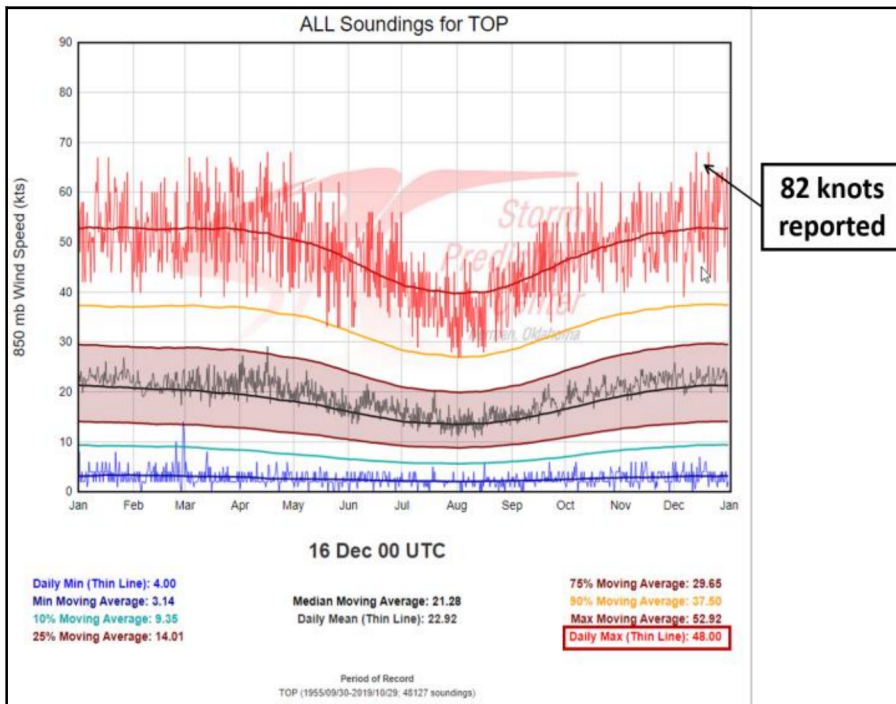


December 15th, 2021—A day for the record books

Section 1: Weather Overview

A powerful and strengthening low pressure system moved rapidly from the Colorado Rockies into the Plains and eventually over Lake Superior on December 15, 2021. This system was very unusual for the associated strength of the winds. The storm brought a devastating combination of multiple hazards across the state of Kansas including large devastating wildfires, severe thunderstorms, damaging wind gusts and blowing dust.

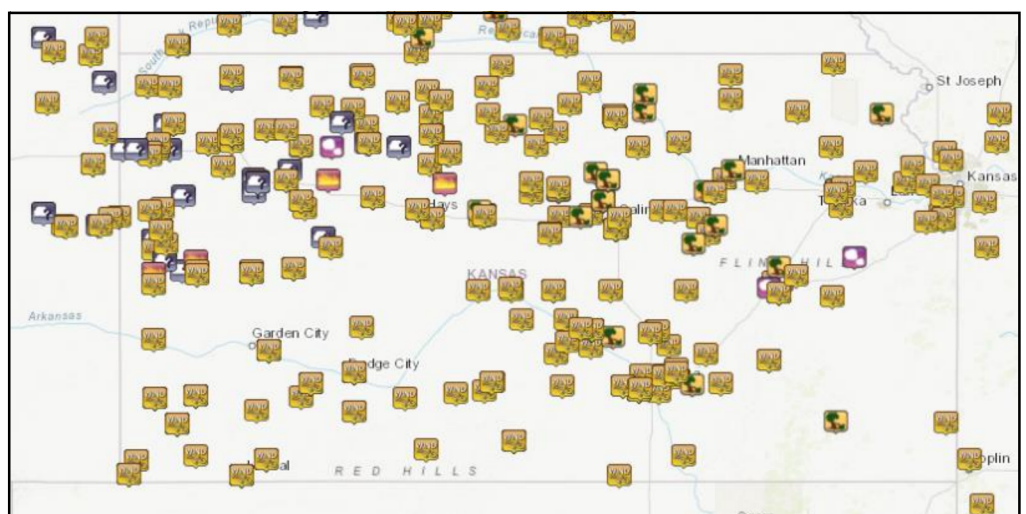


Non-Thunderstorm Wind Gusts:

Winds above the surface increased due to the strengthening of the low pressure system as it approached the state. In fact, the wind speeds captured by the NWS Topeka upper air sounding on December 15th showed over 90 mph winds at 4000 feet, which was stronger than anything recorded at that level on that date, going back to 1955 (Image 1). The warm and dry air beneath the cold air above resulted in strong mixing which brought those strong winds down to the surface. The end result was widespread non-thunderstorm wind gusts of 75-100 mph. These gusts resulted in damage to homes, infrastructure, schools, and buildings (Image 2).

Image 1 - Data plot of NWS Topeka upper air sounding climatology. The sounding measured wind speeds on December 15, 2021 of over 82 knots or 94 mph winds at 4000 feet which was stronger than anything recorded at that level going back to 1955.

Image 2 - Snapshot of multiple storm reports that occurred across the state of Kansas. See Section 2: Reports for more specific storm report details.



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Wildfires: Due to the combination of intense non-thunderstorm winds of 75-100 mph, very dry air, unusually high temperatures and low humidity, extremely critical fire weather conditions developed across parts of western and central Kansas during the day. From the Storm Prediction Center, this was the first Extreme Critical fire risk area for the month of December since records began in 1999 across the Central Plains (Image 3). Once fires started they exhibited extreme behavior including rapid spread at more than 50 mph. This led to extreme fire weather growth and spread over the course of 6-8 hours during the late afternoon and evening. Per the Kansas Forest Service, the total acreage burned across Kansas on December 15th was 163,755.9 acres with 121,621.6 acres burned in the Four County Fire (Image 4). Three Fire Warnings were issued for fires which threatened some structures in Kansas. Unfortunately, these fires did result in two fatalities.

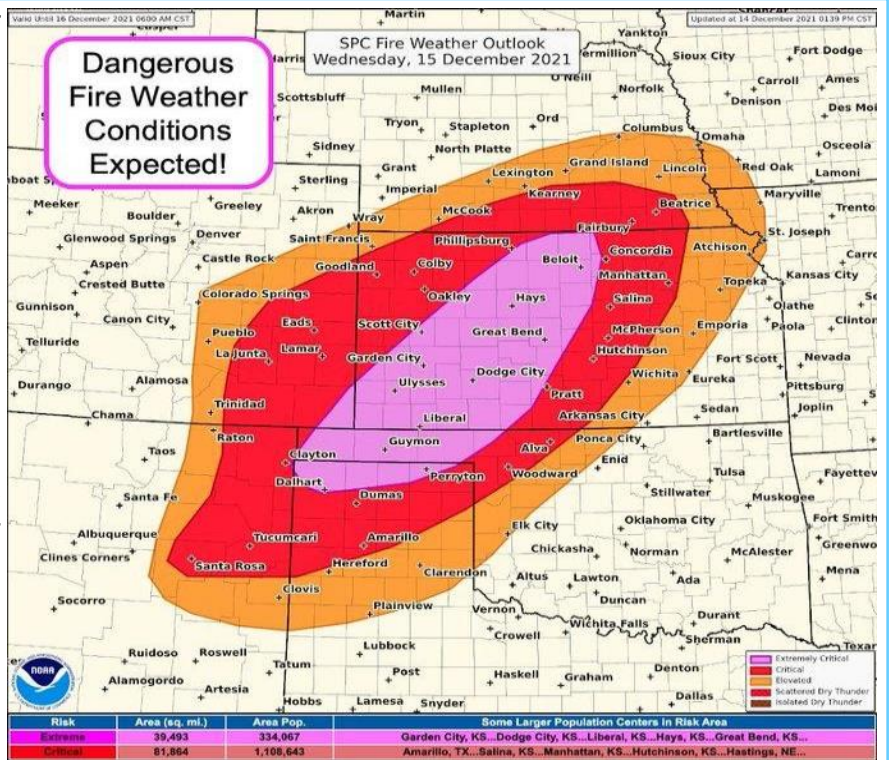


Image 3 - From the Storm Prediction Center, this was the first Extremely Critical fire risk area for the month of December since records began in 1999 across the Central Plains.

December 15th, 2021 Wildfire Perimeters Update

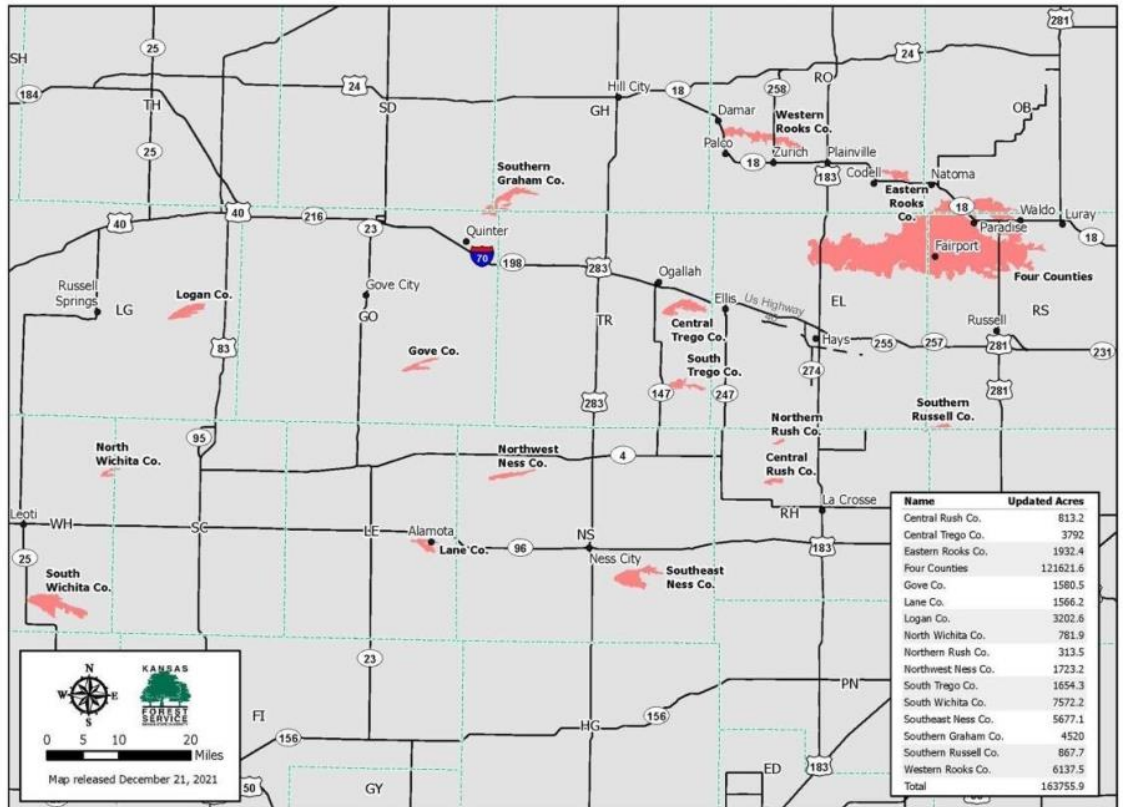


Image 4 - From the Kansas Forest Service, the total acreage burned across Kansas was 163,755.9 acres with 121,621.6 acres burned in the Four County Fire.

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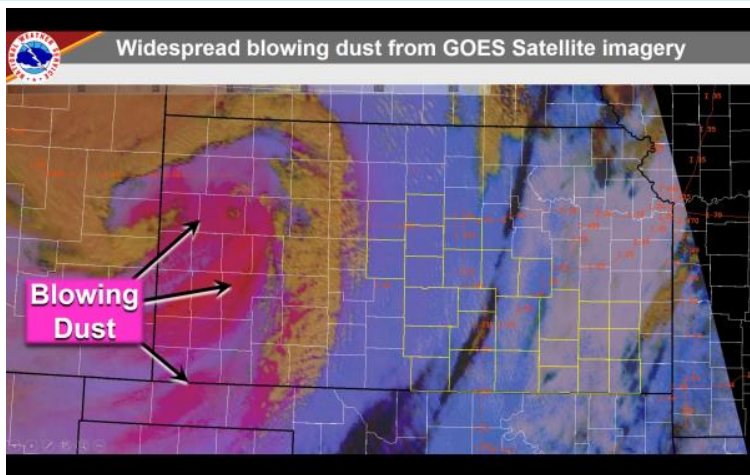


Image 5 - Satellite detected widespread blowing dust across western Kansas at 1 PM on Dec 15, 2021.

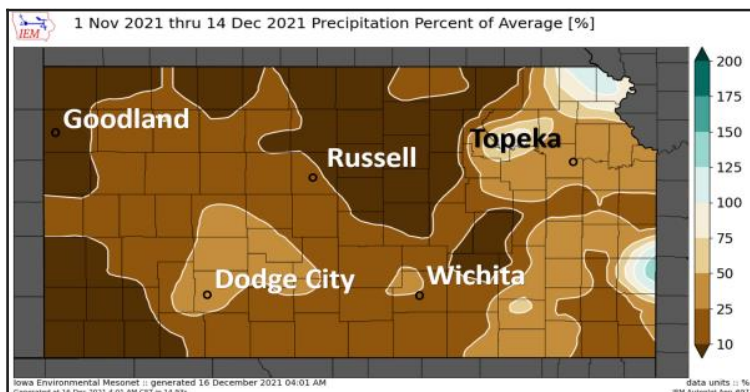


Image 6 - Precipitation Percent of Normal (Nov 1 - Dec. 14, 2021). Abnormally dry weather preceded this event allowing widespread blowing dust to develop.

Blowing Dust: Once the non-thunderstorm winds of 75+ mph developed, widespread blowing dust was observed thanks to the very dry conditions over the previous month and a half (Image 5). In fact, most of the state had received well below 50% of normal precipitation with moderate drought conditions expanding into portions of the western half of the state (Image 6). At least one fatality was associated with a car accident in reduced visibility due to blowing dust in western Kansas.

Severe Weather: As the surface low pressure system quickly strengthened, a line of severe thunderstorms developed and rapidly moved across the eastern half of the state bringing strong, damaging winds and large hail. Overall there were 123 severe convective reports (hail and thunderstorm wind) from this event which exceeds the previous December record of 20 back in 2016; records began in 1950 (Images 7 and 8). These storms resulted in damage to homes and infrastructure. The Storm Prediction Center has classified this event as a derecho. For more information on derechos, visit: <https://www.spc.noaa.gov/misc/AbtDerechos/derechofacts.htm>

Section 2: Reports

There were well over 300 reports documented for this event which includes severe weather, non-thunderstorm wind gusts, dust storms and wildfire. We included a small sampling of the various hazards in this report. For a comprehensive list of the damage reports including non-thunderstorm wind gusts, thunderstorm related winds, and wildfire reports in Kansas for December 15, 2021, please see:

Western Kansas:
<https://go.usa.gov/xtUTe>

Eastern Kansas:
<https://go.usa.gov/xtUTS>

KS December Severe Reports Since 1950 (Tornado, Thunderstorm Wind, Hail)	
2021	123 (Preliminary)
2016	20
1975	14
2008	14
1999	10
2002	9
1956	4
1982	4
1988	4
1972	2
2011	2
2014	2
1959	1
2003	1
2010	1
2019	1

Courtesy: NCDC Severe Events Database

Image 7 - Kansas December severe convective reports (tornado, hail, thunderstorm wind) since 1950. Preliminary Kansas December 2021 severe reports are at 123 which is the most on record.

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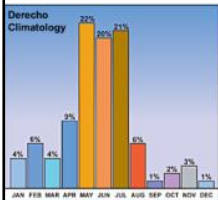


Most Preliminary Significant (75+ mph) Wind Gusts in a Day since 2004*



Top 8 Days by Number of Preliminary Significant (75+ mph) Wind Gusts		
Date	# of 75+ mph wind gusts	Event
12/15/2021	64	Central Plains to Upper Mississippi Valley Derecho
8/10/2020	53	Midwest (Iowa) Derecho
6/6/2020	47	Rockies to Northern Plains Derecho
6/29/2012	37	Midwest to Mid-Atlantic Derecho
6/14/2014	31	Central Plains to Midwest Severe
6/16/17	24	Central Plains Severe
6/30/14	23	Midwest Derecho
6/10/21	23	Northern Plains Severe

*Data from 2004 to present. 2021 data is preliminary and subject to change before final storm data publication.



1% (or less) of all derechos occur in the month of December

Derecho Climatology Illustration by Dennis Cain. Located at SPC Derecho FAQ page.

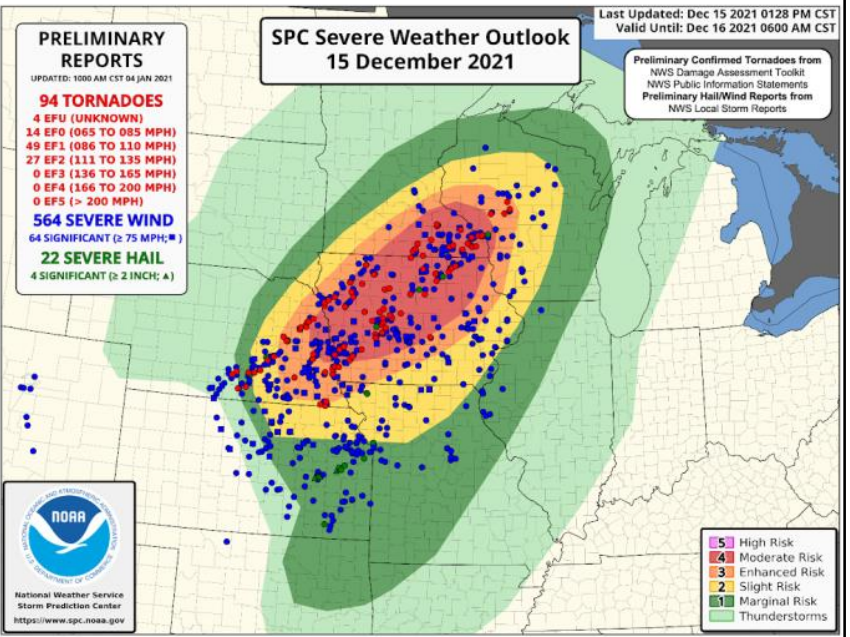


Image 8 - Information graphic from the Storm Prediction Center. This entire event had more 75+ mph wind reports than any event on record.

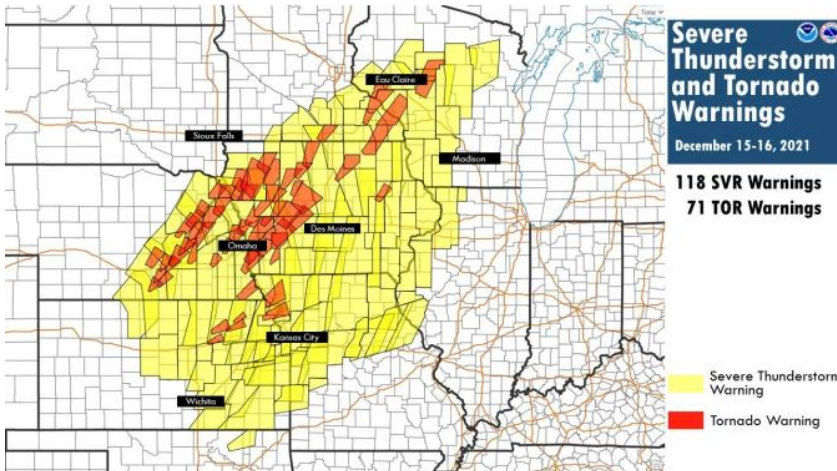


Image 9 - Map showing all severe thunderstorm and tornado warnings issued during the entire event across the Central Plains and Upper Midwest.

Top 10 Thunderstorm Wind Gusts

County	Location	Event Type	Mag. (MPH)	Remark
Clay	2 E Clay Center	TSTM WND GST	85	
Republic	2 NE Courtland	TSTM WND GST	84	Large ash tree down. Bent metal basketball pole in half.
Jefferson	3 NW Perry	TSTM WND GST	80	
Phillips	Woodruff	TSTM WND GST	80	
Rooks	8 NNE Codell	TSTM WND GST	80	
Cloud	Concordia	TSTM WND GST	78	
Riley	2 NE Ogden	TSTM WND GST	76	
Lincoln	Lincoln	TSTM WND GST	75	
Wabaunsee	6 SSE Saint George	TSTM WND GST	75	
Allen	Moran	TSTM WND GST	70	A large tree was knocked down as well as two power poles. Moran was still without power in spots this morning.

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Top 10 Non-Thunderstorm Wind Gusts

County	Location	Event Type	Mag. (MPH)	Remark
Russell	Russell Airport	NON-TSTM WND GST	100	
Saline	2 NNE Salina	NON-TSTM WND GST	98	
Smith	13 NNW Smith Center	NON-TSTM WND GST	97	
Rooks	8 NNE Codell	NON-TSTM WND GST	95	
Geary	1 ENE Grandview Plaza	NON-TSTM WND GST	94	
Cloud	Concordia	NON-TSTM WND GST	90	
Norton	1 ENE Lenora	NON-TSTM WND GST	90	
Finney	3 NW Pierceville	NON-TSTM WND GST	89	
Riley	3 NE Ogden	NON-TSTM WND GST	89	
Wallace	2 WNW Sharon Springs	NON-TSTM WND GST	87	

Various Other Notable Reports

County	Location	Event Type	Mag. (in)	Remark
Logan	Oakley	DUST STORM		Numerous wrecks due to low visibility and strong winds during a dust storm.
Sherman	3 W Edson	DUST STORM		A Semi-truck blew over due to strong winds.
Thomas	Rexford	DUST STORM		*** 1 inj *** Brown out conditions created zero visibility. An accident occurred at mile marker 181 when a semi truck rear ended another semi.
Lyon	6 WSW Emporia	HAIL	4	Softball-sized hail reported at mile marker 137 off I-35.
Osage	3 NNW Melvern	HAIL	2	
Ellsworth	9 WSW Westfall	NON-TSTM WND DMG		A semi-trailer overturned on I-70 at mile marker 229, blocking part of the interstate.
Gove	Gove	NON-TSTM WND DMG		Multiple <u>outbuildings</u> destroyed across the county.
Johnson	2 SSE Lake Quivira	NON-TSTM WND DMG		*** 1 inj *** A tree fell on an individual from high wind gusts ahead of storms.
Russell	Russell	NON-TSTM WND DMG		West facing windows blown out in lots of homes. Numerous trees were knocked down in town.
Saline	2 SW Assaria	NON-TSTM WND DMG		*** 1 inj *** Overturned semi on interstate 135 just south of HWY 4 in Saline county. One man was injured.
Jefferson	Oskaloosa	TSTM WND DMG		Multiple power poles reported down. A large barn blown down at Topeka and Union St.
Leavenworth	3 NNW Jarbalo	TSTM WND DMG		Several outbuildings with roofs blown off.
Morris	1 W White City	TSTM WND DMG		Roofs peeling off buildings as well as the side of a metal building got blown out.
Osborne	13 SW Tipton	TSTM WND DMG		Large tree was blown over. Roof damage to outbuildings.
Ottawa	Minneapolis	TSTM WND DMG		Power lines and transformers down.
Graham	Saint Peter	WILDFIRE		Wildfire caused damage to several outbuildings.
Osborne	3 S Natoma	WILDFIRE		Wildfire first visible on satellite around 330pm has continued to burn to near natoma as of 715pm.
Wichita	Lydia	WILDFIRE		Wildfire north of the town of Lydia burned two homes.

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Summary

Kansas experienced a historically destructive weather event on December 15th, 2021 which caused over 15 million dollars in damages. The high winds and low humidity led to large devastating wildfires that spread with incredible speed, eventually consumed 163,755.9 acres and killed two people. High winds resulted in blowing dust which led to injuries and one fatality due to vehicle accidents in low visibility. Lastly this storm system also triggered a line of severe thunderstorms that produced widespread 60-100 mph wind gusts as the storms passed across central and eastern Kansas. In the end, the resulting strong winds (both thunderstorm and non-thunderstorm) caused a record number of weather stations to measure 75 mph wind gusts or greater across the state.

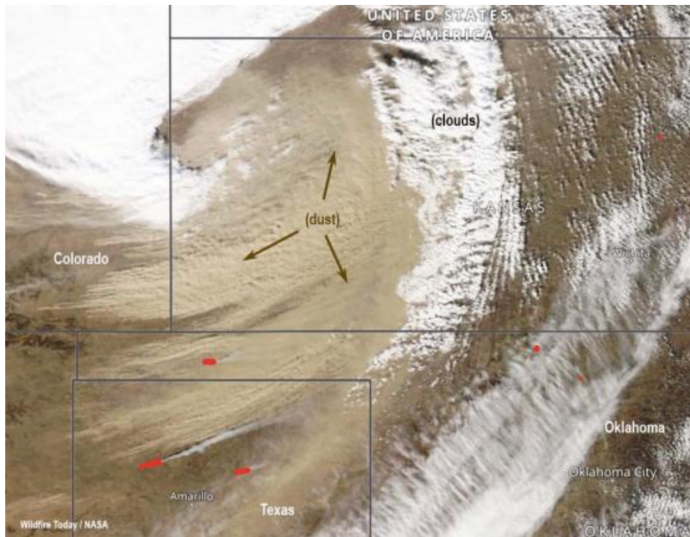


Image 10 - Satellite photo, fires in Oklahoma, and Texas, Dec. 15, 2021. The red areas indicate fires. Photo courtesy of Wildfire Today.

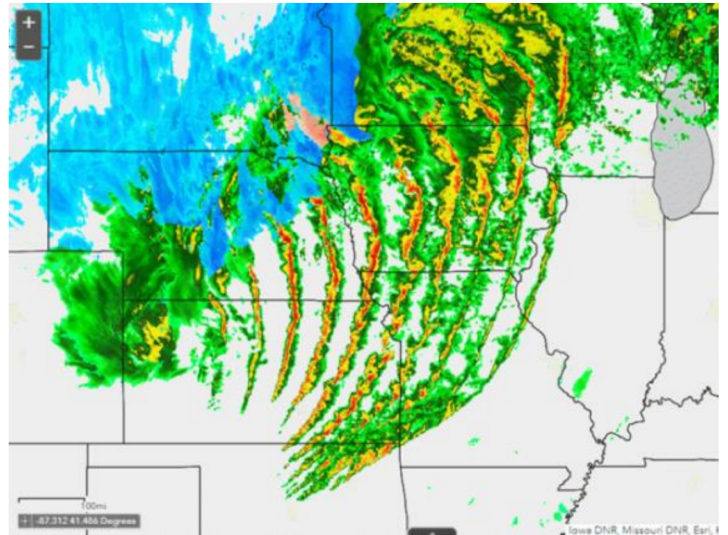


Image 11 - Progression of the line of severe storms, as shown on radar. Image courtesy of DTN.

Do you have a NOAA Weather Radio?

What is it?

NOAA Weather Radio (NWR) broadcasts National Weather Service warnings, watches, forecasts and other hazard information 24 hours a day.

How does it notify you?

Weather radios equipped with a special alarm tone feature can sound an alert and give you immediate information about a life-threatening situation. During an emergency, NWS forecasters will send out a special tone to activate weather radios in the listening area.



Where do you get a NWR?

You can buy receivers at many retail outlets such as electronics, department, sporting goods, and boat and marine accessory stores and their catalogs as well as online at: <http://www.nws.noaa.gov/nwr/info/nwrrcvr.html#residential>

How much does it cost?

Prices start at \$20 & up depending on the model.

Options for those with special needs?

The hearing- and visually impaired can get these warnings by connecting weather radios with alarm tones or other such as strobe lights, pagers, bed-shakers, personal computers and text printers.

Public safety experts agree: a NOAA Weather Radio should be standard equipment in every home.

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