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# The Topeka Tiller

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National  
Weather  
Service  
Topeka, KS

## Women in Science Day 2018 at Washburn University in Topeka

*By Jenifer Prieto, Lead Forecaster*

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For the last 11 years, women meteorologists from the National Weather Service in Topeka have teamed up with women scientists around the area to host approximately 250 7<sup>th</sup> grade girls for Women in Science Day. The goal of the event is to promote various science, engineering, and technology fields that are largely underrepresented by women in the career field. Based on their interests in a particular field, each student is assigned two labs where women scientists and volunteers facilitate a hands on activity while offering insight and answering questions about their career. With the National Weather



Service, students will perform experiments on seeing how snow forms, building static electricity to power a light bulb (exploring the formation of lightning),

and creating fog and precipitation in jars. Additional labs this year vary from forensic chemistry to dissecting lungs and creating volcanoes.



Featured guest speakers include Rachael Rost, an Education Specialist from the Topeka Zoo and Conservation Center, and Heather Pfannenstiel, a Biology professor at Washburn University. This year's event is scheduled to take place in late October at Washburn University.

# A Recipe for Sustained and Organized Thunderstorms

By Dr. Ariel Cohen, Science and Operations Officer

Did you know that the atmosphere follows its own recipe in cooking up some of the types of thunderstorms that bring tornadoes, large hail, damaging winds, and heavy rains to Kansas? Very much like what we would need to do to create a cake -- mix together flour, eggs, milk, and sugar -- there are specific atmospheric ingredients that must all come together to support sustained, organized thunderstorms! Another term we use for "ingredients" is the term "necessary conditions." That is, it is necessary

for a set of factors to all come together at the same time and place for a certain physical reaction to take place -- in this case, sustained and organized thunderstorms.

So, what exactly is the recipe for sustained and organized thunderstorms? The first couple of ingredients probably won't be too surprising. First, think of how it

feels outdoors before a round of storms moves through. It's typically warm or hot, and humid. Those factors precisely relate to two necessary conditions supporting sustained, organized thunderstorms: **moisture** and **instability**.

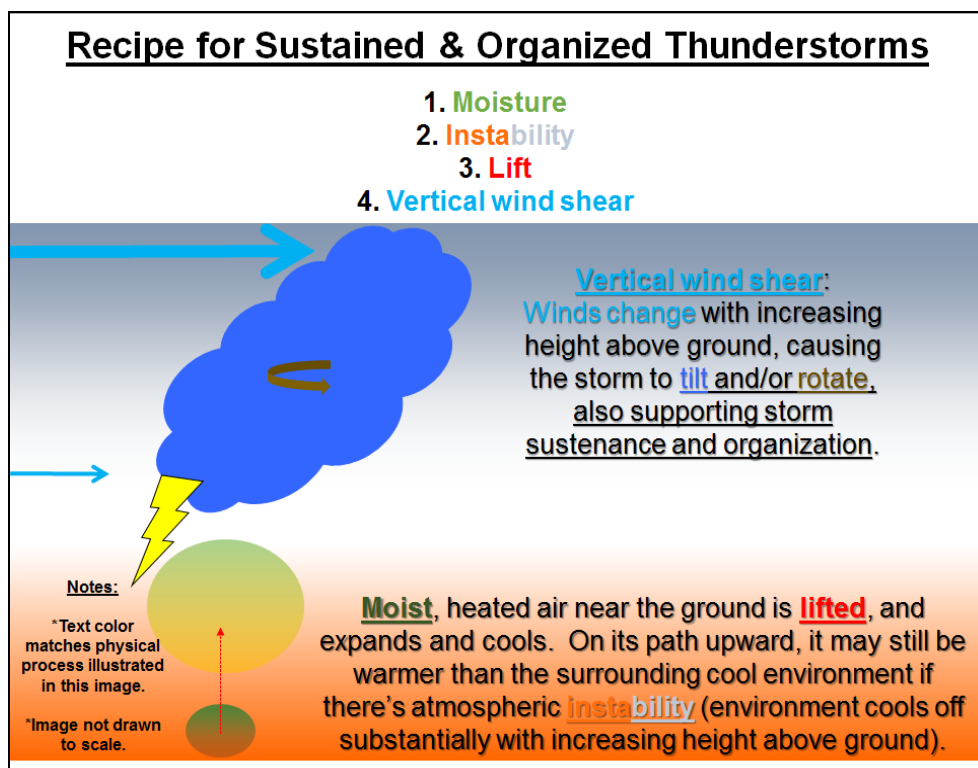
When there's sufficient atmospheric moisture in place, clouds are able to form when the moist air is lifted; that **lift** is a third ingredient for sustained, organized thunderstorm development. When moist air is lifted, such as when a cold front overtakes a humid air mass, the lifted air encounters lower pressures above the ground -- causing it to expand. And when that air expands while ascending, it pushes outward thus performing work on its surroundings, which causes its

internal temperature to cool; energy is conserved. When the moist air cools, it can eventually reach saturation, allowing condensation and cloud formation to occur -- similar to fog formation occurring at night when surface temperatures cool.

Now, suppose that there's moist air near the ground that is *originally heated* before being forced to rise. Also, suppose that the environment in the upper levels of the atmosphere is considerably cooler than

the warm, moist air that was heated near the ground. Then, the warm, moist air that was originally heated near the ground is also more susceptible to being warmer than its surrounding environment as it rises through the atmosphere, despite that originally-heated air experiencing some cooling as it rises. If

that's the case, then the originally-heated air can rise all on its own like a hot-air balloon -- without any additional external lifting mechanism -- while expanding, cooling, and condensing (experiencing saturation). This is what permits the development of deep clouds, precipitation processes, and even lightning if there's enough instability! So, the instability ingredient represents a change in environmental temperatures with height above ground. If the atmosphere is characterized by instability, then heated air near the ground is more likely to remain warmer than the surrounding environment aloft, despite its tendency to naturally cool along its upward path.



Article continues on page 7...

## Winter Weather Travel Safety and Preparedness

By Chad Omitt, Warning Coordination Meteorologist

Living in Kansas you may think that tornadoes pose the greatest risk to your safety from Kansas weather. However, the greatest risk to your safety actually comes from driving in snow and ice during the winter season. We're not talking about the traditional blanket of snow that you can see. The true road ice hazard is subtle and intermittent icing due to light winter precipitation, events that suffer from a lack of obvious visual cues and public awareness (see image at right). It is these conditions that cause the biggest percentage of deaths and injuries and it doesn't take much to make roads icy enough for you to lose control!



Although numbers are largely underreported, here in Kansas at least 15 people lose their lives in automobile accidents where ice and snow plays a role and that number may be much higher. So what can you do to lower your risk when driving on ice and snow?

**1. Know what to expect on your trip and plan accordingly.** If you know you need to travel through especially bad wintery conditions, be sure to check the weather forecast along your trip by visiting [www.weather.gov](http://www.weather.gov). Visit [Kansas Dept. of Transportation web-site](#) to access information about your road conditions including webcams.



**2. Pay Attention, Slow Down and Relax.** This is the most important rule to driving in bad conditions of any kind. And we're not just talking about speed — you want to do everything more slowly and more lightly than you normally would. Hitting your gas pedal, slamming your breaks or cranking your wheel too quickly is a surefire way to lose traction on an icy or wet road.

**3. If you start sliding, turn slightly into the skid and pump your breaks.** Once you're already sliding, your tires have lost traction with the road. It seems counterintuitive, but in order to avoid a spinout you need to turn slightly into the skid, slowly let of the gas and start pumping the breaks. Yanking the wheel in the other direction and locking the brakes will stop your tires from turning, but you'll lose all hope of regaining traction with the road surface.



**4. Know when to quit.** Sometimes road conditions are simply too dangerous to drive in. If you can't see or you keep losing control, pull over. Never push your luck if you're unsure. It's not worth it to drive if you're jeopardizing yourself, your passengers or other drivers on the road.

Article continues on page 4...

## Winter Weather Travel Safety and Preparedness (Continued...)

Even the smartest and safest drivers get into accidents. That's why it's crucial to be prepared for the possibility of any kind of collision or accident that could leave you and your passengers stranded on the side of a cold and possibly dangerous road. The first step is to build an emergency kit and place it in the trunk of your car.

Inside, you will want to include common car safety items like jumper cables, a flashlight and a roadside visibility kit of either reflectors or flares. If you are stranded, a small shovel and bag of sand are must-haves. Left is a list of possible items you may want to have in your vehicle.

### Points to remember:

- Wear your seat belt! Even though wearing your seat belt should already be a no-brainer



at all times, during the winter it's even more critical. An alarming number of road ice fatalities occur with minor accidents where the vehicle occupants were not wearing seat belts.

- Take it slow! *You don't have the skill to drive at normal speeds on icy roads. High speeds make it easy to lose control on ice and snow. Slowing down to below 45mph when icy roads are a threat is one of the best ways to avoid an accident.*

- Pay Attention! Put your mobile device away and focus on the road with both hands on the steering wheel!

By remembering these few important points we hope that you can help keep yourself, your family and fellow drivers safe this winter season.

## Importance of Radiosondes and Weather Balloons

By Sarah Teefey, Meteorologist Intern

In today's advanced age of technology, complete with smart phones, self-driving cars and supercomputers, the National Weather Service continues to utilize one piece of a simpler technology to obtain valuable upper atmospheric information, which in turn is used to enhance forecast accuracy. That technology is the radiosonde, which was first used by the National Weather Service about 80 years ago.

Humans inhabit a very shallow portion of the atmosphere. However, the wide range of weather we experience here near the earth's surface is dependent on atmospheric conditions that extend through the entire troposphere. The troposphere is the lowest layer of the earth's atmosphere, which typically extends to around 33,000 feet above sea level but can vary depending on location and time of year.

Since surface conditions are largely based on upper atmospheric conditions, it is imperative that meteorologists know what is occurring well above the earth's surface. So the question becomes, how do meteorologists determine current conditions at tens of thousands of feet in the air? The answer includes three common methods: aircraft observations, satellites, and radiosondes attached to weather balloons. Radiosondes are small instrument packs attached to a large balloon that measures temperature, pressure, and relative humidity. In addition to providing temperature, pressure and humidity data, radiosondes also measure GPS location which allows for the computation of wind speed and direction.

Article continues on page 5...

## Importance of Radiosondes and Weather Balloons (Continued...)

Surprisingly, in the 80 years radiosondes have been used by the National Weather Service, little has changed with the equipment and operational use of the equipment. Large balloons filled with hydrogen or helium, collectively known as weather balloons, carry the radiosondes beyond the troposphere and well into the stratosphere before bursting.

### Interesting Facts about Weather Balloons

Balloons can rise at rates of 1,000 feet/minute, while the attached radiosonde transmits data every second.

Balloons are about 5 feet in diameter at time of release but can expand to 25 feet in diameter before bursting.

There are over 800 locations worldwide that routinely release weather balloons, 92 of which are operated by the National Weather Service.

Weather balloon sites around the world release balloons at the same time to get a complete sampling of the atmosphere at that designated time.

Sensors on the radiosonde are linked to a battery powered radio transmitter that sends the data to an antenna at the surface. The data obtained is used as input into computer models to give the models an accurate starting point. Reliable baseline data is important for all weather forecasts, but it is especially important when a life threatening event is expected,

such as a land falling hurricane. That is why when Hurricane Florence was heading toward the Carolina coast in September, several National Weather Service offices, including Topeka, conducted special radiosonde flights in order to collect accurate input data for computer models. A typical day will consist of



two flights, one in the morning and one in the evening. However, in the days leading up to Florence's landfall, the Topeka office also released radiosondes at midday and midnight, making for a total of four flights per day. The conditions measured by those special flights (even as far east as Kansas) proved helpful in forecasting Florence's impacts.

The valuable data obtained from radiosondes, combined with their relatively inexpensive cost compared to other methods of measuring upper air data, is why radiosondes are still in use more than 80 years after their debut with the National Weather Service.

## Summer Summary 2018

*By Kyle Poage, General Forecaster*

Temperatures for the summer months of June, July, and August averaged to be above normal while precipitation was generally below normal, though locations in the Belleville, Garnett, and Hiawatha areas received near-normal amounts of rainfall.

The season started with a record high of 96 degrees on June 1, although more persistent levels of heat and humidity were experienced from mid-June to mid-July. Heat index values commonly reached around 100 degrees area-wide from June 16 to 18 with warm and muggy overnight conditions resulting in temperatures only falling in the middle 70s,

resulting in a few records for the highest minimum temperature being tied in this period. Heat index levels were even higher at the end of June and again around Independence Day with widespread feels-like temperatures peaking from the upper 90s to 109 degrees. Low temperatures at Topeka during this time only dropped to around 80 degrees, setting two records for highest daily minimums on June 28 and 29. The final period of extreme heat occurred in the middle portions of July when heat index values again reached the upper 90s to 109 degrees from July 10 to July 13 and again July 19.

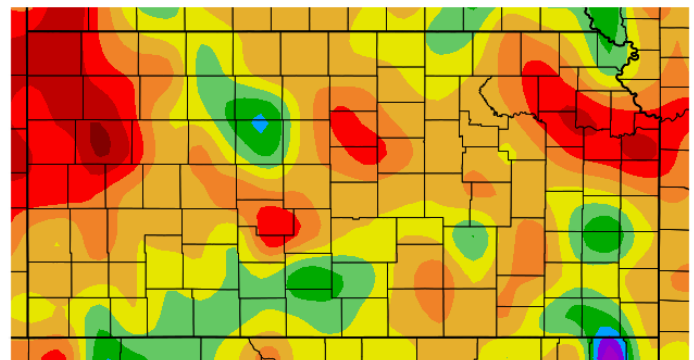
**Article continues on page 6...**

## Summer Summary 2018 (Continued...)

Severe weather was scattered across the area throughout the summer, though no tornadoes were reported. Thunderstorms in the late evening and overnight hours of June 11 to June 12 produced scattered tree damage including some trees blown down and hail up to 1.5 inches in diameter in northeast and east-central Kansas. Thunderstorms shifted west into mainly north-central Kansas June 18 with areas of strong winds resulting in tree limbs blown down and three to four inches of rain in portions of Washington and Marshall counties, with isolated flash flooding near Marysville. Severe weather returned to portions of Republic and Cloud counties the following evening with tree damage resulting. A more widespread event took place during the next evening as severe thunderstorms traveled from Cloud county east-southeast into Douglas county with several large tree limbs blown down along their path and a 78 MPH wind gusts measured at Forbes Field near Topeka. The period from late June through the middle of July was more tranquil, though one of the most notable events occurred on July 19. Severe thunderstorms entered north-central Kansas shortly afternoon and exited east-central Kansas by the late afternoon, producing several 60 to 80 MPH wind gusts, snapping large trees, and blowing down business signs. Severe weather was

more spotty in the early evening of August 6 and mid-afternoon to early evening of August 16 with hail around one inch in diameter and some wind gusts to 65 MPH reported. The final severe weather event of the year impacted far northeast Kansas in portions of Brown county from the middle of the morning into the early afternoon with damage to trees and outbuildings resulting.

Precipitation (in)  
6/1/2018 – 8/31/2018



Generated 9/20/2018 at HPRCC using provisional data.

NOAA Regional Climate Centers

## Pathways Program

*By Emily Heller, Meteorologist Intern*

Are you a student interested in working for the National Weather Service? If you or anyone you know attends any type of academic establishment and want to work for the Federal service, a relatively new program called the Pathways Internship Program may be for you.

The Pathways Internship Program provides a way for students in a multitude of academic institutions the opportunity to learn about Federal careers as paid employees while continuing their schooling. The full list of requirements to be considered for this position can be found at this site: [https://www.wfm.noaa.gov/POAD/pathways/index\\_1.html](https://www.wfm.noaa.gov/POAD/pathways/index_1.html)

Pertaining specifically to the National Weather Service, the pathways program has provided a multitude of students with invaluable experience working directly at a forecast office alongside NWS meteorologists. The program aims to have students obtain a wide variety of experiences ranging from day to day operations to educational visits with regional and national centers. Students may also have the chance to participate in

research projects and other local office endeavors. Learning to forecast, launch weather balloons, and support decision support services are all initiatives with this program as well.

Since the Pathways program originated, the Topeka office has had one individual transition from Pathways Intern to full-time Meteorologist for the NWS. Our office is also lucky to have a current Pathways Intern who spent all of the summer working in Topeka and plans to return to work on breaks from school.

To search for Pathway Program opportunities available, utilize USAJobs and select "Students & Recent Graduates" under the Hiring Path filter, or "internships" or "recent graduates" under the Appointment Type filter.



## Recipe for Organized Thunderstorms (Continued...)

Everything we talked about addresses the ingredients, or necessary conditions, for thunderstorm formation. But, there are many different types of storms. Some storms tend to remain much more vertically aligned, whereas other storms may tend to tilt more. It's those storms that tilt which can tend to separate the updraft air from the downdraft air. That is, for tilted storms, the rising motion we talked about earlier, tends to be separated from the precipitation-loaded downdraft air which forms when the storm becomes sufficiently mature. This storm tilt is necessary for the updraft to persist for any meaningful duration of time. Without the storm tilt, the cool downdraft air can quickly offset the ascending motion critically supporting the storm, while potentially stabilizing the inflow air that the storm ingests. As a result, a change in wind velocity (speed and/or direction) with height above ground is necessary for storms to be sustained. We call this final ingredient **vertical wind shear**. Moreover, this vertical wind shear can assist in a storm's ability to exhibit organization -- such as rotational or squall-line characteristics -- which can have a general tendency of yielding more substantial weather hazards over a broader area than disorganized storms that can quickly collapse after forming.

Putting it all together, the atmosphere must feature an overlap of **moisture**, **instability**, **lift**, and **vertical wind shear** at the same time and place in order to support the development of organized and sustained thunderstorms. It is these storm types that can result in the most hazardous weather for the citizens across Kansas, and anywhere else in the world. Meteorologists work around the clock to identify patterns that support these ingredients, in order to anticipate and message upcoming hazardous weather. The image on the previous page



highlights these ingredients, and includes color coding based on the annotations and processes that are illustrated in this image.

If you would like to learn more about the ingredients supporting sustained and organized thunderstorms, along with many of the factors involved in severe-thunderstorm forecasting and weather forecasting in general, please check out the Severe Thunderstorm Forecasting Video Lecture Series! This lecture series is available on the Storm Prediction Center's website, <https://www.spc.noaa.gov/exper/spcousom/>, and features 91 videos addressing a multitude of aspects of severe-weather forecasting. These videos encapsulate much of the graduate-level course offered at the University of Oklahoma entitled "Applications of Meteorological Theory to Severe-Thunderstorm Forecasting", which the author of this article created while he was a Storm Prediction Center Forecaster and University of Oklahoma Ph.D. Candidate. Some videos address more advanced topics than others, and the combined lecture series is meant to provide a holistic overview of the many factors that go into severe-thunderstorm forecasting.

## Employee Spotlight! Meet Sarah Teefey, NWS Topeka's Newest Meteorologist

*By Sarah Teefey, Meteorologist Intern*

Hi everyone. I am the most recent addition to the Topeka National Weather Service office, joining the team as a meteorologist in mid-September. I grew up here in eastern Kansas and became interested in meteorology at the young age of eight when a meteorologist visited my school. That same year, I experienced the intensity of a microburst firsthand and became even more intrigued (and a little more terrified) about the power of Mother Nature. From that point on, I was hooked. I found myself always wanting to know what the weather was going to do and I would talk about the weather to anyone who was willing to listen.

I went on to study meteorology in college and obtained a Bachelor of Science Degree in Atmospheric Science from the University of Kansas. I spent the first seven years of my career as a broadcast meteorologist in Lawrence, Kansas and Springfield, Missouri. As a broadcast meteorologist in Kansas and Missouri, I experienced events ranging from ice and snow storms (including one blizzard) to tornado outbreaks and flash flooding. Most notably, I helped cover the system that produced the EF-5 tornado in Joplin, MO on May 22, 2011, and a system that produced nine tornadoes in southern Missouri and northern Arkansas on New Year's Eve of 2010. During my time as a broadcast meteorologist, I also had the opportunity to speak to over 40 different groups of people, including pilots, soldiers and school aged children of all grade levels, about weather and preparedness.

Following my stint in broadcast meteorology, I



worked as an environmental consultant with a firm in Kansas City where I conducted air dispersion modeling and assisted industrial clients with air compliance and regulatory efforts.

I am very excited to now be a part of the National Weather Service here in northeast Kansas where the weather most certainly will not be ignored. I look forward to tackling the challenges of forecasting the dynamic weather we experience here in the Midwest, communicating weather and hazard information, and participating in community outreach events as part of the Topeka team.

## Departing Employees

As the leaves change, so does the staffing at NWS Topeka this Fall with two employees who have either already left or are planning to leave shortly.

Kris Sanders, a General Forecaster at NWS Topeka, has gotten a promotion to Lead Forecaster in Grand Junction, Colorado. We wish him all the best!

Meteorologist Intern, Emily Heller, has also received

a promotion to General Forecaster in Sacramento, California. As the editor of this newsletter for the past four years, Emily is happy to pass the editor position to Sarah Teefey.

Congratulations and good luck to both!



## COOP Corner

Summer 2018 has come and gone, and was marked with very warm temperatures and dry conditions for portions of northeast and east central Kansas. After starting out with the third coldest April on record, the area quickly rebounded with the warmest May on record. Drought conditions spread across sections of northeast Kansas this summer where a large swath of the area fell under extreme or exceptional drought conditions. July was exceptionally dry for many locations including Topeka and Lawrence; with monthly rainfall totals of 0.49" and 0.26" respectively. Some drought relief was brought with the widespread heavy rains of early October, which also ushered in the first fall like temperatures for the season. So, it is that time of year when we should consider bringing indoors the funnels and inner tubes of the rain gauges. Snow has already fallen across Nebraska and South Dakota this season. Funnels and inner tubes should be inside if freezing temperatures are forecast, or by November 1, whichever comes first.

2018 Length of Service awards were presented to:

Alan Winkler	McFarland, KS	45 Years
Joe E. Chizek	Cuba, KS	30 Years
Mary Knapp	Manhattan KSU	30 Years
Scott Seifert	Clyde, KS	30 Years
Bernard Vandorn	Frankfort, KS	25 Years
City of Herington	Herington, KS	25 Years
Larry & Sally Hess	Sharpe, KS	15 Years
Terry Tietjens	Abilene, KS	15 Years
Thomas Moravek	Belleville, KS	10 Years
Troy Isaacson	Belleville, KS	10 Years



**Alan Winkler receives the Dick Hagemeyer Award for 45 Years of Service; Pictured with Alan is Topeka's Meteorologist in Charge, Kris Craven**



**Jason Alt and Dave Gehrke with the City of Herington accept the 25 Year Institution Award.**

If you have any questions at all regarding snow measurements, or any other questions, please contact me via email at [shawn.byrne@noaa.gov](mailto:shawn.byrne@noaa.gov). Thank you all for your service! It is valued and very much appreciated!



National Weather Service

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Editor: Emily Heller, Meteorologist  
Intern

## Winter Weather Spotting Tips:

### Weather to Report:

Snowfall depth  $\geq$  1 inch

Any ice accumulation (including roads)

Precipitation type changes (i.e. rain to freezing rain, snow to sleet, etc.)

### What to Include in your Report:

Your Name and/or Call Sign (Spotter Number)

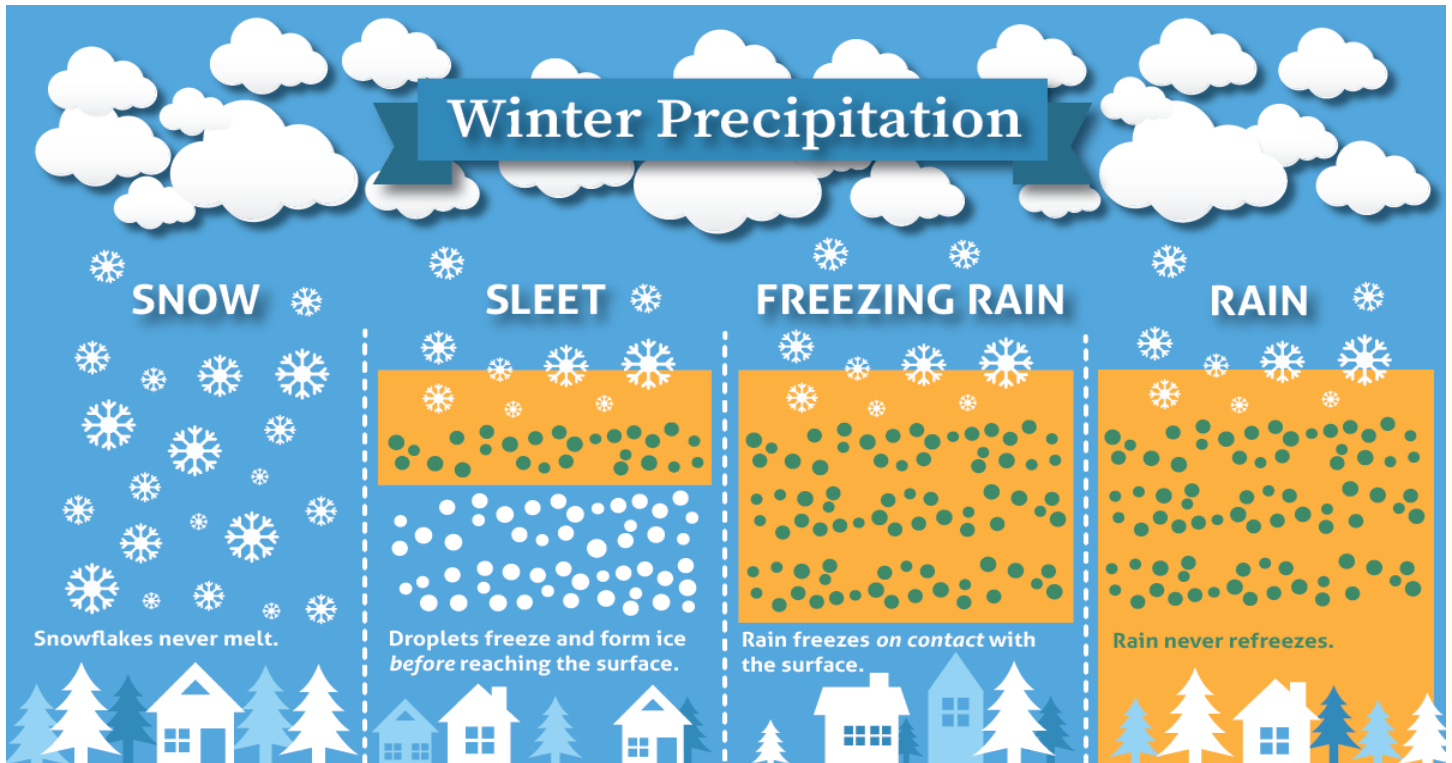
Your Location

Time and Date of Event

Location and Duration of Event

Visit the following website for more information:

<http://www.erh.noaa.gov/iln/spotters/measuringsnow.php>



At or Below 32°F

Above 32°F

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

