Serving Residents of Northeast Kansas Since 1878

The Topeka Tiller

National Weather Service Topeka, KS

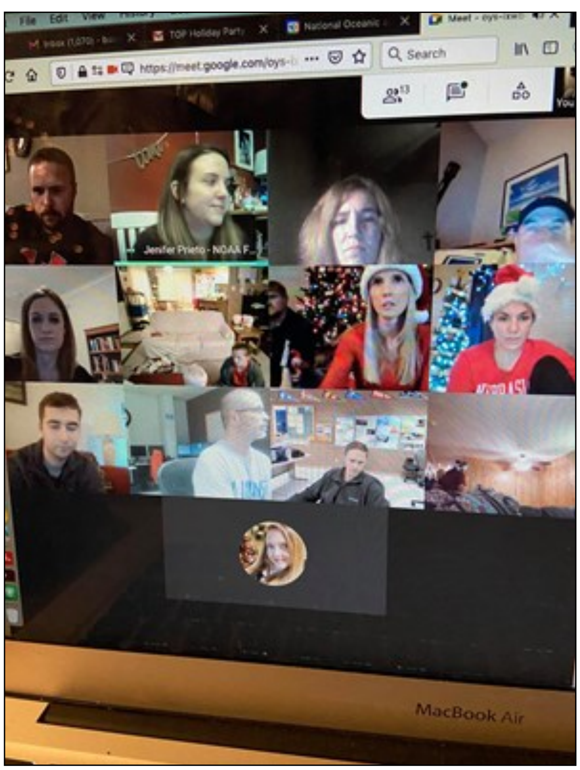
Spring 2021 Volume 14, Issue 1

Inside this issue:

How NWS Topeka Maintained Effective Operations During the COVID-19 Pandemic

By Jenifer Prieto, Lead Meteorologist

While the country surpasses the one year mark of the COVID-19 pandemic, the staff at NWS Topeka continues to review and perfect office procedures and communications in preparation for severe weather season. Throughout the year, meteorologists and support staff were required to limit staffing within the office workplace, resulting in most individuals teleworking from home. This changed the dynamic quite a bit, forcing the staff to become more creative in sharing office duties and maintaining open lines of communication - not only with each other, but also with our partners. To give a few examples, meteorologists provide daily virtual weather briefings to the State Emergency Operations Center on hazardous weather conditions for the next few days. Meteorologists also have provided virtual spotter talks and coordinated duties with persons in office to compose social media posts and briefings in order to message upcoming hazardous weather. Meteorologists have analyzed the atmosphere for severe and winter storm potential from home to collaborate with colleagues who are creating the forecast within the office. The Meteorologist-in-Charge (MIC) also hosts daily and biannual video conference calls to update everyone on office operations, maintenance concerns, and science-sharing topics catered towards improving the scientific understanding of Kansas weather phenomena that we are all too familiar with. Key lessons were learned from the past year in regards to improved flexibility to changing staffing and therefore impacts to operations in the forecast office. We also learned to adapt effectively in improved communications online with new software tools and applications that have allowed us to work more efficiently. While we have appreciated the positive lessons learned from operating through a pandemic, we look forward to working together in person in the coming year.



Staff of NWS Topeka have their game faces on during a virtual holiday party in December 2020. Photo courtesy of Bryan Baerg.

Meteorological Challenges of the 18 November 2020 Delia Wildfire Event & Wildfire Safety Reminders

By Brandon Drake, Meteorologist and Bryan Baerg, Meteorologist

November 18, 2020 proved to be a very challenging fire weather set-up across the NWS Topeka forecast area. It was also one of the most impactful critical fire danger days we've seen over the past few seasons. Typically textbook "Red Flag" Warning days consist of three main ingredients:

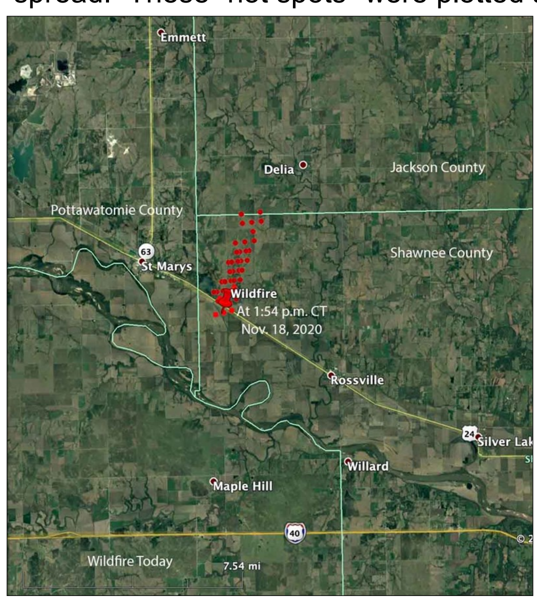
1. critically dry (cured) fuels

2. relative humidity values closer to 20% or lower

3. sustained wind speeds greater than or equal to 20 mph OR gusts greater than or equal to 25 mph for a 3 hour period.

Similar to forecasting ice or snow with a winter storm system, an impactful fire weather set-up can often result from seemingly small differences in one or more of these ingredients. This is exactly what occurred and led to favorable environmental conditions for the Delia wildfire to exhibit erratic fire behavior and rapid spread. Leading up to this day, drought conditions ranged from abnormally dry to moderate drought across the local area which increased the available fuel load. Additionally, the dry conditions leading up to November 18th resulted in dangerous fire weather conditions even with relative humidity values in the 25 to 30 percent range. That's how the day looked from the perspective of ingredient #1. What about ingredient #2? This tends to be one of the trickier forecast elements as current weather models can struggle with something called 'mixing of the boundary layer', which is a fancy way of saying that the actual surface relative humidity values can be drier than forecast. This November day actually ended up ranging between 25-30% relative humidity during the warmest part of the afternoon. This leads to the final ingredient of interest on this day, which is the very strong southerly wind. Wind is an interesting ingredient for this case as it was not only meeting criteria but well exceeding criteria by an order of magnitude, reaching values near 50 mph at peak gusts. The main reason for describing a bit about the meteorological set-up here is to inform the reader that no single Red Flag Warning day fits into a simple "black box". Often there is ambiguity when forecasting what could be a critical fire weather day. But as this situation points out, even if one set of criteria - relative humidity in this case - isn't all that favorable, the other ingredients and their relative differences may need to be given more weight and attention because they can easily offset any other ingredient that by itself isn't all that impressive. All of this is typically a very painstaking process undertaken by one of the weather forecasters and can be a very challenging yes or no decision, and may not be one that can be made until several hours to a day or so before the onset of actual conditions.

While the discussion above is a very simplified version of what goes on behind the scenes, there is also much collaboration that takes place on a day like the Delia wildfire between state fire partners and the forecaster here in office. Ultimately, the Fire Weather Watch in place leading up to this event was upgraded to a Red Flag Warning. The Delia fire would begin as a small "hot spot" along highway 24 near St. Marys around 11:30 am. This fire was captured on GOES 16/17 satellite as a "hot spot", which was helpful in alerting emergency management partners that a fire was ongoing and conditions were favorable for rapid spread. These "hot spots" were plotted as shown in the image at left as red dots courtesy of Wildfire Today from around 11:30 am to 2 pm spreading from south to north.



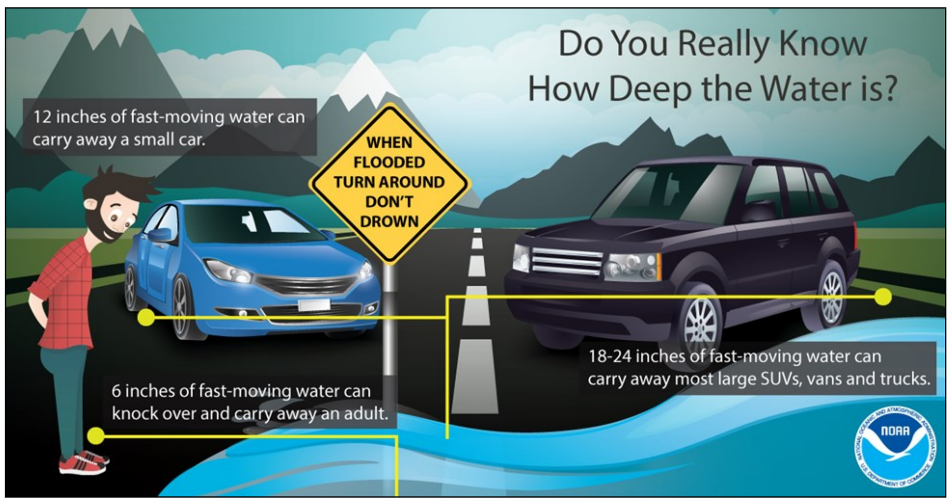
Article continues on page 7...

Severe Weather Safety

By Chad Omitt, Warning Coordination Meteorologist

As we move into May and June, it's important to review some basic safety information related to severe weather and the risks that storms can bring here in Kansas. Most people imagine that tornadoes hurt and kill the most people each year in Kansas. However, looking back over the past 10 years, flooding has taken the lives of people more than tornadoes and lightning combined. It's true that Kansas leads the country in documented tornadoes per square mile each year, but most tornadoes tend to impact smaller areas and don't last longer than 10 or 15 minutes before dissipating. Let's take a quick look at each thunderstorm hazard and review the important safety advice for reducing the risk from each.

Flash flooding
Don't drive through flooded areas, especially at night in areas you are not familiar with. The majority of deaths due to flash flooding occur with people driving through flooded areas. Believe it or not, water only one foot deep can carry an automobile and you never know the condition of the roadway under the water…it may be gone! If you come upon flood waters, stop! Turn around and go another way. Most flash flood deaths occur in automobiles, so turn around don't drown!



Tornado Safety
The greatest danger from a tornado is the blowing and falling debris which may be traveling at over 150 mph! So, you need to know where to go! Remember, get as low as you can and put as many walls between you and the outside as possible. Go to your safe room or basement if you have one, and try to get underneath something sturdy and cover your head with a helmet for extra protection. Back in 2011 when over 500 people lost their lives from violent tornadoes, many fatal injuries were due to blunt force trauma to the head, so use a bike or sports helmet whenever possible! If you don't have a basement, choose a smaller interior room on the lowest floor and cover up as best you can.

The worst places to be during a tornado are in a mobile home or vehicle. If you are in a mobile home, go to your designated shelter – either a community shelter or another pre-determined location like a friend or neighbor's home that has better sheltering options, such as a basement or interior room on the lowest floor of a wood-framed home. Do not stay in your mobile home if you are in the path of a tornado!

Article continues on page 9...

Winter 2020-2021 in Review

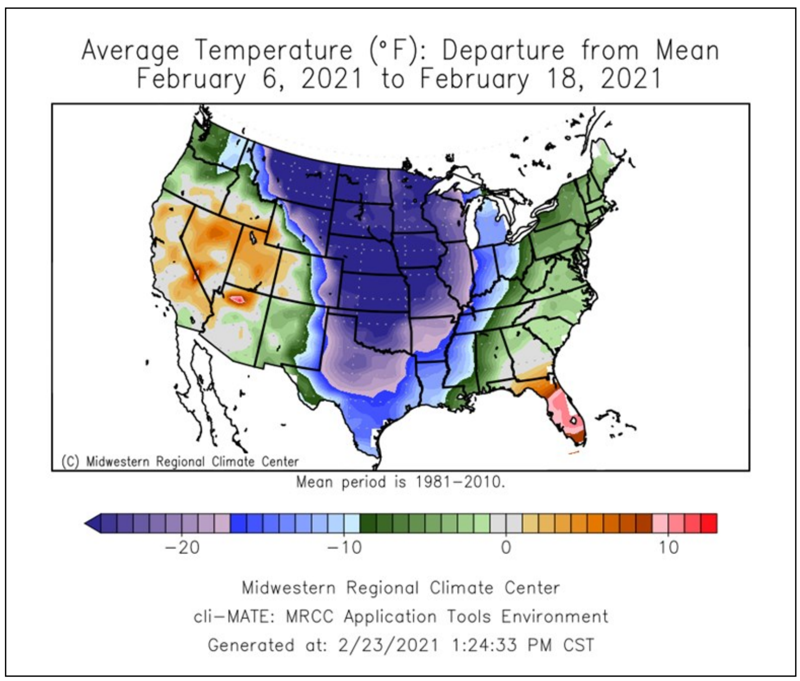
By Daniel Reese, Meteorologist

Looking at the overall numbers, the winter of 2020-2021 finished with near average temperatures and a bit less than average snowfall. Topeka ended the winter (DJF) 0.2° F below average with a total winter snowfall of 11.8”. When including 0.6” of snow on October 26 and 3.1” from the recent April 20 snow event, that brings the cold season total to 15.5”, slightly below the long-term average of 17.8”. Concordia ended the winter 0.7° F above average with 19.5” of total snowfall from October through April. This was just below the average of 20.2”. However, these numbers alone don’t nearly tell the whole story.

December was a warm month, finishing 6° F above average at Concordia and 5° F above average at Topeka. It was also a very dry month, as little snowfall occurred during December. Concordia’s only two days of snow were on the 12th and 28th, with both days seeing only 0.4”. Topeka was even less snowy in December. Only a trace of snow was recorded during the month, just the 14th time on record that no measurable snow fell in December.

January continued the warm pattern, ending 5° above average at both Topeka and Concordia. However, the pattern became much wetter, beginning on the first day of the year when 4.5” of snow fell in Topeka. Two more notable snows occurred during the rest of the month, including the 15th when 2” of snow fell in Topeka, accompanied by wind gusts to 50 mph. From the 25th to 27th, another system brought 1” of snow to Topeka and 9” to Concordia, with a few spots near the Nebraska border seeing over an inch of snow.

The main event that this winter will be remembered for took place in early to mid-February. A pattern change ended the previous warmth and brought some of the coldest temperatures in decades not just to Kansas, but to parts of the Plains as far south as southern Texas. In northeast Kansas, well below average temperatures occurred February 6-19, with the coldest temperatures from the 14th to 16th. By most metrics this stretch was the coldest since 1989, and broke records for both the intensity and the longevity of the cold. Only 5” of snow fell at Concordia and 4” fell at Topeka during this stretch, but the low temperatures meant this snow stuck around for a while.



In Topeka, ten consecutive days saw high temperatures 15° or colder, the longest such streak on record. One daily record cold maximum and three daily record lows were set, with the low of -21° on February 16 tying for the 7th coldest temperature on record in Topeka. Similar records were set at Concordia. The ten consecutive days at or below 15° were the second longest such streak on record. Three daily records were set, two for the low temperature and one for the coldest high. The low of -22° on February 16 was the 7th coldest temperature on record at Concordia as well.

Article continues on page 7...

Use of Dual Polarization Radar for Detection of Severe Weather Hazards

By Sarah Teefey, Meteorologist

The National Weather Service (NWS) first began using radar technology to detect precipitation in the 1940's. Since then, several refinements and upgrades have been made to the Weather Surveillance Radar system. Of note in recent decades, Doppler radar technology was implemented in the late 1980's and early 1990's. The WSR-88D (D for Doppler) provided a huge advancement in radar technology in that it allowed radar operators to see the movement of the precipitation and wind fields within thunderstorms. WSR-88Ds remain in operational use around the country today, but over the last decade have also utilized dual polarization technology, or dual pol for short. With this configuration, the WSR-88D transmits and receives pulses of energy in both a horizontal and vertical orientation, allowing radar operators to understand more about the shape and size of the objects being detected. Radars had previously only transmitted pulses in a horizontal direction.

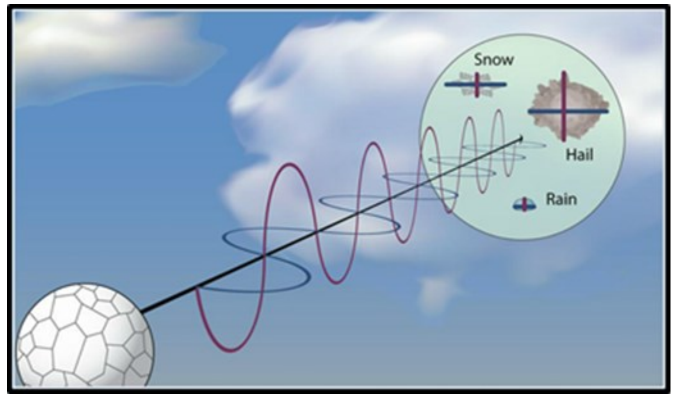


Image 1. Example of Dual Pol Transmission

During severe weather operations, meteorologists at the NWS use this dataset to look for hazards associated with severe thunderstorms, including large hail and tornadoes. For example, when investigating the presence of hail, meteorologists will likely utilize a dual pol product called differential reflectivity (ZDR). ZDR displays the difference between the horizontal and vertical reflectivity values and, thus, gives a good indication of object shape. ZDR values of rainfall generally increase with the size of the raindrop as smaller raindrops are more spherical and larger drops grow into more of a hamburger bun appearance. Small hail is often fairly round in shape as well, with large hail generally being less uniform. Large hail, however, tumbles as it falls, giving a spherical appearance to the radar. Consequently, hail generally has a ZDR value near zero since it is similar in both the horizontal and vertical direction, or at least appears that way. In order to tell hail from small rain, we need to rely on values of reflectivity and another dual pol product, correlation coefficient.

Correlation coefficient (CC) can be used to help detect hail, especially hail that is mixed with rainfall and/or large hail. CC measures how similarly vertical and horizontal pulses act from pulse to pulse. As previously mentioned, large hail tends to be non-uniform in shape. Thus, pulses of energy returned to the radar from such objects can look different from pulse to pulse. Meteorological objects that are non-uniform generally have CC values between 0.8 and 0.97. A value of 1 would indicate pulse consistency from scan to scan.

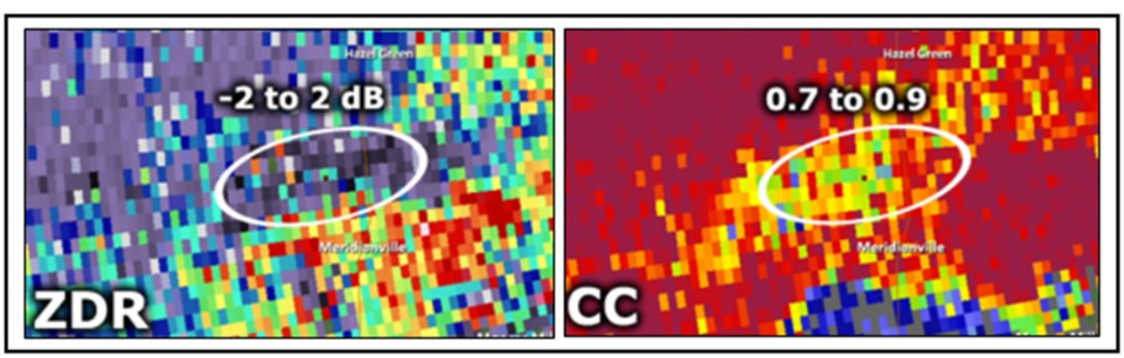


Image 2. Large Hail Signature in ZDR and CC Radar Data

Photo credit: NWS Jackson, MS

Article continues on page 11...

Lightning: The Science and Separating Fact from Fiction

By Chelsea Picha, Meteorologist

Many people are well aware of the dangers that come from thunderstorms, such as hail, tornadoes, and flooding. While lightning can be fascinating to watch, at times it is perhaps one of the more underrated hazards that come with thunderstorms. It strikes the United States about 25 million times a year and remains one of the top weather killers. Around 20 or more deaths have resulted from lightning each year in the United States since 2010 (17 occurred in 2020) and hundreds more are severely injured. Lightning is also one of the least understood types of weather phenomena. With this in mind, here are some basics on what we do know regarding lightning.

Lincoln, Montana at Krohn Lake, June 24-25, 2014. Photo by Janet Sholder. Cabin deck was burned/ melted after being struck by lightning.

As a cumulonimbus (or thunderstorm cloud) grows and precipitation develops within the cloud, it usually contains a mixture of small ice crystals, small hail, rain, and melting hail. These precipitation particles become charged as they move and collide. The exact details of this charging process are still being studied, but there is general agreement on the basics among scientists. Lighter ice crystals are positively charged and get lifted upward by rising air into the highest part of the storm, which is called the anvil. Upward motions tend to cause these charges to spread out horizontally from the cloud base, miles away. Heavier hail is negatively charged and falls to the lower part of the storm, or is suspended by the rising air. The bottom part of the cloud also develops a small positive charge due to precipitation and warmer temperatures. On the ground below, opposite charges develop compared to the charges within the cloud above. The air initially is an insulator between these opposing charges, but when the difference becomes too large, the insulation breaks down and there is a rapid discharge of electricity which we call lightning. Lightning occurs between opposite charges within clouds (intra cloud) or between opposing charges on the ground and in the cloud (cloud-to-ground).

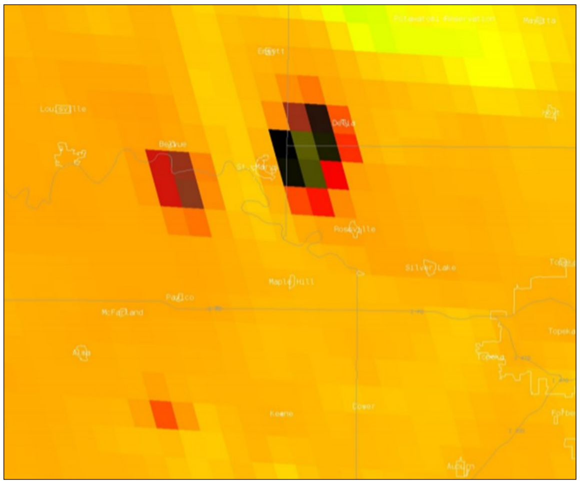
Photo Courtesy of Jesse Rudavski

Cloud-to-ground lightning is the type that poses a danger to humans. The flash begins as a "leader" which establishes the conductive channel the lightning will take as it strikes the ground. It usually moves down from the cloud, but can move upward from a very tall object on a rarer occasion. This "leader" eventually makes contact with the ground if it is moving down, or with the cloud if it is moving up. One or more "return strokes" follow this contact and tend to move upward through the channel - this is the bright flash we actually see. Thunder, then, is the result of lightning quickly heating the air and causing it to expand. That rapid expansion of the air creates the sound wave, which we perceive as thunder.

Article continues on page 10...

Delia Wildfire Event & Wildfire Safety Reminders (Continued…)

The image below shows the Delia fire as what is known as a "hot spot" on the infrared satellite imagery channel spreading toward Delia with two other smaller fires off to the southwest of the main fire of the day.



The Delia wildfire proved to be the beginning of a very active fire weather season across the area. By the time all was said and done, several fire districts were called into service including Manhattan Fire Department personnel, who provided service by refilling the Kansas Forest Service Air Tanker that made several water drops to help contain and put out the fire. The city of Delia had to be put under evacuation orders and multiple structures were threatened throughout the event as the fire rapidly spread into the afternoon with impacts lasting into the evening.

Article continues on page 8...

Winter 2020-2021 in Review (Continued…)

The extended cold caused significant impacts to the region. Lakes and rivers almost completely froze up. There were many reports of frozen and burst pipes across the area. The increased demand for heating was more than capacity, resulting in periods of rolling blackouts in areas.

The pattern that allowed this cold to persist abruptly shifted by late month, allowing temperatures to finally warm above freezing. In fact, by the afternoon of February 23 the temperature had warmed to 71°, a 92 degree warm-up within a week. This was good for the largest one week temperature swing on record for Topeka, breaking the 89 degree warm-up after the February 1899 cold spell. Still, February finished 10-11 degrees below average, countering the warm December and January temperatures.

Clinton Lake in Lawrence shortly after sunrise on February 16, near the time Topeka hit -21 degrees. Photo by Daniel Reese.

Delia Wildfire Event & Wildfire Safety Reminders (Continued…)

Additionally, it was amazing to see - and very welcome news - that most damage resulting from this wildfire was experienced by either raw land or minor structures. The post below on the Delia Rural Fire District #5 Facebook site is a testament to those units, crews, and individuals' dedication and selfless service. We appreciate all that they do on the front lines. They are true heroes!

> **Delia Rural Fire District #5**
> November 22, 2020 ·
>
> I can't find words big enough to express a huge "THANK YOU" to everyone in the community for jumping in and helping knock this extremely dangerous fire down. I'm still not sure of every thing everyone did, the list is endless. There is no way all of us Fire Departments would have been able to conquer this without all the help from this community and surrounding areas. To all the Fire Fighters, Sheriff, Dispatchers, EMS, Forestry Dept, Red Cross, Air Tanker, Emergency Managers, Fire Board members.....Thank you so much for all that we did. 3,000 acres in 2 different counties and not 1 life or 1 home lost. Thank you all for jumping in and working together like a bunch of pros. It was amazing to see how fast 6 different counties worth of Fire Departments can show, while other counties moved in to cover the stations that came to help us. Thank You again to everyone that jumped in!!!

As you have seen, there is much to consider from a weather forecasting standpoint leading up to an event such as the Delia wildfire, and the impacts - although mostly fortunate in this case - can be costly and far reaching. It would be remiss to not reiterate some basic fire safety tips that should be considered and adhered to as good general practice at all times, but especially during fire weather season. Remember, the Kansas Forest Service says that an average of 110,000 acres are burned in accidental or uncontrolled fires every year. Christopher Redmond, from Kansas State University, reminds us that many wildfires are caused by human actions which suggests that we have a lot of control over wildfires starting in the first place. Simply being aware of dangerous fire weather conditions and taking steps to reduce potential of sparking a fire can be done in simple, but often overlooked ways, including not throwing out cigarette butts, being cautious when welding, and other things that cause heat to build up on areas susceptible to fire start including driving over tall grasses. When engaging in more obvious fire start activities such as burning, remember to check on smoldering hot spots often and make sure embers are not being spread and previous fires have been extinguished completely. To further prepare a wildland fire action plan, we encourage you to visit the Kansas Forest Service for details and further information. A great start is their Ready, Set, Go Wildland Fire action guide at https://www.kansasforests.org/fire_management/fire_docs/ReadySetGoGuide.pdf.

Image courtesy of Delia Rural Fire District #5 showing some of the scorched land a few days after the wildfire.

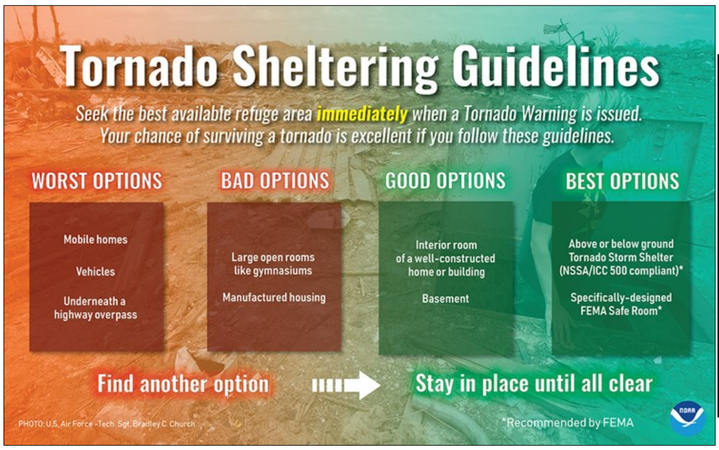
Severe Weather Safety (Continued…)

If you are caught outdoors, you should seek shelter in a basement, shelter, or sturdy building. If you cannot quickly walk to a shelter:

• Immediately get into a vehicle, buckle your seat belt, and try to drive to the closest sturdy shelter.
• If flying debris occurs while you are driving, pull over and park. Now you have the following options as a last resort:

◊ Stay in the car with the seat belt on. Put your head down below the windows, covering with your hands and a blanket if possible.
◊ If you can safely get noticeably lower than the level of the roadway, exit your car and lie in that area, covering your head with your hands.

• Your choice should be driven by your specific circumstances.



The important thing to understand is that if you find yourself outside or in a car with a tornado approaching and you are unable to get to a safe shelter, you are at risk from a number of things outside your control, such as the strength and path of the tornado and debris from your surroundings. This is the case whether you stay in your car or seek shelter in a depression or ditch, both of which are considered last resort options that provide little protection. The safest place to be is in an underground shelter, basement, or safe room.

Lightning Safety
The National Weather Service doesn't issue warnings for lightning, so you have to rely on your own sense of hearing to alert you to the presence of lightning around. If you hear thunder, go inside and wait until the thunder has ended and the storm has passed. If you are outdoors at a sports facility and cannot get into an enclosed structure, then go to your car (hard top vehicle), roll up your windows, and keep your hands inside. Wait until the storm has passed before restarting any outdoor activities. You can use a simple method to figure out approximately how close a lighting strike is, which is to count the number of seconds between the flash of lightning and the sound of thunder. Then divide by 5 or 7 to give you an approximate idea of how many miles away the lightning is. Just remember, when thunder roars, go indoors!

Lightning: The Science and Separating Fact from Fiction (Continued…)

Now that we've covered what scientists know about how lightning forms, let's debunk some common myths surrounding lightning.

Myth: Lightning doesn't strike the same place twice.

Fact: The same location often gets struck repeatedly, especially objects that are tall, pointy, and isolated. For example, the Empire State Building is struck 23 times a year on average.

Myth: If it isn't raining or there are no clouds overhead, you are safe from lightning.

Fact: Oftentimes lightning strikes over three miles from the thunderstorm center, far away from the rain or thunderstorm cloud. "Bolts from the blue" can be 10-15 miles from the actual storm. (Hint, this is underneath the anvil which spreads horizontally and produces positive charge tens of thousands of feet above the ground, as discussed earlier.)

Myth: Rubber tires on a car insulate the ground and therefore protect you from lightning.

Fact: A car is a safe place to be, but it's not because of the tires. Lightning goes through the metal frame and into the ground - this is what protects you. Therefore, if you seek shelter in a car, it needs to be an enclosed and hard-topped vehicle to provide protection (as long as you avoid leaning on doors).

Myth: Metal structures or metal on the body (jewelry, cell phones, etc.) attract lightning.

Fact: The main factors contributing to where lightning strikes are related to height, pointy shape, and isolation. Adding metal does not make a difference. Metal does conduct lightning, however, so objects like metal fences and bleachers should be avoided when seeking protection. In other words, if you need to seek shelter from lightning, there is no need to remove metal from your body first.

Photo Courtesy of Richard Melnick

Taken near Sandia Crest, NM overlooking Albuquerque, 2004

To learn more about lightning, several resources (including more myths and facts) can be found at the following link: https://www.weather.gov/safety/lightning.

Dual Polarization Radar (Continued…)

CC is also an important tool to use when trying to detect the presence of a tornado. Tornadoes often loft various types of debris, such as large tree branches, roofing material, and dust/dirt into the air. Those objects, when detected by radar, will have low CC values (generally less than 0.8 to 0.9) due to their non-uniform shapes. An area of low CC on radar can be characterized as what meteorologists call a Tornadic Debris Signature (TDS), if co-located in an area favorable for tornadogenesis and a reliable reflectivity signal. A TDS would confirm the presence of a tornado causing damage, although there have been times when a TDS has appeared only after a tornado has lifted!

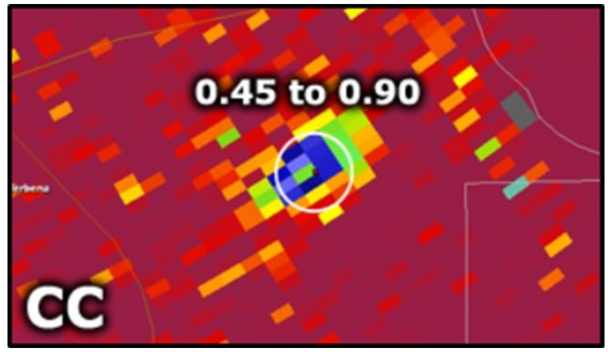


Image 3. TDS in CC Radar Data

Photo credit: NWS Jackson, MS

The examples provided here are just a few illustrations of how meteorologists use valuable dual pol data to aid in severe weather warning operations.

COOP Corner Spring 2021

By Shawn Byrne, Observing Program Leader

Hi all! Well, we survived a very frigid February for 2021! The 16th and 17th of February observed the coldest low temperatures since at least 1989 across the entire area. Numerous stations were hovering near the -20 Fahrenheit mark. Washington recorded low temperatures on the 16th and 17th of -29 Fahrenheit and -28 Fahrenheit, respectively. Concordia observed -23 Fahrenheit on the 16th. Let’s hope we don’t see temperatures that cold again for a while. January and February saw snowfall, with averages of 6-10 inches in January and around 4-6 inches in February. Largest snowfall occurred on January 25th for north central Kansas, where Belleville reported 12 inches.

Severe weather season is upon us, and most of our snow season is behind us, so now is the time to bring your rain gauge funnels and inner tubes and place them back outside. Keep an eye on the weather though as snow could certainly still arrive in April and early May. I was not able to visit many locations last spring and summer due to COVID restrictions. So, if you have leaking inner tubes or chipped funnels, please let me know and I can send you a replacement. I am hopeful we will be able to make the usual service runs this summer, so I look forward to seeing you all. However, we are still observing CDC COVID-19 recommendations currently.

I do look forward to seeing you all soon!

Staffing Notes

We have seen a few arrivals and departures in the NWS Topeka staff within the last year, and a couple more are to come this spring. Last year we welcomed Sara McClure as our Administrative Support Assistant. Early this year, Audra (Hennecke) Bruschi was promoted to Central Region Headquarters as an Emergency Response Specialist, and Ashley Griffin-Smith joined us as our new Information Technology Officer. At the end of May, we will bid farewell to meteorologist Kevin Skow who has been promoted to a Lead Meteorologist position in La Crosse, WI. We will also be welcoming Adam Jones as a new Lead Meteorologist, who will be coming to us from Bismarck, ND. We wish Audra and Kevin the best as they will be missed, but know they will continue to do great things. Congrats to all on their respective positions!

National Weather Service

Topeka, Kansas

1116 NE Strait Ave

Topeka, KS 66616

Local Forecast Phone: 785-234-2592

E-mail: nws.topeka@noaa.gov

Editor: Chelsea Picha, Meteorologist

WE WANT YOU TO LIKE & FOLLOW US ON SOCIAL MEDIA!

"Liking" and "Following" us helps in just some of the following key ways by:

- Getting the message out about hazardous weather events such as severe & winter weather
- Knowing about what you can do to be ready & stay safe during the storm
- "Sharing" and "Retweeting" messages will help build our audience allowing for more timely reach of information
- And best of all, you will stay more connected with the friendly and helpful staff here at the National Weather Service in Topeka!

www.facebook.com/NWSTopeka

www.twitter.com/NWSTopeka
@NWSTopeka

Severe Weather Spotting Card :

Weather to Report:

Hail (report any size)

Strong Wind Gusts (58+ MPH)

Any notable wind damage to trees, homes, businesses

Funnel Cloud/Rotating Wall Cloud or Tornado