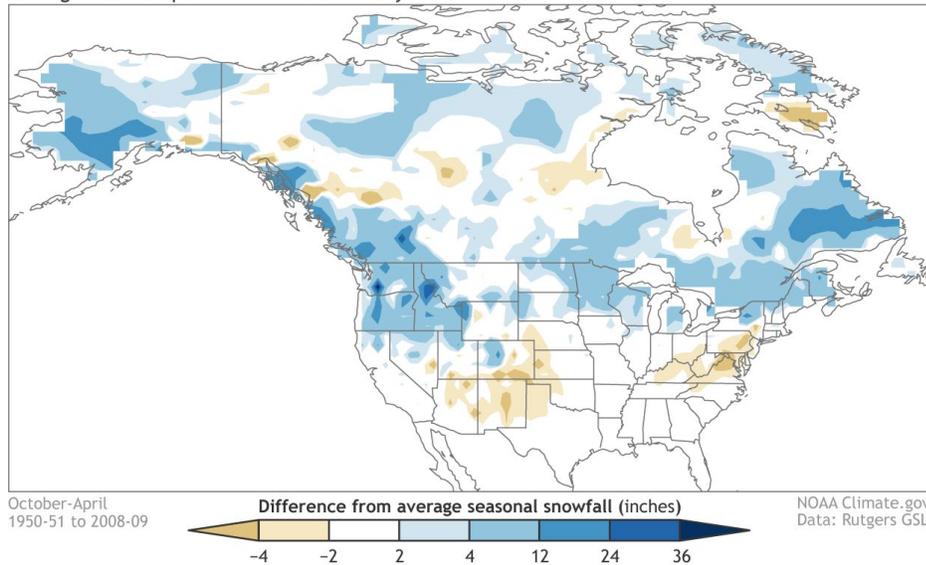
Another winter season is fast approaching and like last fall, La Nina conditions are being closely monitored for their potential impacts across the globe. Last fall, a weak La Nina signal materialized before quickly dissipating once the calendar reached 2017. By all appearances, the current La Nina appears to be developing at a stronger rate.

La Nina conditions develop across the eastern half of the Equatorial Pacific when the wind field becomes stronger than normal. Surface water is pushed westward toward Indonesia at a quicker rate than normal. As sea surface conditions cool, evaporation and moisture transport by atmospheric rivers into the southern United States is reduced.

Locations in the United States have correlations to La Nina in excess of 70 percent when examining temperature and precipitation responses. General trends include wet and cool conditions across the Pacific Northwest and northern Rockies, cool conditions across the northern Plains region, wet conditions across the eastern Corn Belt region, and dry and warm conditions across the southern United States.

Even with these high correlations, other atmospheric phenomena help explain why these favored areas do not experience the same type of conditions with each

Average snowfall patterns for all La Niña years



NOAA

Snowfall departure from average for all La Niña winters (1950-2009). Blue shading shows where snowfall is greater than average and brown shows where snowfall is less than average. Climate.gov figure based on analysis at CPC using Rutgers gridded snow data.

La Nina event. This is especially relevant for interior sections of the United States that are not highly correlated to La Nina. Important factors that may work with or against La Nina signals include the Arctic Oscillation (polar vortex), the Pacific-Atlantic interaction, and Madden-Julian Os-

cillations which transport moisture blobs from the Pacific Equatorial region into the mid-latitude region of the northern Hemisphere.

If you recall last fall, warm and dry

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conditions led to a rapid harvest. Hard freeze conditions across the southern and central Plains were unusually late as cold air penetration from Canada into the continental U.S. was virtually nonexistent until late November. As the stormy pattern developed, surface lows entering the Plains lacked cold air and most events in the central Plains were liquid, not frozen.

Snowfall amounts were above seasonal normals in the eastern Dakota's and the northern third of Nebraska. Southern Nebraska and northern Kansas experienced well below normal snowfall, but above normal moisture. The southern Plains region of southwestern Kansas, southeastern Colorado, along with the Oklahoma and Texas Panhandle region experienced several significant snow events, particularly during the late winter and early spring.

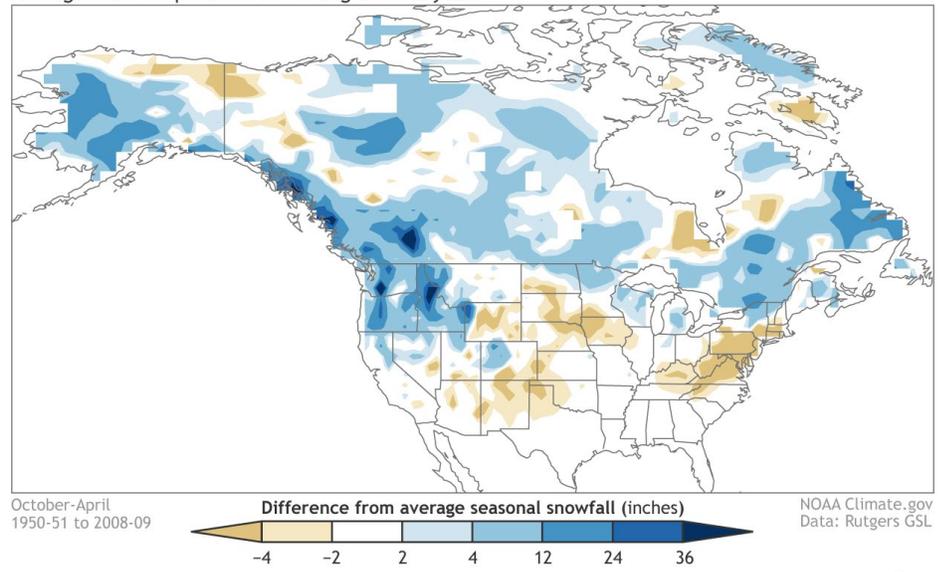
Conditions this fall have some similarities to last fall as average temperatures have been above normal east of the Rockies, just not with the same intensity. Instead of an endless string of warm and dry days like last fall, we saw several quick surges of Arctic air into the continental U.S. this October and November. It appears that cold air from the Arctic region has been able to more effectively push southward from northern Canada.

From my personal observation on the evolution of the North American jet stream pattern this fall, it is apparent that we will likely experience more frequent cold-air events east of the Rocky mountains than last year. We have a ridging pattern in the Gulf of Alaska that is directing the flow on the east side of the ridge southeast from northwestern Canada into southern Canada. This type of pattern would lead to a higher incidence of Alberta Clippers into the northern Plains and Great Lakes during the first half of the winter.

Although Alberta Clippers do bring moisture to the regions they impact, they are generally light events with little significant moisture (think dry snow). This is not great news for the elimination of drought conditions that developed during the second half of last winter. This area will need to experience several large snow events this winter to keep drought conditions from intensifying once again next spring.

Conditions across the central Plains states of Nebraska and Kansas will be dependent on how far southward the

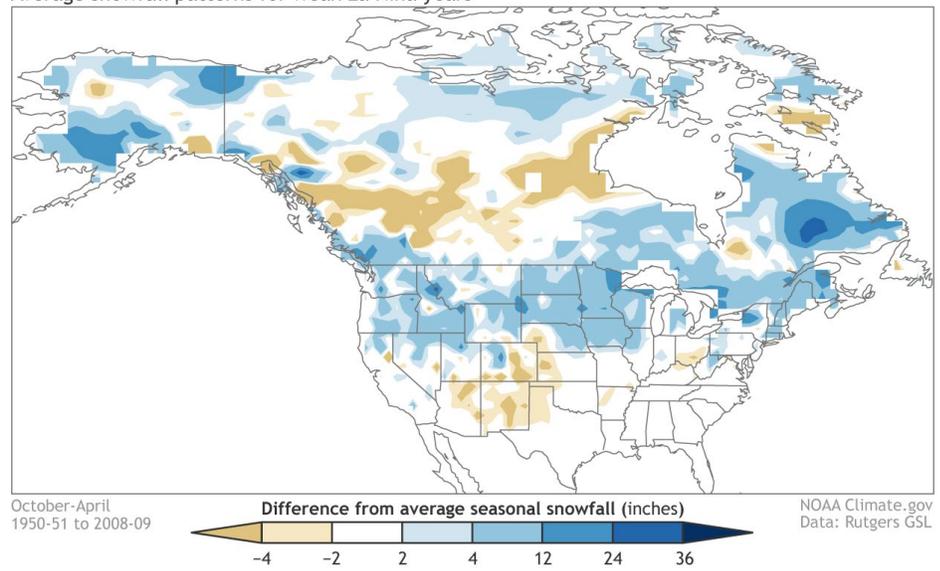
Average snowfall patterns for strong La Niña years



NOAA

Snowfall departure from average for stronger La Niña winters (1950-2009). Blue shading shows where snowfall is greater than average and brown shows where snowfall is less than average. Climate.gov figure based on analysis at CPC using Rutgers gridded snow data.

Average snowfall patterns for weak La Niña years



NOAA

Snowfall departure from average for weaker La Niña winters (1950-2009). Blue shading shows where snowfall is greater than average and brown shows where snowfall is less than average. Climate.gov figure based on analysis at CPC using Rutgers gridded snow data..

cold air penetrates. Deep cold air penetration would argue for frequent Alberta clippers. The other piece of the puzzle will be whether an occasional piece of energy entering the northwestern U.S. is able to deepen over the central Rockies and move eastward. These are the systems that drop heavy snowfall if they are able to pull Arctic

air southward on the backside of the intensifying surface low.

If the southern Plains receives typical La Niña conditions, a gradual drying trend and possible drought development would be expected. The longer this La Niña event lasts, the higher the probability that

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drought conditions will develop across western Texas, western Oklahoma, south-western Kansas, and southeastern Colorado.

If we are looking for the unexpected this winter, then a second consecutive winter of heavy precipitation across the northern two-thirds of California would be an indication of a long winter ahead for the Plains states. Last fall, precipitation dramatically increased as storms pounded the region non-stop for the vast majority of the winter.

On the flip side, if La Nina conditions hold into the spring months, eastern Texas and Oklahoma are in the favored area for above normal tornadic and severe thunderstorm development. A vast majority of the Corn Belt also experiences an up-tick in severe weather during the spring months when La Nina conditions are ongoing. Because of the heavy moisture received during the early fall, soil moisture across the Corn Belt is above normal and planting delays could be a problem once again if an active late spring pattern develops like 2017.

Central Rocky snowpack will likely determine if drought conditions develop during the first half of the summer across northern Kansas and all of Nebraska. Above-normal snowpack across the central Rockies in early May usually result in positive growing conditions during the summer months for the central Plains. Snowpack levels below 80 percent of normal in early May are a leading indicator that drought expansion from the southern Plains is likely.

The reason for this concern is that snow deficits during La Nina winters are not at all uncommon. The National Oceanic and Atmospheric Administration released snowfall departures for all La Nina events, along with weak and strong events. There is a consistent trend in all three plots for below-normal seasonal snowfall from the Texas Panhandle northward into south-western Nebraska, including much of the southern and central Rocky Mountain region of Colorado.

If this forecast verifies, then drought expansion will likely materialize as we work our way through the spring season. However, if La Nina conditions relax during

the late winter, there may be sufficient time for late season snowfall to return in earnest to this region and temporarily alleviate drought concerns.

My official outlook for this winter is for the greatest chance of below-normal temperatures to occur across the eastern half of the state, as the frequent and/or long lived Arctic intrusions appear likely. Western Nebraska will be closer to the ridge pattern over the western U.S. and may lie on the western periphery of these cold air masses.

Snowfall will be dependent on how many storms can make their way through the southern Rockies and tap Gulf of Mexico moisture as the surface systems head northeast into the central Plains. Often these systems are the difference between an above- or below-average snowfall season. Of course, if snowfall comes in above normal, it would be much more efficient in reinforcing cold air outbreaks moving southward out of Canada.

AL DUTCHER,
EXTENSION CLIMATOLOGIST

MESONET SHIFTS TO CALIBRATION SEASON



Glen Roebke, mesonet technician, calibrates weather station instruments in-house during the winter season.

The Nebraska Mesonet is shifting into winter mode.

This winter and early spring will be dedicated to re-calibrating temperature and humidity sensors, as well as any other instruments that need fine-tuning, to ensure the weather observation system's accuracy.

What makes NSCO unique in this regard? Glen Roebke, mesonet technician, has the skills to calibrate the instruments in-house instead of sending them back to the manufacturer.

What else can we expect from Nebraska Mesonet? Roebke and Stonie Cooper, mesonet manager, will be ordering new temperature sensors, as well as a set of solar radiation sensors for the state's weather observation stations. Having a complete second set of solar sensors allows the network to calibrate them at the same time, thus creating a control and ensuring all solar data collected is comparable. Quality is key.

NSCO WORKS TO IMPROVE WIND FORECASTING TOOL FOR POWER COMPANIES

Wind energy is one of the fastest-growing energy sources in the United States, according to the U.S. Department of Energy. Wind power capacity has tripled since 2008 and is expected to supply 35 percent of electrical demand by 2050.

But for power companies, wind production is a highly variable source of power. In the energy marketplace, companies bid on how much wind energy will be generated and offered into the market in advance of an actual day. And the consequences of guessing wrong can cost companies financially. When actual wind production is not at forecasted levels, there is a potential for both negative financial and adverse electric system reliability impacts.

“Right now, wind forecasting tools are available,” said Ron Thompson, Energy Manager for the Nebraska Public Power District (NPPD), “but they fall short when it comes to accuracy for our needs.”

That’s why for the past year, NPPD has been working with the Nebraska State Climate Office to improve short-term wind forecasting across the state. The intended outcome of the two-year project is to develop a more reliable, more accurate wind forecasting model to better predict wind energy output.

“If we improve the quality of the forecast, we improve the reliability of the power system,” Thompson said. For NPPD, a member of the Southwest Power Pool, which covers the central area of the U.S. from the panhandle of Texas to North Dakota. Power generated in the pool is shared, depending on need and availability.

For the project, Martha Shulski, climate office director and researcher, has analyzed data from NPPD’s eight wind farms (those completely or partially owned or under contract by NPPD) in conjunction with that of the Nebraska Mesonet (65 stations across Nebraska). The actual data collected at the wind farms is being used to validate the wind forecasting model’s output.

Early results show that by adding in the Mesonet wind data, collected at 3 meters above ground, the wind prediction



U.S. DEPARTMENT OF ENERGY

is more accurate and closer in line with actual wind power collected at 80 meters above ground.

“The research indicates that weather forecasts seem to consistently overestimate the wind speed,” Shulski said. “By including Mesonet observations into the data assimilation, we see a reduction in that bias.”

For the next year, Shulski will continue to run more analyses, comparing overestimations for different times of year, knowing that wind speeds drop during the summer months. “We also want to incorporate soil moisture into the model and see what sort of forecast improvement we get, if any,” she said. “We want to work closely with NPPD to tailor a decision tool for their application.”

About 9 percent of NPPD’s power supply was generated through wind energy collection in 2016, though the average among all power companies serving the state was 7.5 percent, according to the U.S. Energy Information Administration. And though Nebraska is ranked fourth in wind energy potential in the nation, it

ranks 18th in the amount of electricity it actually produces with existing turbines, the Associated Press reported in October of this year.

Still, wind energy utilization in Nebraska and the rest of SPP is expected to keep growing, said Alan Dostal, NPPD’s director of research. Improved wind forecasts can help utilize this intermittent resource. A more accurate wind forecast tool will help make sure the energy is used efficiently, effectively and economically.

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The Holland Computing Center, a high-performance computing resource for the University of Nebraska system, also is contributing to this project, which is funded through the Nebraska Center for Energy Sciences Research, a collaboration between the Nebraska Public Power District and the University of Nebraska-Lincoln. It was established in 2006 with the intent of supporting innovative research in energy sciences.

**SHAWNA RICHTER-RYERSON,
COMMUNICATIONS**