The Nebraska State Climate Office is to deliver science-based weather and climate services at the local and state levels.

To do that, it manages the Nebraska Mesonet weather network, regularly calibrating the equipment and sensors at each of its 63 research-grade stations to ensure the quality of the system.

Luckily, the quality of data is the No. 1 reason 24 groups sponsor the Nebraska Mesonet weather stations spread across the state.

“Many of our sponsors have seen the value in having quality data — not just for their own uses, but for their neighbors across the state,” said Martha Shulski, director of the state climate office.

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NEBRASKA MESONET SUPPORT PRICELESS
Because the stations collect high-quality weather and climate data, NSCO is able to supply high-grade products — such as evapotranspiration rates, a cattle comfort index, and growing degree days — to its varied users. It means the state-collected data is usable to both regional and national climate groups, including the High Plains Regional Climate Center and the National Oceanic and Atmospheric Administration.

“Data from Nebraska can then be integrated into regional and national scale products to increase utility of our observations,” Shulski said.

Those who help make those products possible include base support from the State of Nebraska Department of Natural Resources and the University of Nebraska-Lincoln.

The complete list of sponsors and how many stations they support includes:

**University of Nebraska–Lincoln**
- Agronomy and Horticulture Department, 3
- Institute of Agriculture and Natural Resources, 13
- Northeast Research & Extension Center, 1
- Nebraska State Climate Office, 8
- Panhandle Research & Extension Center, 3
- School of Biological Sciences, 1
- South Central Research & Extension Center, 1
- West Central Research & Extension Center, 3

**Government Agency**
- Central Platte Natural Resources District, 6
- ENWRA — Lower Platte South NRD, 3
- Lower Elkhorn NRD, 1
- Lower Loup NRD, 1
- Lower Niobrara NRD, 1
- Lower Republican NRD, 1
- Middle Republican NRD, 3
- Tri-Basin NRD, 1
- Upper Big Blue NRD, 1
- Upper Republican NRD, 1

**Other**
- Central Nebraska Public Power

**Eclipse was big news with Nebraska Mesonet, too**

The 2017 Total Solar Eclipse that crossed the United States on Aug. 21 was big news everywhere, including with the Nebraska Mesonet. Thirty of our stations were within the line of totality, recording the drop in temperature and lack of solar radiation, where cloud cover was not an issue.

For the event, we created a website to live-stream data maps from our stations, starting at 12:48 p.m. when the eclipse hit the western side of the state. The last observations in Nebraska were recorded by 1:10 p.m.

We also live-streamed our weather cam, which allowed viewers to watch the eclipse from inside, no eye protection necessary.

We recorded both live streams and created videos of both the satellite and camera streams. See them on the site, eclipse.unl.edu.

**Nebraska Mesonet added to national program**

It’s official. We’ve been accepted as part of the National Mesonet Program, a Congressionally mandated program that began in 2006.

The goal of the program was to bring non-federal meteorological data sources to NOAA for use in weather forecasts and climate modeling.

Now, our 63 stations are among thousands from state-run organizations across the country delivering research-grade data on a variety of variables, including:

- Air temperature
- Precipitation
- Humidity
- Barometric pressure
- Solar radiation
- Soil temperature
- Soil moisture
- Wind speed and direction

With this information, NOAA expects to better predict high-impact phenomena, such as major winter storms, and small-scale events such as flash floods and short-lived extreme wind gusts, which could benefit the ag industry, water resource managers, transportation, public health and safety, and energy production.

“Our network adds real-time weather data taken every five minutes to improve prediction and analysis of weather phenomena and hopefully reduce risk,” Shulski said.

**Maintenance season draws to close**

The Nebraska Mesonet staff has been performing maintenance to our 63 stations since early spring. At each station, we’ve maintained landscapes, calibrated instruments, and upgraded anemometers to a stronger, more reliable model.

By the end of September, the station 2 miles northwest of Sidney became our last station, officially bringing maintenance season to a close, and our focus will shift to calibrating our research-grade instruments for next season.
Daylight hours are slowly disappearing, and the cool down in August was a gentle reminder that fall conditions are rapidly approaching. The past two falls across the central Plains region have brought in very warm temperatures and relatively benign precipitation. The above-normal temperature conditions offset cooler-than-normal conditions over most of Kansas. Below-normal moisture was common across the central and eastern Corn Belt. The remnants of Harvey was responsible for the vast majority of moisture that fell across the western Gulf of Mexico region.

I am torn on CPC’s 90-day Outlook showing above-normal temperatures nationwide. Looking at the past 30- and 60-days, you have to question whether their fall forecast will verify. Yes, we have had periods of intense heat, but the overall average during these periods has been below normal to just above normal. A particularly persistent upper air Great Lakes trough was the primary influence on our cool August temperatures.

Additionally, the Equatorial Pacific is showing a cold pocket developing in the central region of this zone and temperature deviation beneath the surface shows a substantial cold pool developing. CPC’s latest El Nino watch indicates that the odds for El Nino have decreased to 15 percent to 20 percent chance of formation, while La Nina formation has increased to 25 percent to 30 percent. Neutral conditions are now in the 40 percent to 50 percent range.

If the central Equatorial region continues to cool, this would favor a strengthening of the Great Lakes (Hudson Bay low) trough, which would bring increased chances for cold air intrusion to the eastern U.S. westward into the eastern half of the central and northern High Plains (North and South Dakota, Nebraska, and Kansas). The latest 16-day GFS model run at the time this story was put together indicates at least two cold air intrusions before the middle of September, with an outside chance for scattered frost developing across the upper Great Lakes and headwater region of the Mississippi watershed.

In terms of fall weather, the oscillation between distinct periods of above- and below-normal precipitation was projected east of a line from the Texas panhandle to the central upper peninsula of Michigan.

If we examine the precipitation trends during August, the most concentrated area of above-normal moisture lies is the High Plains region from Texas to the Canadian border. This area is split by drier-than-normal conditions over most of Kansas.
below-normal temperatures should continue well into the month of September. With the central Plains region on the western periphery of the Great Lakes trough, moisture convergence in the western Central High Plains region should continue. Therefore, recent precipitation events that we have been experiencing lately are likely to continue as warm and moist air from the southern Plains overrides the cool air situated in the western sections of the upper air trough region.

The only way I see that the current pattern will change is if we see a complete 180-degree reversal of the upper air pattern. This would mean that an upper air trough develops over the western half of the U.S. and a ridging pattern over the eastern U.S. If this pattern was to develop, low pressure systems at the surface would move from a southwest to northeast transect and pull Gulf of Mexico moisture northward ahead of systems ejecting out of this mean trough (under this scenario, the eastern third of the U.S. would see above-normal temperatures and below-normal precipitation).

All in all, this is a very difficult forecast due to the uncertainty of the Equatorial Pacific cold pool and whether this area will expand and strengthen, or relax and weaken as we approach late November.

The weather models continue to point toward continued cold air intrusions, with no ease up in sight. Therefore, current atmospheric conditions lead me to believe an early freeze is in the cards. For Nebraska, the first 32°F event usually occurs near the end of September through the first week of October across the western third of the state and figures the extreme southeastern corner of Nebraska will occur seven to 10 days later. Average hard freeze dates in the fall are almost always seven days later, in the Oct. 7-21 range.

Precipitation is a more difficult call and can be enhanced by tropical systems like Harvey and Maria, more so in areas of the Corn Belt east of Nebraska. Our precipitation events across the western Corn Belt will be favored by two mechanisms. The first mechanism would be cold air aloft associated with a northwest flow aloft. Surface heating is sufficient to create lift that interacts with cold air aloft and thunderstorm development is enhanced. This is the type of weather we commonly experienced during August.

The second mechanism is a slow-moving upper trough ejecting pieces of energy out of the Western U.S. This was a common pattern this spring leading to cool and wet conditions during planting. We often see this pattern begin in earnest sometime during the late September through November period. The bridge between these two competing mechanisms will determine how long we remain dry during the fall harvest season.

Thunderstorms were periodic during September in a northwest flow aloft pattern. Drier-than-normal conditions will be favored during October until upper air troughs begin to impact the Western U.S. When the Western U.S. upper air trough develops (if it does), wetter and cooler temperatures are likely to develop across the Central and Northern Plains regions. This may be a challenging forecast for our agricultural producers trying to wrap up the 2018 crop season.

From my perspective, based on current and potential future atmospheric conditions, temperature variability will likely continue. I expect temperatures to be average to below average for the eastern third of the state. Average to above-average temperatures would be most likely across the western third of the state where they are closer to the western U.S. upper air ridge. Above-normal precipitation is favored for the eastern half of the state in a northwest flow aloft regime though early October. Normal moisture is favored for the western half of the state. If the western U.S. upper air ridge breaks down during September, above-normal moisture is favored statewide during the October to November period.
Arctic climate affects us, too

We’re teaming up with Nebraska researchers to increase Arctic climate resilience

At the Nebraska State Climate Office, we often say that Nebraska is the crossroads of climate — just look at the name of our quarterly newsletter.

But we say it because air currents from both the northern and southern latitudes drive climate in our state, making it among the most variable in the United. This also means what happens climatologically at the Arctic latitudes has effects on the livelihoods of those in Nebraska — especially when looking at food production and the growing global growing need for successful crops.

This is why last year, Martha Shulski, director of NSCO and researcher with the School of Natural Resources at the University of Nebraska-Lincoln, represented UNL as we were voted in as a member of the UArctic Council. The council is a cooperative network of universities, colleges, research institutes and other organizations from around the world concerned with education and research in and about the northern or Arctic latitudes.

In late August, Shulski and Mesonet manager and doctoral student Stonie Cooper attended the UARektic Rectors’ Forum in Scotland, which highlighted how native peoples in the North are responding and adapting to challenges presented by changes in climate. Also attending were UNL Chancellor Ronnie Green and our research partner Hannah Birge, post-doctoral researcher with the Agronomy and Horticulture Department at Nebraska.

The goal of the forum was to address three key areas:

- How researchers in the science and humanities fields can better work together to advance our understanding of the circumpolar North;
- How research can better assist those living in the North respond to challenges related to global changes in climate, a panel discussion led by Green; and
- How northern peoples’ knowledge and wisdom in how they have adapted so far can help shape agendas for future research.

According to the National Science Foundation, in 2007 the United States joined 12 other nations in forming the UArctic Council to develop a strategy for improving research and building a vision for the future.

The council is a member of the UArctic Rectors’ Council, which is the UArctic Council annual collaborative meeting in late August.

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- How northern peoples’ knowledge and wisdom in how they have adapted so far can help shape agendas for future research.

At the state climate office, we’re bringing those themes back to the state. Also in August, it was announced we had earned, with Birge and SNR researcher Craig Allen, one of the first National Science Foundation grants for its new convergence research program.

With the award, our team will gather scientists, practitioners and stakeholders for workshops in Nebraska and Alaska that build a framework to enhance the Arctic’s resilience, and therefore our resilience to changes in climate. While the Arctic is threatened by factors such as climate change, ocean acidification and ozone depletion, Nebraskans are looking at stronger rain events, followed by periods of drought, as well as increasingly high air and soil temperatures, which could result in decreased food and economic security.

Increasing the Arctic’s ability to withstand environmental stresses and shocks will help mitigate the harmful effects of rapid change around the globe.

Participants in our workshops will develop research networks, test new ideas and envision pathways to Arctic stability, incorporating the knowledge and perspectives of indigenous people in the Arctic and Native Americans and other stakeholders in Nebraska and the Midwest. We’ll communicate results to all stakeholders after the workshops.

So far, 17 researchers have confirmed participation in the workshops, the first of which is scheduled for March 2018 in Fairbanks, Alaska. The second will take place in May 2018 in Lincoln with a third workshop back in Fairbanks in September 2018.

The workshops will position participants to influence policymaking decisions and continue high-impact research.

The project is among the initial 23 awards funded by the NSF’s Growing Convergence Research program, which will focus on merging knowledge from disparate areas to solve major challenges, and we’re excited to see where it takes us and how it will improve our services for our stakeholders, including you. We’ll keep you posted as the research develops.

Shawna Richter-Ryerson, NSCO communications. Tiffany Lee, with university’s Office of Research and Economic Development, contributed to this report.