



# Iowa and Nebraska Winter Weather Awareness Day



Thursday, November 4, 2021

## Snow Already?

With a few portions of the area, mainly Nebraska, having already had their first taste of winter, now is the perfect opportunity to start thinking about winter weather safety and being prepared for the upcoming season. Brushing up on winter weather terminology such as snow squalls, blizzard warnings, and winter storm watches are one way to ensure you are prepared for what Mother Nature throws our way. See page 12 for more information.

## Outlook for the Winter

After the early start to last year's winter season, many may be wondering what this winter will bring. Forecasting the long term impacts of the winter season is not easy to do. However, there are signals that can give us clues on what conditions may be like. On page 6, NOAA's official winter outlook gives a broad look at the expected temperature and precipitation trends through the winter. The outlook is not a forecast for individual storms moving across the states, but rather a snapshot of a period of time.

## Winter Storm Severity Index

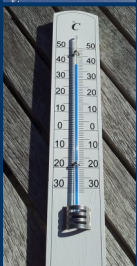
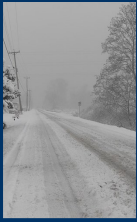
The Winter Storm Severity Index (WSSI) is a way to categorize the potential impacts of an impending winter storm based on past events. The October Snowstorm of the 1997-1998 winter season would be considered a higher impact event than a snowstorm bringing a quick dusting of snow. You can learn more about the elements of the WSSI and how to apply it to winter storms on page 11.

## Recap of Last Winter, Safety & More

The 2020-2021 winter weather season brought a variety of forecasting challenges across the state. An Arctic outbreak brought record cold temperatures in February. Drought led to favorable conditions for wildfires and dust storms in January. Nebraska saw its fair share of winter weather, with a season extending from Labor Day Weekend to mid-April. For a snapshot of winter weather events making headlines around the state last winter, check out the area review beginning on page 25. As we head into another winter season, now is a great time to prepare winter emergency kits and winterize vehicles. Working to prepare ourselves and our communities before weather strikes, we can better equip ourselves keep every-

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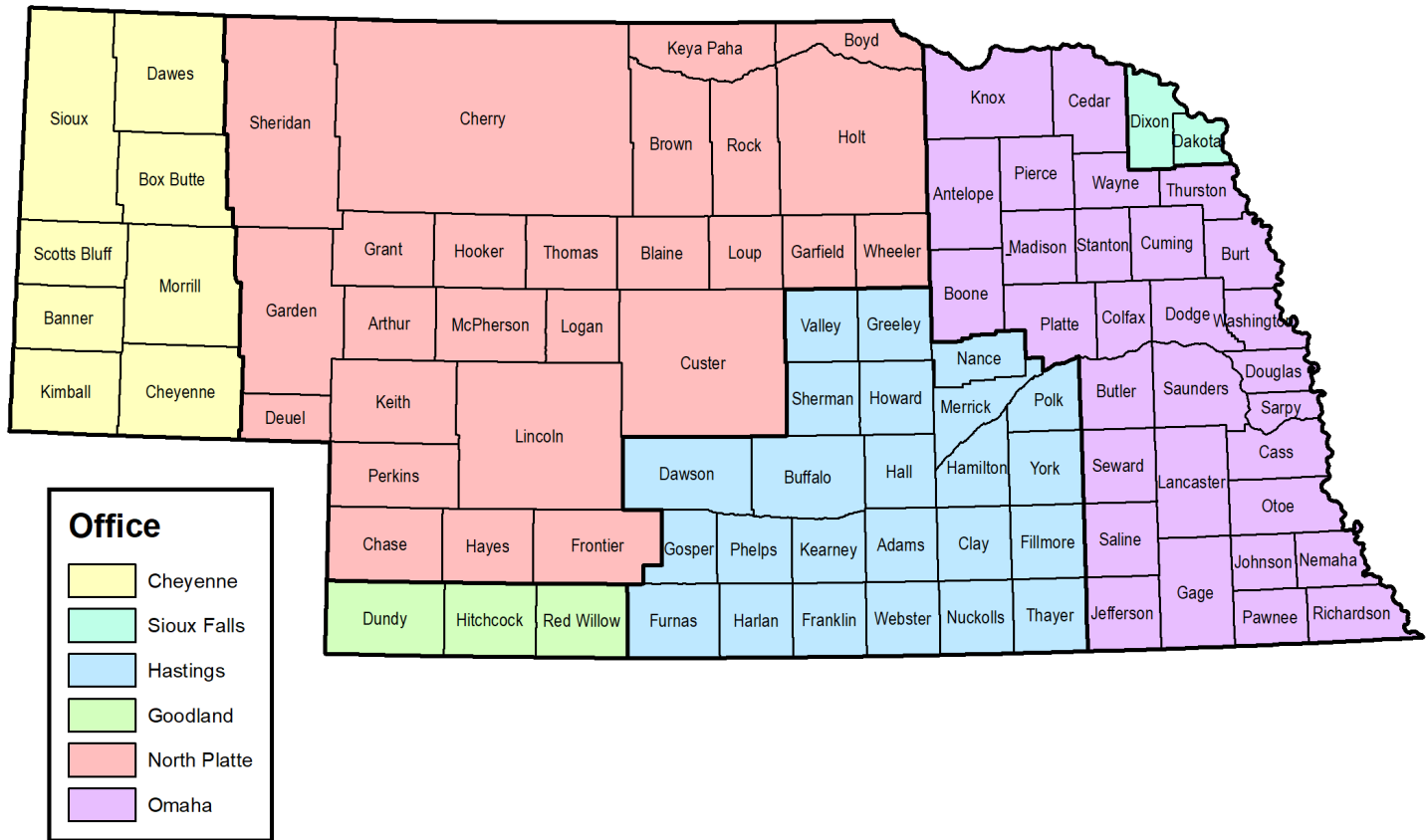


# National Weather Service Offices Serving Nebraska



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## National Weather Service Office Coverage



### Panhandle

#### **Cheyenne, WY**

1301 Airport Parkway  
Cheyenne, WY 82001

(307) 772-2468

[www.weather.gov/cheyenne](http://www.weather.gov/cheyenne)

### West and North Central

#### **North Platte**

5250 E. Lee Bird Drive  
North Platte, NE 69101

(308) 532-4936

[www.weather.gov/northplatte](http://www.weather.gov/northplatte)

### Extreme Southwest

#### **Goodland, KS**

920 Armory Road  
Goodland, KS 67735

(785) 899-7119

[www.weather.gov/goodland](http://www.weather.gov/goodland)

### South Central

#### **Hastings**

6365 N. Osborne Drive West  
Hastings, NE 68901

(402) 462-4287

[www.weather.gov/hastings](http://www.weather.gov/hastings)

### East

#### **Omaha/Valley**

6707 N. 288th Street  
Valley, NE 68064

(402) 359-5205

[www.weather.gov/omaha](http://www.weather.gov/omaha)

### Extreme Northeast

#### **Sioux Falls, SD**

26 Weather Lane  
Sioux Falls, SD 57104

(605) 330-4247

[www.weather.gov/siouxfalls](http://www.weather.gov/siouxfalls)





# National Weather Service Offices Serving Iowa



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## National Weather Service Weather Forecast Offices



Sioux Falls, S.D.



La Crosse, Wis.

Omaha, Neb.

Quad Cities

Des Moines

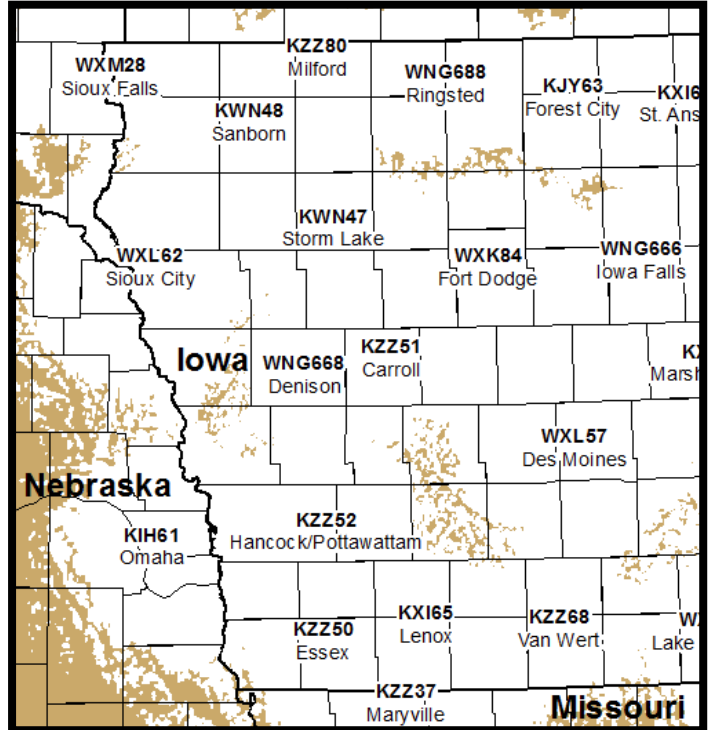
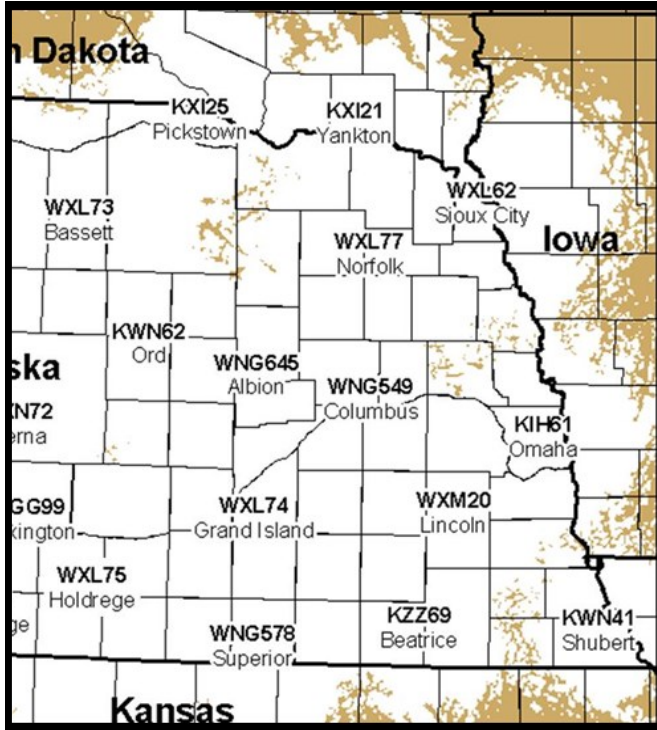
<p style="text-align: center;"><b><u>Southwest</u></b></p> <p style="text-align: center;">Omaha/Valley, NE 6707 N. 288th Street Valley, NE 68064  (402) 359-5205  <a href="http://www.weather.gov/omaha">www.weather.gov/omaha</a></p>	<p style="text-align: center;"><b><u>Northwest</u></b></p> <p style="text-align: center;">Sioux Falls, SD 26 Weather Lane Sioux Falls, SD 57104-0198  (605) 330-4247  <a href="http://www.weather.gov/siouxfalls">www.weather.gov/siouxfalls</a></p>	<p style="text-align: center;"><b><u>Central</u></b></p> <p style="text-align: center;">Des Moines 9607 NW Beaver Drive Johnston, IA 50131-1908  (515) 270-2614  <a href="http://www.weather.gov/desmoines">www.weather.gov/desmoines</a></p>
<p style="text-align: center;"><b><u>Northeast</u></b></p> <p style="text-align: center;">La Crosse, WI N2788 County Road FA LaCrosse, WI 54601  (608) 784-7294  <a href="http://www.weather.gov/lacrosse">www.weather.gov/lacrosse</a></p>		<p style="text-align: center;"><b><u>Southeast</u></b></p> <p style="text-align: center;">Quad Cities IA/IL 9040 N Harrison Street Davenport Municipal Airport Davenport, IA 52806-7326 (563) 386-3976  <a href="http://www.weather.gov/davenport">www.weather.gov/davenport</a></p>



# NOAA Weather Radio All-Hazards (NWR)



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NOAA Weather Radio All-Hazards (NWR) is a nationwide network of radio stations broadcasting continuous weather information directly from the nearest National Weather Service office. NWR broadcasts official NWS warnings, watches, forecasts and other hazard information 24 hours a day, 7 days a week.

Working with the Federal Communication Commission's (FCC) Emergency Alert System, NWR is an "All-Hazards" radio network, making it your single source for comprehensive weather and emergency information. In conjunction with Federal, State, and Local Emergency Managers and other public officials, NWR also broadcasts warning and post-event information for all types of hazards, including natural (such as tornadoes or floods), environmental (such as chemical releases or oil spills), and public safety (such as AMBER alerts or 911 Telephone outages).

Known as the "Voice of NOAA's National Weather Service," NWR is provided as a public service by the National Oceanic and Atmospheric Administration (NOAA). NWR includes 1000 transmitters, covering all 50 states, adjacent coastal waters, Puerto Rico, the U.S. Virgin Islands, and the U.S. Pacific Territories. NWR requires a special radio receiver or scanner capable of picking up the signal. Broadcasts are found in the VHF public service band at these seven frequencies (MHz):

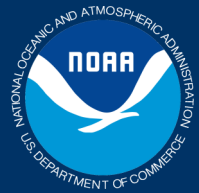
162.400	162.425	162.450	162.475	162.500	162.525	162.550
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Coverage information and SAME Codes for every county in the U.S. can be found at:

[www.weather.gov/nwr/Maps](http://www.weather.gov/nwr/Maps)







# National Weather Service Social Media



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## Have you found us on your favorite social media platform?

Do you have a Facebook page or a Twitter account?

Did you know that your local National Weather Service office is on social media? Each office in the NWS has a Facebook and Twitter account. Find your local NWS office and check it out!

Each office's Facebook and Twitter account keeps you informed and up-to-date with the latest forecasts, watches and warnings for your local area. Be a part of the process, we always need ground truth reports and we love to see your pictures. Comment on our Facebook posts, or send us a tweet, with your information, report or question and we will respond to it as quick as we can.

### Follow your local office...



**NWS Cheyenne, WY**

**@NWSCheyenne**

**NWS Cheyenne**

**NWS Goodland, KS**

**@NWSGoodland**

**NWS Goodland**

**NWS North Platte, NE**

**@NWSNorthPlatte**

**NWS North Platte**

**NWS Hastings, NE**

**@NWSHastings**

**NWS Hastings**

**NWS Sioux Falls, SD**

**@NWSSiouxFalls**

**NWS Sioux Falls**

**NWS Omaha, NE**

**@NWSOmaha**

**NWS Omaha**

**NWS Des Moines, IA**

**@NWSDesMoines**

**NWS Des Moines**

Social media information about other NWS offices can be found at:  
[www.weather.gov/socialmedia](http://www.weather.gov/socialmedia)



# 2021-2022 Winter Outlook

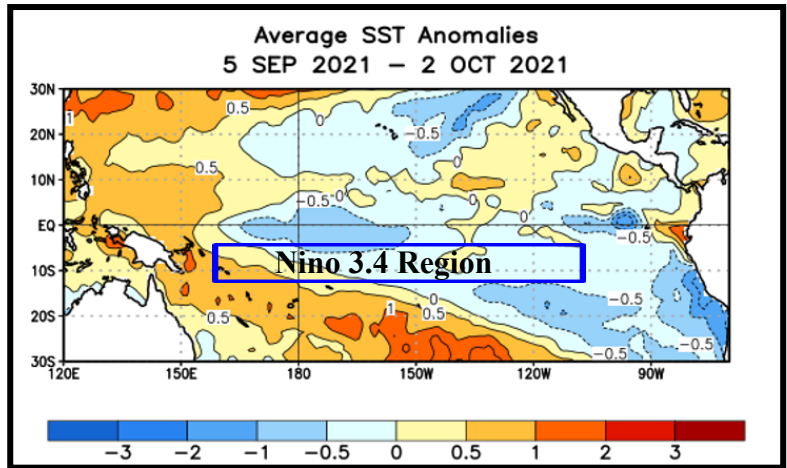


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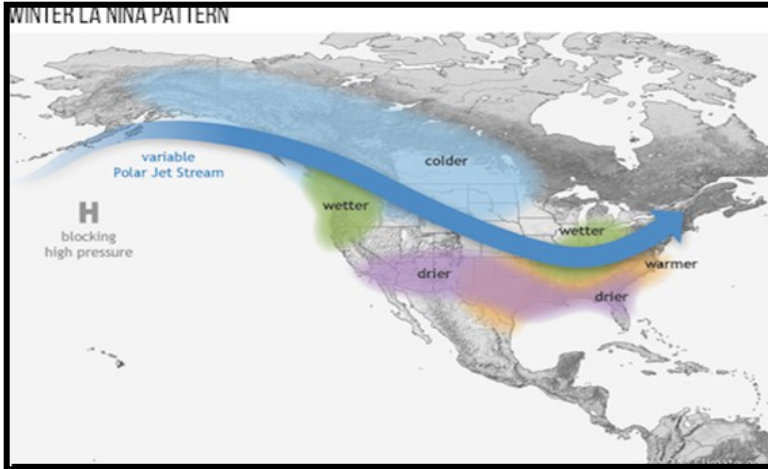
## Winter Outlook

Believe it or not, winter weather conditions across the Continental United States are influenced by water temperatures halfway around the world in the equatorial Pacific. Last winter, water temperatures in the equatorial Pacific were cooler than normal. When temperatures in the equatorial Pacific are 0.5°C or colder, a La Niña advisory is issued. Last winter season, the Oceanic Niño Index or (ONI) peaked at -1.3.

For this winter, La Niña conditions are forecast to develop later this fall and persist into the winter months. As for the strength of La Niña, the latest forecast has the ONI index falling to -0.7 to -1.2, which is a slightly weaker La Niña compared to last winter.



## La Niña's Impact on Winter Weather



In a La Niña pattern, the polar jet is shifted north into the Gulf of Alaska as a ridge of high pressure develops over the northern Pacific. Downstream of this ridging, colder than normal temperatures are expected over the Northern Plains and Great Lakes region, with wetter than normal conditions over the Great Lakes and Pacific northwest. Drier and warmer conditions are expected from California into the southeastern states.

## La Niña's Impacts in Nebraska

La Niña's impacts in Nebraska tend to be more subtle compared to the northern and southern parts of the country. A persistent northwesterly flow aloft tends to favor more Alberta clipper type systems and less of the Four Corners type lows, which can bring heavy snow and significant winter weather to the Central and Southern Plains. Local research by the North Platte NWS Office shows a small signal toward warmer than normal and drier than normal conditions across western Nebraska during a La Niña event. Research done by the Hastings NWS Office indicates that in central Nebraska, precipitation is slightly above normal and snowfall is slightly below normal during La Niña events.

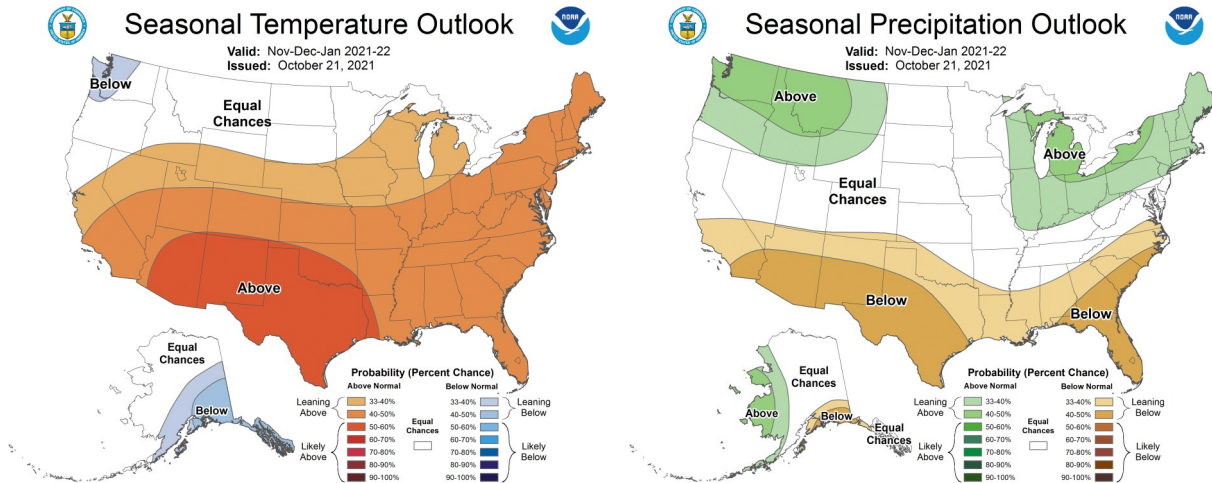


# 2021-2022 Winter Outlook



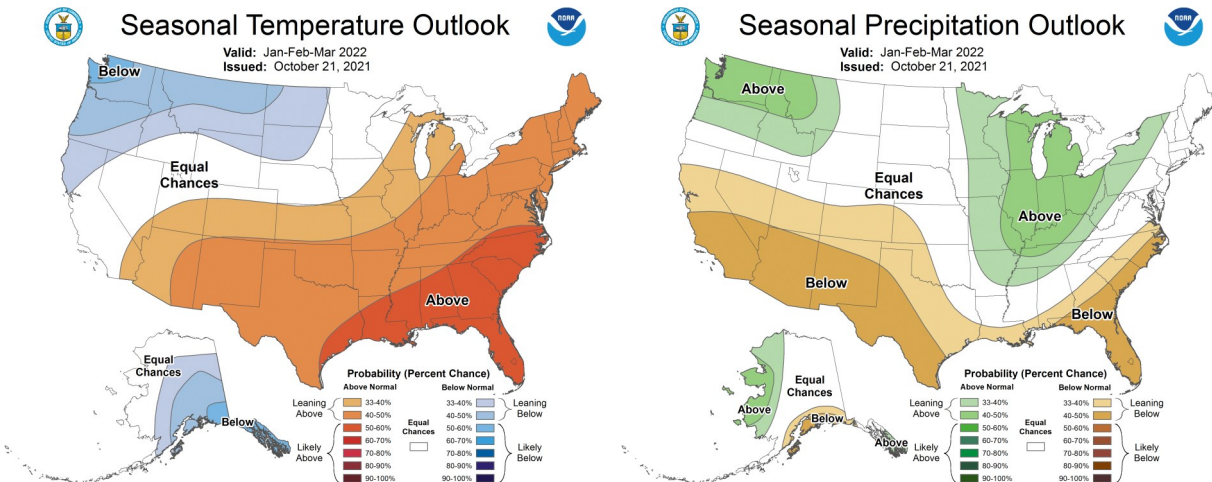
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## The Official Outlook for this Winter Early Winter (November, December, January)



As of October 21st, according to the Climate Prediction Center, above normal temperatures are forecast for early winter. The precipitation outlook is for equal chances for above, below, or near normal. This means there is not a strong enough long range signal to forecast above, below, or near normal precipitation.

## Late Winter (January, February, March)



As of October 21st, according to the Climate Prediction Center, there are equal chances for above, below, or near normal temperatures and precipitation for all of Nebraska. This comes as no surprise given the relatively weak La Niña signal for this winter and low predictability for Nebraska which typically accompanies a weak negative (La Niña) ONI index.

In short, this winter season for Nebraska and Iowa should start out with above normal temperatures. For Nebraska, there is no strong forecast signal for above, below, or near normal precipitation. The outlook for late winter shows no strong forecast signal for above, below, or near normal temperatures or precipitation. For Iowa there is a slight chance for above normal precipitation.







# Winter Climate Basics



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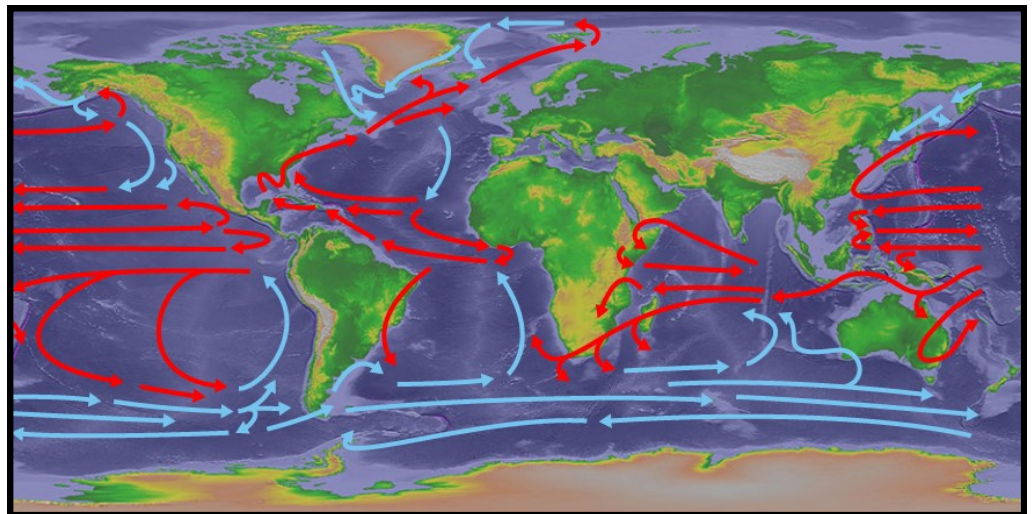
“Climate” is a word used often by the media, scientists, and even in everyday vernacular. But what does “climate” mean? Climate is the long-term average of temperature, precipitation, and other atmospheric variables for a given location. This is a time scale of decades and centuries. This is different from weather, since weather is what occurs in the atmosphere over a much shorter time scale such as a week, a day, or an hour. In other words, climate is what has happened over a long time, but weather is what we actually get on a day-to-day basis. For example, climate is like what you have in your closet, but weather is like what you actually wear on a given day. A real example of climate would be western Nebraska getting an average of 30 inches of snow every winter. Weather on the other hand would be how much snow actually occurs on a given day.

Meteorological winter runs December to February. An example of winter weather would be how cold it gets on a given day (or night). Winter Climate is what affects winters on longer time scales, such as El Niño/La Niña cycles. This winter is going to be affected by La Niña.

Climate is affected on much longer time scales, so some natural sources of change include ocean currents, energy from the sun, changes in Earth’s orbit, and volcanic eruptions. Let’s dive into these a bit deeper.

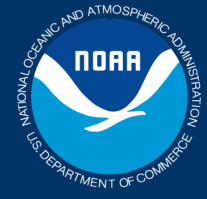
Did you know that almost  $\frac{3}{4}$  of Earth’s surface is water? Because a majority of the globe’s surface is water, the oceans absorb most of the sun’s radiation. Some spots warm more than others thanks to Earth’s tilt. As a result, the oceans act as conveyor belts to distribute warm (and cold) water around the world! In doing so, the ocean helps to regulate the climate. If the ocean didn’t, the equator would have hotter hots and the poles colder colds.

The sun isn’t always the same level of brightness. The sun brightens or darkens over 11 year cycles. The level of activity varies up or down, and impacts the amount of radiation that reaches Earth’s surface. This means Earth could be colder or warmer depending on where the sun is in its cycle. The sun reached a solar minimum in 2019, so it is still on the lower end of activity. It is projected to reach a solar maximum in 2025. The general thought is that more activity means more radiation to Earth. However, given the relatively short period of the cycle, the changes in Earth’s climate are at most 0.15%, and often considered too small to have an honest impact. So, although it is worth mentioning, other forces affect Earth’s climate much more, and on a much longer timescale.



The general thought is that more activity means more radiation to Earth. However, given the relatively short period of the cycle, the changes in Earth’s climate are at most 0.15%, and often considered too small to have an honest impact. So, although it is worth mentioning, other forces affect Earth’s climate much more, and on a much longer timescale.





# Winter Climate Basics



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Did you know that Earth's orbit isn't perfect? It changes on a scale of thousands of years. Parts of this include Earth's eccentricity in its orbit, Earth's precession, and Earth's obliquity on its axis. Earth tries to orbit in a perfect circle around the sun, but gravitational pull from the sun in one direction, and Saturn and Jupiter in other directions makes the orbit into an ellipse, sort of like when someone hula hoops. Earth's eccentricity is how much this path deviates from being a perfect circle (seen on the right). As such, Earth's orbit cycles every 100,000 years (or more) between its most circular and most elliptical path. This affects climate, because when the orbit is most elliptical, more radiation reaches Earth. Currently, Earth is in a more circular orbit, and is trending towards a more elliptical orbit. Another important part is Earth's precession, which is its wobble on its axis. Many know Earth spins on its axis, but it is better described as wobbling like a top. This means that its orbit will be oriented in different alignments throughout the cycle (seen below). This impacts climate because the wobble makes for strong seasonal contrasts between hemispheres. This cycle varies every 21,000 years or so. Lastly is Earth's obliquity. This is when Earth's tilt varies between roughly 22 and 24 degrees. This affects climate as larger angles allow for

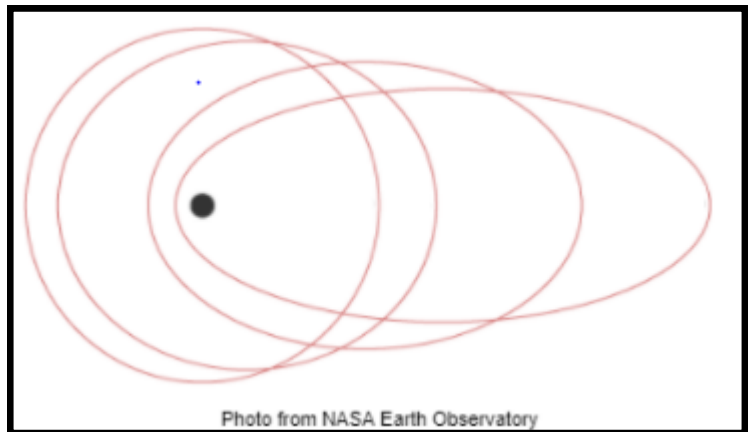
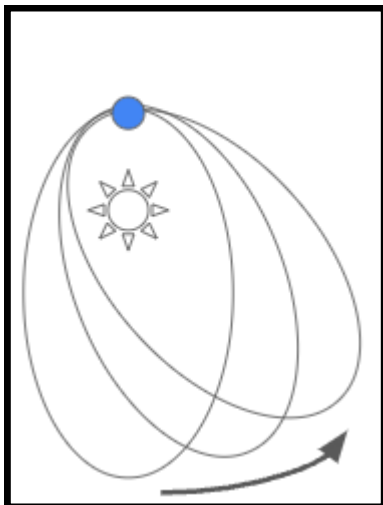


Photo from NASA Earth Observatory



more radiation to be received from the sun. Currently, the Earth's axis is around 23 degrees, and is slowly decreasing towards a minimum tilt. This cycle spans about 41,000 years. All three put together are referred to as the Milankovitch Cycle, and have a natural effect on Earth's climate in the long term.

Last but not least, volcanic eruptions also act to cool the planet. When a volcano erupts, it emits volcanic gases and ash into the air. These volcanic gases cause cooling, as they reflect solar radiation back into space and stop the air from being heated further. In other words, they give the Earth shade. These gases and particles take a couple years to redistribute, or fall to the ground, thus affecting climate. Lastly, because the atmosphere works to redistribute the warm and cold air across the planet, the effects of a volcanic eruption are worldwide.

To learn more about climate, check out [www.climate.gov](http://www.climate.gov)



# Probabilistic Messaging



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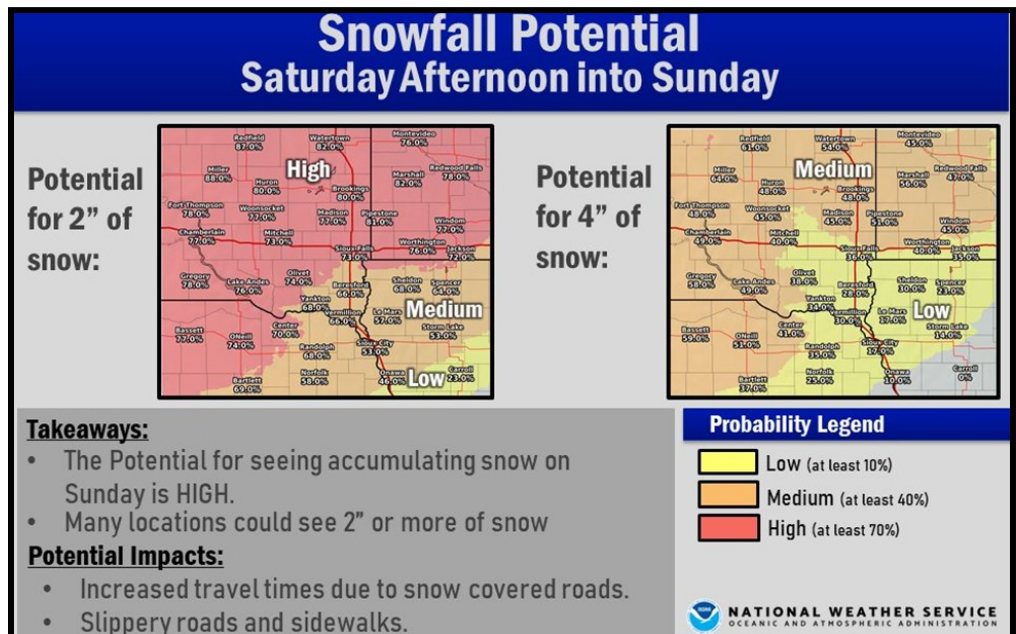
The use of 'probabilities' in providing forecast information to partners and the public was broadly introduced to the State of Nebraska several years ago. This year, the National Weather Service (NWS) offices that serve Nebraska will continue to expand the use probabilistic data in messaging. You may wonder why probabilistic messaging is important. Isn't the job of the highly skilled Meteorologist to tell me exactly what to expect weather-wise each day? Meteorologists would love to be able to tell you *exactly* what to expect at any given location and at any given time, but as we all know, that simply is not possible.

Consider a winter storm that will bring a range of snowfall across a given county. Depending on your location, you could see anywhere from a skiff of snow to as much as a foot! How does a meteorologist effectively message that? In this hypothetical case, we're only considering size of the county as a singular factor to snow amounts. Are we talking about Sarpy or Cherry County? There's a big difference obviously. Now let's consider timing of the snow storm, topography, storm track uncertainty, marginal temperatures...you get the idea; effectively messaging a potentially impactful storm becomes very difficult. This is where the value of probabilistic messaging comes in.

NWS forecasters are now leveraging ensemble and probabilistic output along with our local expertise to support Impact Based Decision Support Services. We want to provide to you those possible outcomes that could positively or negatively impact your area. This is all so you can make informed contingencies to support your organizational goals and plans. This is not to say that we will no longer provide you amounts or other deterministic forecast information, but you will be hearing more "possible outcomes," or "probability of exceedance," or even "dynamic ranges."

What if I told you that we are monitoring a snow storm where there is a high likelihood of 2" of snowfall to fall over a 24 hour period, but the probability of exceedance of seeing 4" or more accumulation is very low, generally less than 10%. How would your agency react to my forecast? Now what if I told you that the probability of snow accumulation of around 2" is still high, however, there is a small chance of light ice accumulations from freezing drizzle. Would your contingency change? What if I stated that there is a possible outcome where snow amounts would only amount to an inch or less, but several hundredths of an inch of ice from the freezing drizzle would accumulate before the snow begins? This possible outcome is in the minority. The most likely scenario is that your location would see 2" of snow, but armed with an impactful possible outcome, would you change your contingency plan?

The usefulness of probabilistic messaging is that it raises awareness to potentially impactful or anomalous forecasts and provides you with possible outcomes. The easy part in this process is identifying these events, the hard part is the messaging. Communication is a two-way street. Please continue to provide feedback on our probabilistic messaging, your feedback is always appreciated.





# What Is The Winter Storm Severity Index?



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The Winter Storm Severity Index (WSSI) is a spatial assessment of the societal impacts of winter storms. It highlights regions and localities with the forecasted potential for damaging and life-threatening effects brought on by winter weather. This includes, but is not limited to tree damage, school closures, transportation issues like flight cancellations, traffic accidents, and road closures. These winter storms can create a risk to life and property and cause millions of dollars in damage.

The WSSI product allows forecasters, emergency management, and the general public to make informed and tactical decisions about the potential for significant weather related impacts. Using the WSSI, experts are able to effectively assist in preparing the public for upcoming winter hazards.

Considerable time and discussion was put into the verbiage of the potential impacts scale. In meteorology, it is not only important to produce an accurate forecast, but also to effectively communicate weather hazards and impacts to the public. Visuals are just as important as verbal communication when conveying hazards, which is where the WSSI product becomes an effective tool for weather personnel.

The WSSI is comprised of six equally weighted components of winter storms:

- Blowing Snow
- Flash Freeze
- Ground Blizzard
- Ice Accumulation
- Snow Amount
- Snow Load

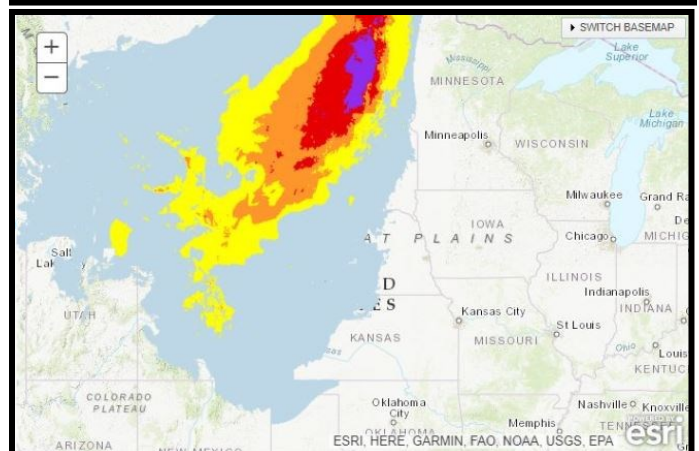
The Overall WSSI is the maximum forecasted impact from any of the six components listed. The goal of the product is to summarize multiple winter weather impacts from a storm into an easily consumable graphic. The WSSI creates a 72 hour summary graphic with 24 hour breakout graphics.

**Remember:** The WSSI should always be used in context with other NWS forecast and warning information. Also, it does not account for conditions that have occurred prior to the creation time. It only uses forecast information. During an ongoing winter weather situation, the WSSI will not be representative of the entire event.

Learn more about this product at

[www.wpc.ncep.noaa.gov/wwd/wssi/wssi.php](http://www.wpc.ncep.noaa.gov/wwd/wssi/wssi.php)

Potential Winter Storm Impacts	
	<p><b>No Impacts</b> Impacts not expected.</p>
	<p><b>Limited Impacts</b> Rarely a direct threat to life and property. Typically results in little inconveniences.</p>
	<p><b>Minor Impacts</b> Rarely a direct threat to life and property. Typically results in an inconvenience to daily life.</p>
	<p><b>Moderate Impacts</b> Often threatening to life and property, some damage unavoidable. Typically results in disruptions to daily life.</p>
	<p><b>Major Impacts</b> Extensive property damage likely, life saving actions needed. Will likely result in major disruptions to daily life.</p>
	<p><b>Extreme Impacts</b> Extensive and widespread severe property damage, life saving actions will be needed. Results in extreme disruptions to daily life.</p>



WSSI Example from October 10, 2019





# Winter Weather Terminology



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With the winter weather season already underway across portions of Nebraska, reminding ourselves of what different winter weather products mean can give us the knowledge to make plans before hazardous weather strikes. The difference between a watch and a warning can be described in terms of pizza:

A **watch** means that conditions are favorable or the ingredients are present that are required for an event to occur.

In the pizza example, in a watch, all of the ingredients are present to make a pizza, but we don't have a pizza. We just have a bunch of ingredients.



A **warning** means that conditions for a specific event are imminent or already occurring.

In the pizza example, a warning means that the ingredients have come together and we have our pizza or will have our pizza shortly.



Criteria for what constitutes a winter season warning or advisory varies depending on your location and the time of year. Specific criteria for a location can be found through your local National Weather Service office. Here are some National Weather Service products you may see issued this upcoming winter:

- **Winter Storm Watch:** Issued when there is a possibility of significant amounts of snow or ice accumulations within the next 24 to 36 hours of the onset of a winter storm system. A Winter Storm Watch can be upgraded to a Winter Storm Warning or Blizzard Warning, or downgraded to a Winter Weather Advisory.
- **Winter Storm Warning:** A Winter Storm Warning is issued when a storm is producing or expected to produce heavy snow or significant ice accumulations.
- **Blizzard Warning:** A winter storm with sustained winds or frequent wind gusts to 35 mph or greater, continued blowing or falling snow that reduces visibility to  $\frac{1}{4}$  mile or less for at least three hours. Forecasted snow amounts are not taken into account when issuing a blizzard warning.
- **Snow Squall Warning:** A snow squall warning is issued when an intense period of moderate to heavy snowfall and gusty winds impact an area for a short duration, usually under three hours. Snow squalls can cause significant reductions to visibility and can be described as a "mini blizzard".

*Continued on next page*



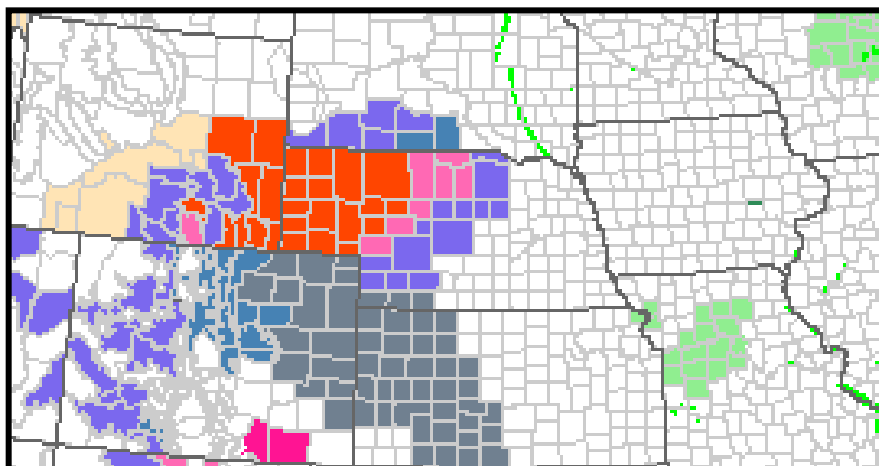


# Winter Weather Terminology

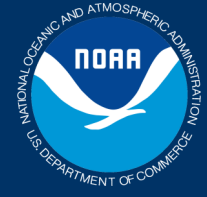


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- **Winter Weather Advisory:** A product issued to account for a system producing snow, sleet, freezing rain, freezing fog, etc. that does not meet Winter Storm Warning criteria. Local criteria for the issuance of an advisory varies by region.
- **Ice Storm Warning:** This product is issued when ice accumulations from freezing rain are expected to cause damage or significant impacts. Many areas consider ¼ inch of ice accumulation or greater to be a threshold for issuing a warning.
- **Wind Chill Advisory:** Issued when the forecasted wind chill may become life threatening due to exposure over a period of time.
- **Wind Chill Warning:** Issued when the wind chill is forecasted to become life threatening.
- **High Wind Watch:** A High Wind Watch is issued when there is a possibility that winds could become life threatening.
- **High Wind Warning:** A High Wind Warning is issued when high winds that are life threatening are imminent or already occurring.
- **Blowing Dust Advisory:** A Blowing Dust Advisory is issued when visibility is being reduced to between ¼ and 1 mile in blowing dirt for a non-localized area.
- **Dust Storm Warning:** A Dust Storm Warning is issued when visibility is significantly being reduced or brown out conditions are occurring for a non-localized area.



This map from March 18, 2020 shows a variety of winter products in effect across the region, including a **Blizzard Warning**, a **Winter Storm Warning**, a **Winter Weather Advisory**, and a **Winter Storm Watch**.



# Pathfinder: Improving Winter Road Messaging For The Public



Winter Weather Awareness Day - November 4, 2021

## NEBRASKA

Good Life. Great Journey.

DEPARTMENT OF TRANSPORTATION

weather forecasts and road conditions

The Nebraska Department of Transportation (NDOT) and the National Weather Service (NWS) offices serving Nebraska will continue the program called "Pathfinder" this winter across the entire state. This program is sponsored by the Federal Highway Administration (FHWA), and is a collaborative strategy to proactively manage the transportation system ahead of and during adverse weather events, and translate weather forecasts and road conditions into consistent transportation impact messages for the public.

Pathfinder is a unique public-private partnership. Entering our 4<sup>th</sup> year within the pathfinder framework, NWS and NDOT will continue building on the existing relationship. This continued relationship will build on our efforts to create a "shared impact message" for the public. This message will highlight how weather will impact road and travel conditions, be consistent among each entity, and shared across the various dissemination platforms of all parties involved.

Pathfinder is a state-wide project, involving all eight NDOT districts, and all six NWS offices serving Nebraska. While the main focus is on winter weather, Pathfinder will be able to address all types of weather impacts across the state, including high-end wind events, dust, and flooding.



In the end, Pathfinder is geared toward two specific outcomes:

- 1) Providing the traveling public consistent road-weather messaging for safer, smoother travel.
- 2) Continuing to foster relationships among the various public and private sector entities involved in information for the traveling public.

For more information about the Pathfinder project in Nebraska, contact either of the following:

Jesse Schulz  
NDOT Meteorologist  
402-479-4609

Mike Moritz  
Warning Coordination Meteorologist  
NWS Hastings  
402-462-2127 ext. 726



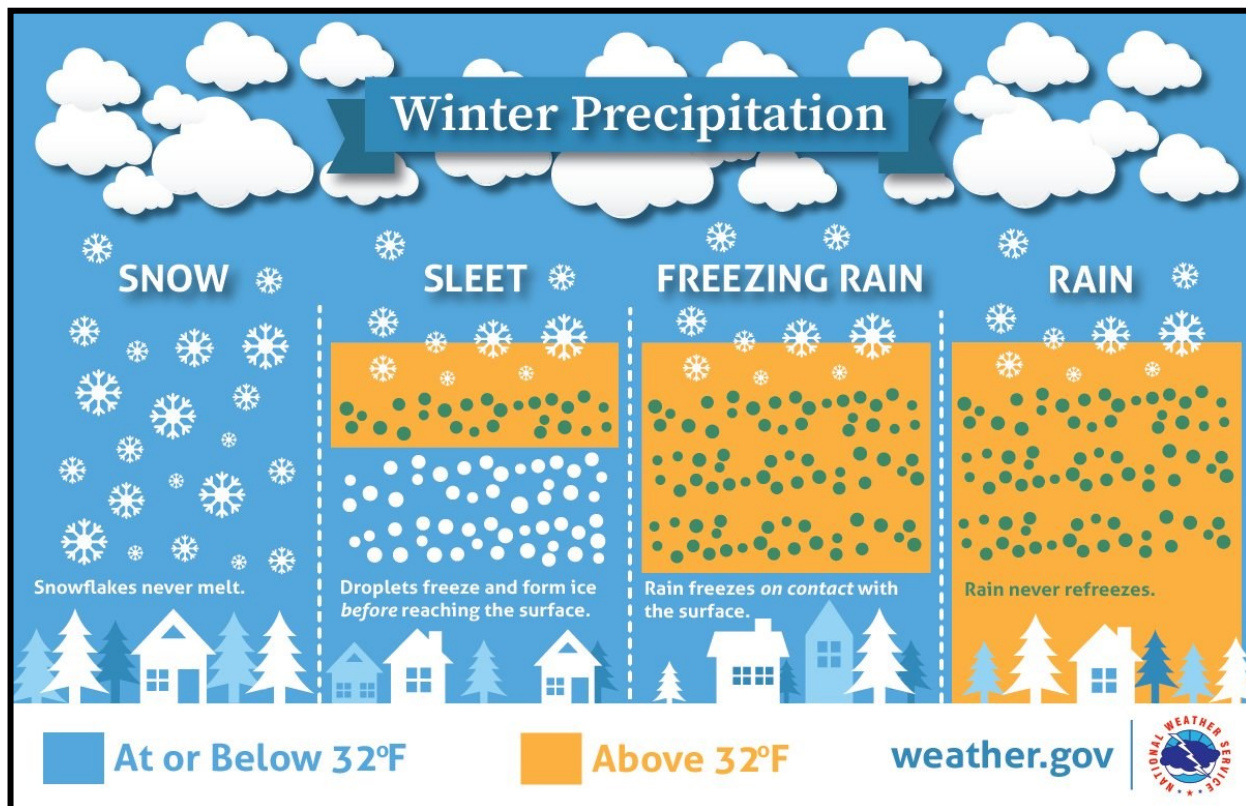
# Determining Winter Precipitation Types



Winter Weather Awareness Day - November 4, 2021

Determining what type of precipitation will fall in the winter can be a challenging aspect of the forecasting process. This depends on the temperature profile in the troposphere, or the lowest 7 to 8 miles of the atmosphere. Usually the temperature decreases from the ground up in the troposphere, but layers of warmer air can result in different precipitation types.

- **Snow:** Ice crystals form in clouds at heights where the temperature is below freezing. As these ice crystals fall through clouds towards the ground, they will grow and become snowflakes. If the air is below freezing all the way to the ground, they will fall as snow. However, if the atmosphere near the ground is warm enough, the snow will melt and fall as rain.
- **Sleet:** If there is a shallow layer of warmer air, slightly above freezing, snowflakes will partially melt then refreeze closer to the ground. This will create tiny ice balls known as sleet.
- **Freezing rain:** In this process, the layer of warmer air is much deeper and completely melts snowflakes into raindrops as they fall. If there is a shallow layer of air below freezing near the ground, these raindrops will freeze wherever they land, creating a potentially hazardous situation.





# Challenges Of Forecasting Snowfall Amounts



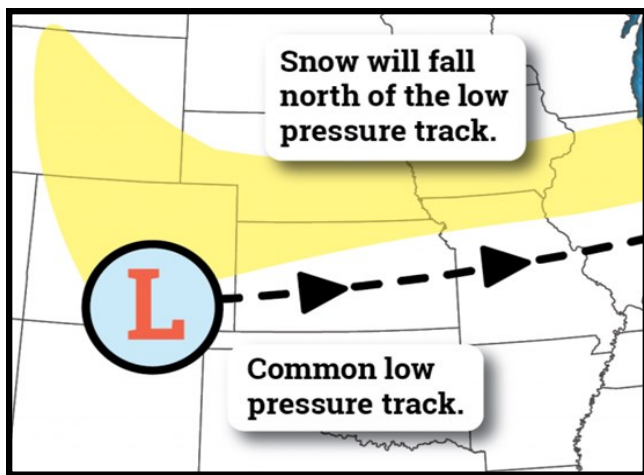
Winter Weather Awareness Day - November 4, 2021

Forecasting the amount of snowfall can be challenging for meteorologists. There are several factors involved in forecasting snow amounts, that can result in a boom or a bust for snowfall. Let's take a look at some of them.

**Surface Temperature:** Surface temperature plays an important role in determining the type of precipitation that reaches the ground. A cold surface will be conducive for snowfall. In events where the surface is above freezing but snow continues to fall, accumulations will be low as the snow melts upon impact.

**Precipitation Type:** Precipitation type is determined based on the temperature and moisture profile near the surface. Temperatures below freezing will not result in snow if the moisture profile is lacking. Similarly, a slight change of a degree or two in the temperature profile can change the type of precipitation that falls. See the precipitation type graphic on the previous page for more information.

**Storm Track:** A key factor in determining the type and amount of precipitation is the track of a storm system. A slight shift of a storm track to the north could result in less snow and more ice for an area to the south. A shift to the south could result in higher snowfall amounts. Forecasters use their experience and understanding of models to determine where the storm will go and where the heaviest snow will set up.



**Snow to Liquid Ratio:** The snow to liquid ratio is a calculation of the expected amount of snowfall for a certain amount of liquid an area is expected to receive. In a 10:1 snow to liquid ratio, a person would expect to see ten inches of snow for every inch of rain. These amounts typically range from a 1:1 to 30:1 ratio depending on the temperature and location. Typically, a 13:1 or 14:1 ratio is seen across Nebraska, however, this can differ depending on temperature and moisture. Colder surface temperatures will produce higher snow/liquid ratios which results in light and fluffy snow and higher snowfall amounts. Lower ratios result in heavier, wet snow and lower snowfall accumulation amounts.

**Thunder Snow:** Thunder snow is an event that is reliant on temperature. In a normal situation, a thunderstorm will develop and produce rain due to warm surface temperatures. In a thunder snow situation, the temperature at the surface is cold with a shallow layer of warm air that lifts in a process similar to a thunderstorm. With temperatures colder, precipitation falls as snow, often with higher amounts of snow than if thunder snow were not occurring.

All of these factors are taken into consideration when forecasting snow amounts. Any changes to the factors listed, as well as some others not mentioned, can lead to a change in the amount of snowfall that was originally forecasted. It is important for everyone to pay close attention to updates to the forecast during a winter storm event to see if there are changes.

The latest forecast, no matter the season, can always be found at [www.weather.gov](http://www.weather.gov)





# Winter Weather Dangers



Winter Weather Awareness Day - November 4, 2021

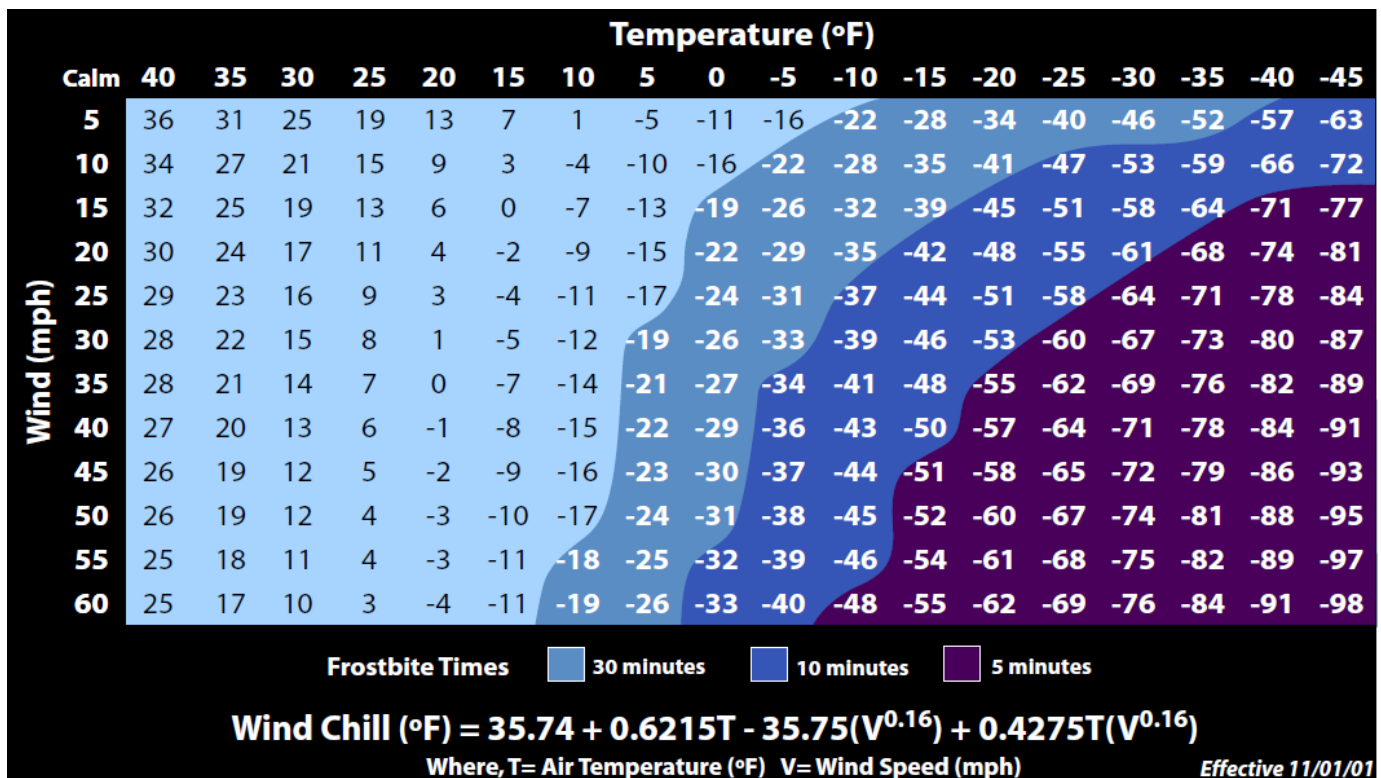
Exposure to cold can cause frostbite or hypothermia and become life-threatening. Infants and elderly people are most susceptible. What constitutes extreme cold varies in different parts of the country. In the south, near freezing temperatures are considered extreme cold. Further north, extreme cold means temperatures well below zero. Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat.

## Wind Chill

- Is not the actual temperature, but how the combination of wind and cold feels on exposed skin.
- It is based on the rate of heat loss from exposed skin. As the wind speed increases, heat is carried away from the body at an accelerated rate, driving down the body temperature.
- Wind chill will also impact animals!
- The only impact on inanimate objects (cars or pipes) will be to shorten the time it takes for that object to cool, they cannot cool below the actual air temperature.

More information about the Wind Chill Index can be found at:

[www.weather.gov/safety/cold-wind-chill-chart](http://www.weather.gov/safety/cold-wind-chill-chart)





# Winter Weather Dangers



Winter Weather Awareness Day - November 4, 2021

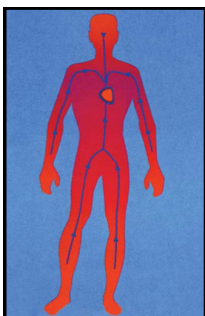
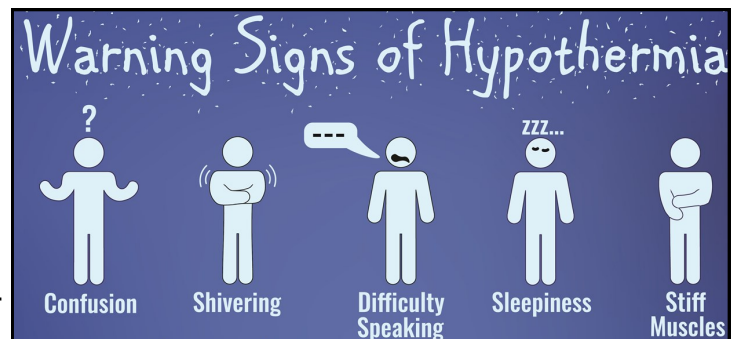


## Frostbite

- Damage to body tissue caused by extreme cold.
- Can cause a loss of feeling and a pale appearance in the extremities. Your body cuts circulation to the extremities to protect the vital organs.
- Can occur in a matter of minutes!

## Hypothermia

- It is a potentially dangerous drop in body temperature (below 96°), caused by a prolonged exposure to the cold.
- It can cause long lasting health issues, or could even result in death!
- Age (children and elderly), certain illnesses or even certain medications can make one more



## If You Need To Provide First Aid

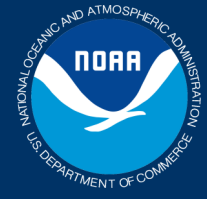
- Get indoors as quickly as possible. Seek medical attention!
- Warm the person slowly, starting with the body core. Warming extremities first drives cold blood toward the heart and can lead to heart failure!
- Get the person into dry clothes and in extra layers. Remove any tight items.
- Drink warm liquids. Do not give alcohol, drugs, coffee or anything hot.

## Are You Prepared For The Cold?

- Before heading out the door, make sure you check the forecast so you'll know what to expect.
- Adjust your schedule (if possible) to avoid the coldest part of the day.
- Dress for the cold! Layer your clothes and protect your head and extremities.
- Make sure your pets and livestock have enough food and water!
- Is your home and vehicle prepared?



Learn more at: [www.weather.gov/safety/winter](http://www.weather.gov/safety/winter)



# Winter Weather Safety Tips



Winter Weather Awareness Day - November 4, 2021

## ***Be Prepared Before the Storm Strikes!***

When preparing your home or workplace for the upcoming winter season, keep in mind that the primary concerns deal with the loss of heat, power and telephone service, along with a shortage of supplies if a winter storm continues for an extended period of time.

### ***Make sure to have the following supplies available:***

- Flashlight and extra batteries
- Battery-powered NOAA Weather Radio and portable radio to receive emergency information - these may be your only links to the outside world.
- Extra food and water. Have high energy food, such as dried fruit, nuts and granola bars, and food which doesn't require any cooking or refrigeration.
- Extra medicine and baby items.
- First-aid supplies.
- Heating fuel. Refuel BEFORE you are empty. Fuel carriers may not reach you for days after a winter storm.
- Emergency heat source: fireplace, wood stove, space heater.
  - Use properly to prevent a fire and remember to ventilate properly.
- Fire extinguisher and smoke alarm.
  - Test smoke alarms once a month to ensure they work properly.



### ***On the farm and for pets:***

- Move animals into sheltered areas.
- Shelter belts, properly laid out and oriented, are better protection for cattle than confining shelters.
- Haul extra feed to nearby feeding areas.
- Have plenty of water available. Animals can die from dehydration in winter storms.
- Make sure your pets have plenty of food, water and shelter.



# Winter Weather Safety Tips



Winter Weather Awareness Day - November 4, 2021



## **I'm caught outside:**

- Find shelter!
- Attempt to stay dry.
- Cover all exposed body parts.
- If there is no shelter available:
  - Build a lean-to, windbreak or cave to protect yourself.
  - Build a fire for heat and to attract attention.
  - Place rocks around the fire to absorb and reflect heat.
  - Melt snow for water, eating snow lowers body temperature.

## **I'm caught in a vehicle:**

- Stay in the vehicle! You could quickly become disoriented in wind-driven snow and cold.
- Run the motor about 10 minutes each hour for heat.
- Open the window a little for fresh air to avoid carbon monoxide poisoning.
- Make sure the exhaust pipe is not blocked.
- Be visible to rescuers!
  - Turn on the dome light at night when running the engine.
  - Tie a colored cloth, preferably red, to your antenna or door.
  - After the snow stops falling, raise the hood to indicate you need help.
- Exercise from time to time, move arms, legs, fingers, and toes vigorously to keep blood circulating and to keep warm.

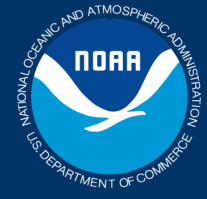


## **I'm caught inside:**

- Stay inside! If using alternate heat from a fireplace, wood stove, space heater, etc., be sure to use fire safeguards and properly ventilate.
- If you don't have heat available:
  - Close off unneeded rooms.
  - Stuff towels or rags in cracks under doors.
  - Cover windows at night.
- Eat and drink, providing the body with energy and preventing dehydration.
- Wear layers of loose fitting, lightweight, warm clothing. Remove layers to avoid perspiration and subsequent chill.







# Winter Weather Travel Tips



Winter Weather Awareness Day - November 4, 2021

Along with your home and workplace, vehicles also need to be prepared for the upcoming winter season. It is very important to fully check and winterize your vehicle, which includes having a mechanic check your battery, antifreeze, wipers, windshield washer fluid, ignition system, thermostat, lights, exhaust system, heater, brakes, and oil levels.

If you must travel during winter conditions, it is best not to travel alone. Try to plan your travel during the day, and make sure to let others know your destination, route, and when you expect to arrive. Make sure to keep your gas tank near full to avoid ice in the tank and fuel lines.

## ***Always carry a Winter Storm Survival Kit in your car!!***

- ◆ Mobile phone, charger and batteries
- ◆ Flashlight with extra batteries
- ◆ First-aid kit
- ◆ Knife
- ◆ Shovel
- ◆ Tool kit
- ◆ Tow rope
- ◆ Battery booster cables
- ◆ Compass and road maps
- ◆ A windshield scraper and brush or small broom for ice/snow removal
- ◆ Blankets and sleeping bags, or newspapers for insulation
- ◆ Rain gear, extra sets of dry clothes



- ◆ Large empty can to use as emergency toilet. Tissues, paper towels, and plastic bags for sanitary purposes
- ◆ Small can and waterproof matches to melt snow for drinking water
- ◆ Cards and games
- ◆ High calorie, non-perishable food, such as canned fruit, nuts, and high energy snacks (Include a non-electric can opener if necessary)
- ◆ A small sack of sand or cat litter for generating traction under wheels and a set of tire chains or traction mats
- ◆ A brightly colored (preferably red) cloth to tie to the antenna





# Road Condition Information



Winter Weather Awareness Day - November 4, 2021

Before you travel, check out the latest road conditions. Road report information across Nebraska can be found at the Nebraska Department of Roads web site at:

[511.nebraska.gov](http://511.nebraska.gov)

[511ia.org](http://511ia.org)

**Nebraska:** When in-state, call **511**.

When out of state call: 1-800-906-9069

**Iowa:** When in-state, call **511**

When out of state call: 1-800-288-1047

If you are located inside the states listed below, you can dial 511 for road information.

**South Dakota:** [www.safetravelusa.com/sd/](http://www.safetravelusa.com/sd/)

Out of state: 1-866-MY-SD511 (1-866-697-3511)

**Wyoming:** [map.wyoroad.info/](http://map.wyoroad.info/)

Out of state: 1-888-WYO-ROAD (1-888-996-7623)

**Colorado:** [www.cotrip.org/home.htm](http://www.cotrip.org/home.htm)

Out of state: 1-303-639-1111

**Kansas:** [www.kandrive.org/kandrive/](http://www.kandrive.org/kandrive/)

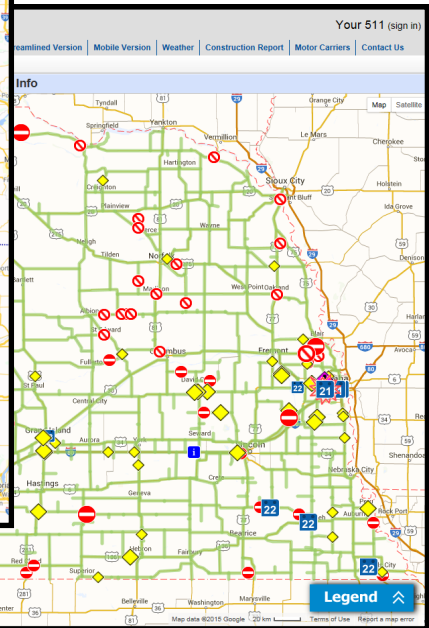
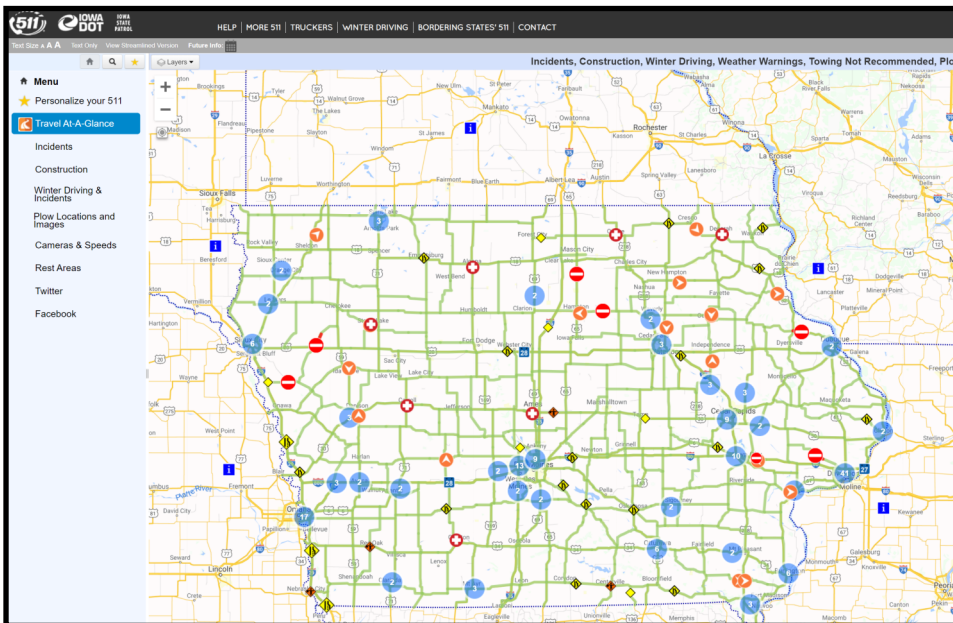
Out of state: 1-866-511-KDOT (1-866-511-5368)

**Missouri:** [traveler.modot.org/map/](http://traveler.modot.org/map/)

Out of state: 1-888-ASK-MDOT (1-888-275-6636)

National Traffic and Road Closure Information can be found at:

[www.fhwa.dot.gov/trafficinfo/index.htm](http://www.fhwa.dot.gov/trafficinfo/index.htm)





# Winter Preparedness For Schools



Winter Weather Awareness Day - November 4, 2021

## Be a Force Multiplier in Your Community

- Know where to get weather information: Utilize NOAA Weather Radio, local media sources, Internet, social media and paging services.
- There are many trusted weather sources on social media. Follow and share an organization you know and trust.

## Alerting Students and Staff

- Alert students and staff to take action: Use mobile communications for bus drivers and a PA system for school staff and students.
- Parents should be reminded about the dangers of improperly dressing their children for school.



## Activating a Plan

- Determine when to activate a plan: Gather information about the type of winter storm, expected impact and time of impact on the school district. The primary decision will be whether to cancel, delay, or hold classes as usual. In Watch situations, immediate action will usually not be required. When a Warning or Advisory is issued, assess the weather situation by monitoring forecasts, current weather conditions and road conditions.
- Consider what kind of an impact will the storm make? Will roads be impassable or will road conditions just have a minimal effect on transportation of students, causing only small delays? How will the storm impact students traveling on foot?

## School Bus Driver Actions

- For heavy/blowing/drifting snow: Be familiar with alternate routes, stay up to date on the latest forecast, and maintain communication with school officials.
- For ice storms: Remain alert for downed trees, utility lines, and other road hazards. Be familiar with alternate routes. Stay up to date on the forecast and maintain communication with school officials.
- Extreme cold: Learn to recognize and treat symptoms of hypothermia and frostbite.
- Know how to get road information: State Highway Departments or Law Enforcement are often your best sources for road conditions. City and county transportation or school officials are also excellent sources.

[511.nebraska.gov](http://511.nebraska.gov)



## Safety Instruction

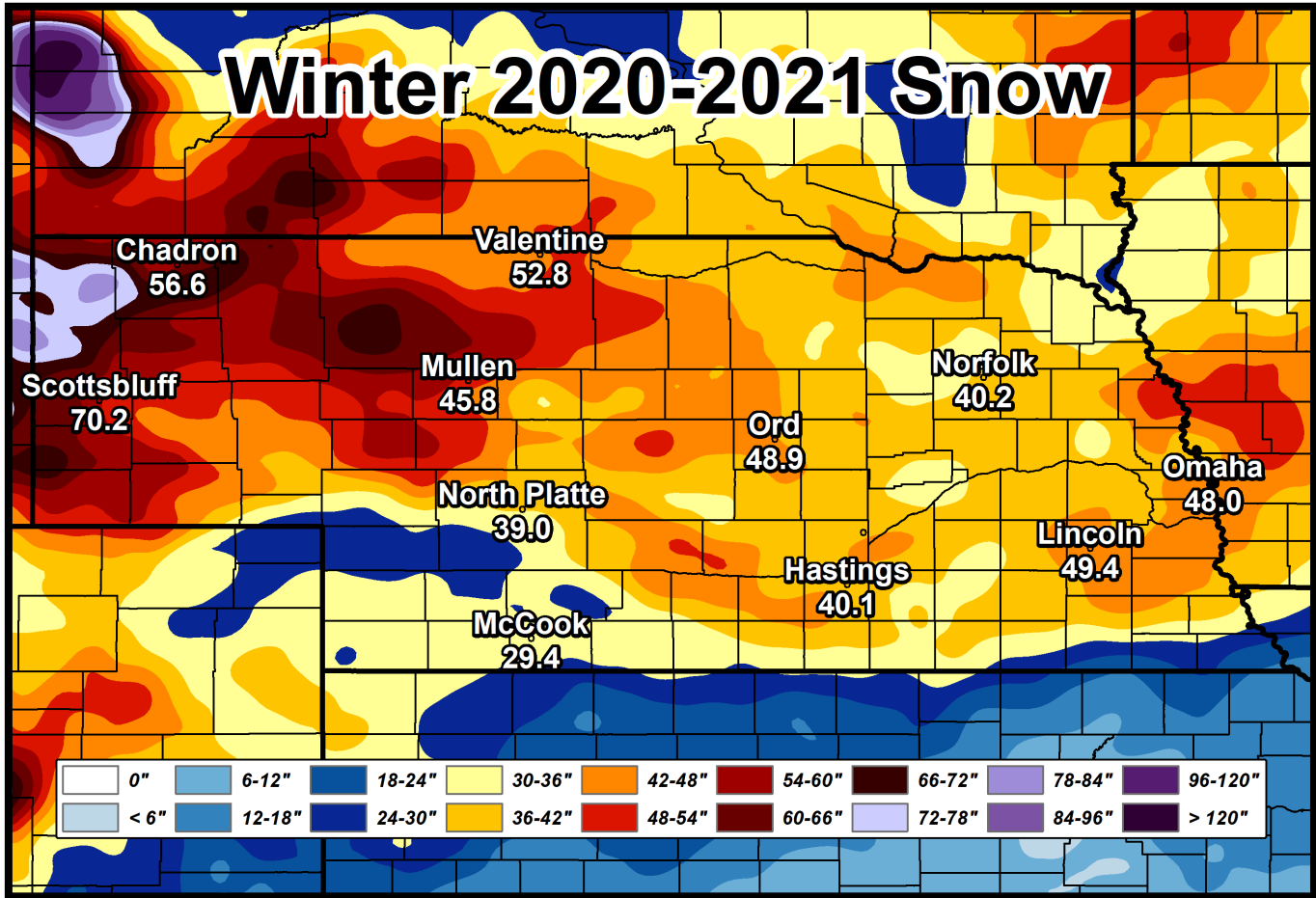
- Nebraska Winter Weather Awareness Day is a great opportunity to test your organizational drills and procedures.
- Contact your local Emergency Manager or National Weather Service Office for a speaker to discuss winter weather safety.



# 2020-2021 Iowa-Nebraska Winter Weather Summary



Winter Weather Awareness Day - November 4, 2021



Location	Normal	2020-21 Total	% of Normal
Scottsbluff	42.5"	70.2"	165%
North Platte	29.6"	39.0"	132%
Valentine	34.2"	52.8"	154%
McCook	29.9"	29.4"	98%
Grand Island	27.7"	39.7"	143%
Norfolk	29.9"	40.2"	134%
Omaha	27.1"	48.0"	177%
Lincoln	26.0"	49.4"	190%
Des Moines	36.5"	56.6"	155%





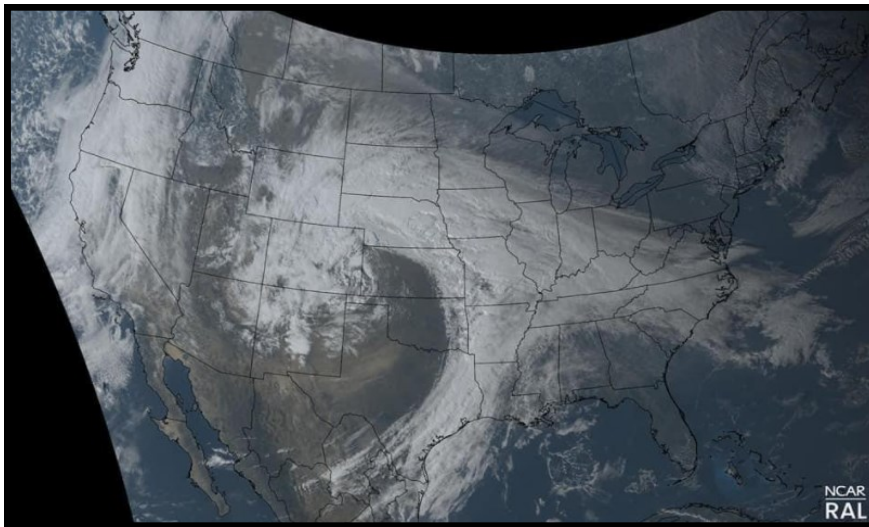
# 2020-2021 Nebraska Winter Weather Events



Winter Weather Awareness Day - November 4, 2021

## Nebraska Panhandle - NWS Cheyenne, WY March 2021: Historic Blizzard

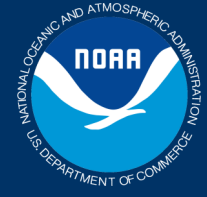
A once in 50-to-75-year historic blizzard took place across far eastern Wyoming and western Nebraska on March 13 through 14, 2021. This was a storm that NWS Cheyenne and the residents of the area will not soon forget. It brought schools, businesses, and travel to a halt for three to four days. Weather models indicated the storm well in advance, with NWS Cheyenne conducting a record number of back to back partner briefings, conducting Facebook Live updates, and highlighting the significant impacts starting six days in advance.



A slow-moving upper-level disturbance moved from the southwest U.S. into southern Colorado then Nebraska from March 8 through 15, 2021. This disturbance strengthened on the weekend of March 13 through 15 and drew abundant moisture from the Gulf of Mexico, which was transported into eastern Wyoming and western Nebraska. The deep moisture combined with a strong easterly wind and instability wrapping around the northern side of this disturbance resulted in a unique setup, with strong lift occurring along and east of the Laramie Range into the High Plains. This resulted in anomalously high snowfall

amounts from Natrona County south to Laramie County, Wyoming and east into the Nebraska Panhandle. Snowfall rates of 2 to 3 inches per hour occurred at times on Saturday night, March 13, and continued through midday Sunday, March 14. Snow to liquid water ratios were low on Saturday with values near 7 to 1 before midnight, and increased to 12 to 1 after midnight into Sunday. This resulted in heavy, wet snow, followed by drier, more powdery snow. As wind speeds increased to 45 to 55 mph, significant drifting occurred.

Many residents were without power across eastern Wyoming and the Nebraska Panhandle during the height of the storm from wind and heavy snow toppling branches, trees, and power poles. Live-stock and calving impacts were low per agriculture reports given the lead time for preparations and warmer temperatures following the event. The highest snowfall amounts recorded in Western Nebraska occurred in Banner and Kimball Counties, with totals of 30 to 36 inches. Widespread 15 to 25 inch totals occurred across the higher areas of Scotts Bluff County and into the Pine Ridge region of the northern Nebraska Panhandle. This storm's intensity was remarkable across the region in closing interstate commerce for 3-days, as rotary plows had to be brought in to clear the roads. Commerce finally returned to normal by Thursday and Friday later that week following the previous weekend's historic blizzard.



# 2020-2021 Nebraska Winter Weather Events



Winter Weather Awareness Day - November 4, 2021

## West and North Central Nebraska - NWS North Platte, NE February 2021: Niobrara River Ice Jam

Ice jamming most commonly occurs on the North Platte and Platte Rivers in western and north central Nebraska, but has also occurred on other rivers including the Niobrara River. Ice jamming can happen during the freeze up stage during early to mid winter, or more commonly during late winter into early spring as frozen river ice begins to break up.



In February 2021, ice jamming occurred along portions of the Niobrara River between Boyd and Holt County. Ice jamming was reported at the Highway 11 bridge south of Butte, where minor overflows were reported just upstream of the bridge. More significant ice jamming occurred at the US-281 bridge south of Spencer.

Photo Credit: Niobrara Tribune

A Cooperative Observer in Butte recorded below normal temperatures from January 23rd through the 29th, with highs from the upper teens to upper 20s and lows from the upper single digits and teens. Bitter cold temperatures arrived on February 6th and lasted through February 20th. Most days during this period only had highs from the single digits above zero to single digits below zero, and lows from five below zero to 24 below zero. These temperatures ranged from 25 degrees to 35 degrees below normal!

Significantly warmer temperatures returned to the area beginning February 21st and lasted through the end of February. As high temperatures reached the upper 40s to mid 50s, an open channel of water developed and the ice jam began to break up as the river level receded.



Photo Credit: Nebraska Department of Transportation





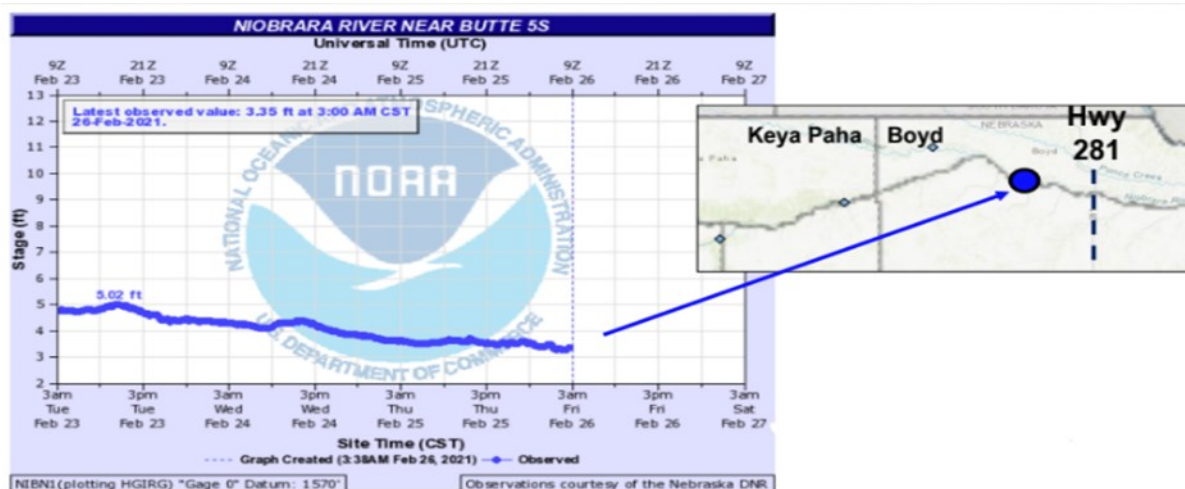
# 2020-2021 Nebraska Winter Weather Events



Winter Weather Awareness Day - November 4, 2021

## West and North Central Nebraska - NWS North Platte, NE February 2021: Niobrara River Ice Jam

The National Weather Service continually monitors river stages. The Advanced Hydrologic and Prediction Services graph on the Niobrara River south of Butte showed the river level fell nearly two feet from February 23rd through February 26th as much warmer temperatures returned to the area.



## Extreme Northeast Nebraska - NWS Sioux Falls, SD Winter Overview

There were a few notable events during the 2020-2021 winter season across extreme northeast Nebraska. Significant freezing rain occurred November 9-10 with ice storm conditions across parts of Dakota County. Ice accumulated to around 1/4 inch on elevated surfaces, resulting in some power outages. The ice was followed by snow accumulations of three to six inches. Two blizzards impacted the area. The first occurred on December 23. Strong winds gusting between 40 to 50 mph combined with falling snow to produce widespread whiteout conditions. The second occurred on January 15, when wind gusts of 30 to 40 mph and roughly four inches of new snow resulted in widespread near white out conditions. Finally, there was a multi-day bitter cold snap in mid-February, when wind chill values exceeded 35 below zero. The coldest wind chill reading during this stretch was 50 below zero, which occurred one mile north of Emerson.



# 2020-2021 Nebraska Winter Weather Events



Winter Weather Awareness Day - November 4, 2021

## Extreme Southwest Nebraska - NWS Goodland, KS January 2021: Benkelman Fire

One of the more notable weather events of the 2020-2021 winter weather season for extreme southwestern Nebraska turned out to be a non-precipitation event. A cold front moved through the region on January 13<sup>th</sup> with strong winds continuing through the 15<sup>th</sup>. Wind gusts ranging from 50 to 70 mph were reported across Dundy, Hitchcock and Red Willow counties.

A fire sparked shortly before midnight on January 15<sup>th</sup> located about four and a half miles northwest of the town of Benkelman. The fire was the result of remnant embers from a previous fire being rekindled by strong winds moving through the region. Strong northwest winds pushed into the area with the front, setting off the fire and allowing it to grow quickly.

Around 3 AM MST, Dundy County Assistant Emergency Manager Pam Reichert issued an evacuation order for the town of Benkelman due to the fire's continued southeasterly track and concern that the fire would reach town. In collaboration with Dundy County Emergency Management, the Goodland National Weather Service office issued a Civil Emergency Message which was transmitted over NOAA Weather Radios, warning residents of the evacuation notice.

### LARGE WILDFIRE ONGOING

Evacuation needed for Benkelman, Nebraska per Emergency Management

**TIME**  
This image shows the estimated location of the fire at 3:11am MST/ 4:11am MST on January 15<sup>th</sup>, 2021.

**LOCATION**  
NW of Benkelman, Nebraska

**Benkelman Residents**

Evacuate to the east or to the west of town  
Use caution while evacuating due to low visibility due to smoke.

National Weather Service • Goodland, Kansas

This graphic, published on January 15, 2021, shows a smoke plume from the Benkelman Fire on radar. The fire resulted in the evacuation of Benkelman residents.

Smoke from the fire resulted in near zero visibility in some areas. The fire was contained on the northwestern edge of Benkelman after crossing Highway 34. The high school and a restaurant near the wildfire reported extensive smoke damage. An outbuilding near a motel on the northwestern side of town is the only known building burned in the fire. Additional hot spots were located as far as two blocks away from the fire, where embers were carried by the wind. The evacuation order for Benkelman was lifted around 7:30 AM MDT.

The Benkelman Fire is an example of the importance of the partnership between the National Weather Service, local emergency management officials and law enforcement. As many as sixteen fire trucks responded to the fire showing the importance of local first responders in working together to keep the fire from reaching further into town. The National Weather Service provided weather updates to local emergency management and fire officials in an effort to keep first responders, law enforcement and evacuating residents safe and informed of changing weather conditions.





# 2020-2021 Nebraska Winter Weather Events



Winter Weather Awareness Day - November 4, 2021

## South Central Nebraska - NWS Hastings, NE February 2021: Record Cold

Most of the time, the day-to-day weather happens without any fanfare. Then there are moments it makes an impression which will last a lifetime. The extreme cold of February 2021 will easily be one of those weather events in local meteorological yore.

Up until February, the winter of 2020-21 was dry and fairly mild. However, a plunging Polar Vortex sent arctic air diving south across the Central Plains on February 5. That started a 15-day period during which the temperature didn't rise above freezing, including the better part of a 72-hour period when temperature didn't rise about zero degrees! That was the longest such stretch in 37 years (since December 1983).

Obviously, records were shattered, including some all-time low temperatures. On February 16, Hastings set its all-time low temperature of -30°. NWS Cooperative observers at York (-34°), Superior (-33°) and Osceola (-31°) also set all-time record low temperatures. In the case of York, records date back 121 years. Kearney tied for the 2nd coldest temperature at -30°.

**EXTREME COLD START**

**-30°F**

Ties All-Time Record Low in Hastings set on January 12, 1912

**February 16, 2021**

York, NE (3N)	-34°
Greeley, NE	-34°
Superior, NE	-33°
Hebron, NE	-33°
Aurora, NE	-31°
York Airport, NE	-31°
Osceola, NE	-31°
Hastings, NE	-30°
Loup City, NE	-29°
Lexington, NE	-28°
Grand Island, NE	-27°

NATIONAL WEATHER SERVICE  
WEATHER FORECAST OFFICE - HASTINGS, NE

In addition to the extreme cold, a steady stream of light, fluffy snow falls impacted the area. Over the course of two weeks and about five different snow events, most of south central Nebraska measured anywhere from 10 to 16 inches of the powdery white stuff. In fact, on Valentine's Day, Hastings had 14 inches of snow on the ground and an overnight low of -28°! This was common across the area, leading into the coldest morning on the 16th.

The cold lost its grip during the last week of February and temperatures finally climbed above freezing. Daily high temperatures remained above freezing the rest of the month. By the end of the month, the 14 inches of snow on the ground had shrunk to a trace at most locations. February 2021 went into the records as the second coldest February on record, trailing only February of 1936, and included the coldest average high temperature for any February at Hastings of 23.6°.

February 2021: A record cold month everyone was glad when it was over, but one which will not be soon forgotten.



# 2020-2021 Nebraska/Iowa Winter Weather Events

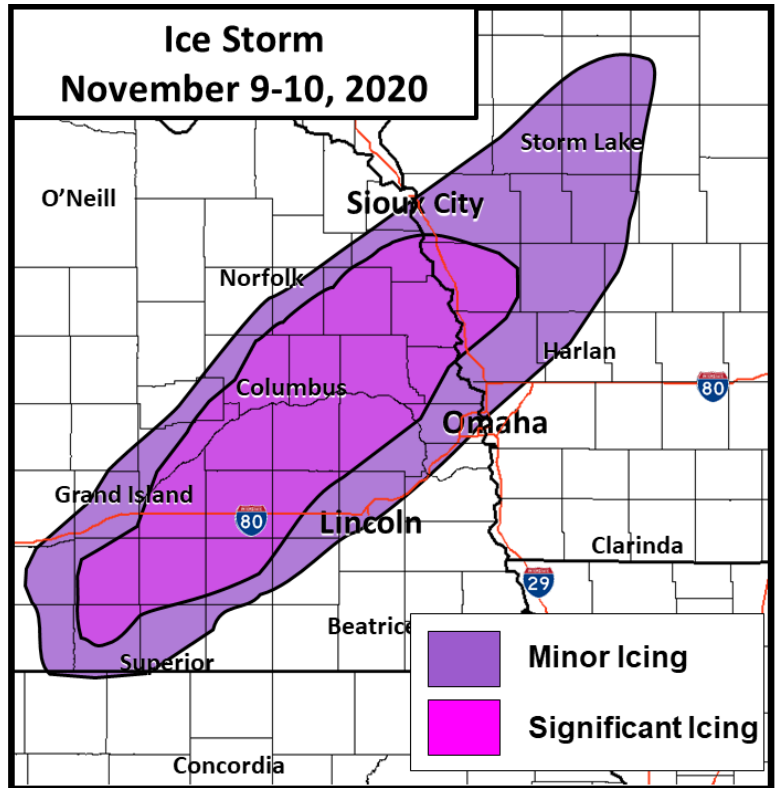


Winter Weather Awareness Day - November 4, 2021

## Eastern Nebraska - NWS Omaha/Valley, NE November 2020: Ice Storm

On November 9 and 10, a large persistent area of rain and thunderstorms moved across central and eastern Nebraska. On the ground, temperatures across much of this region were 32 degrees or colder, causing much of this rain to freeze to trees, powerlines, bridges, and other elevated objects. This particular storm had numerous locations in Nebraska that recorded 6 to 12 hours of freezing rain, leading to the ice storm conditions. Finally, wind gusts during this freezing rain were commonly in the 20 to 30 mph range. Wind gusts up to 25 mph coupled with the weight of ice added physical stress to tree branches and electrical infrastructure, causing additional damage. Later on November 10, moderate to heavy snow overspread the area, with up to 10 inches of snow falling.

Many locations in the affected area accumulated at least 0.25" of radially-measured ice on power lines and trees. The stress of ice on power lines was so great that power poles were toppled. This resulted in extended power outages, some over 30 hours.



Damage costs from the storm totaled to nearly 1.5 million dollars. One of the hardest hit communities was Thurston County, where nearly the entire county lost power on the morning of November 11th. All the communities did not have power totally restored until November 14th. Warming shelters were opened and the tribal communities in the county were offered hotel vouchers.

Branches down in Fremont (left). Photo by Tami Morales. Large tree limb brought down by the weight of ice and winds in Osceola (right).