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Tennessee Climate Office Monthly Report

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### 2021 - Tennessee Annual Climate Summary

Tennessee Climate Office, East Tennessee State University

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# 2021 Tennessee State Climate Summary

Tennessee Climate Office \* East Tennessee State University

Prepared by William Tollefson and Dr. Andrew Joyner

With contributions by [Climate Data Representatives](#)

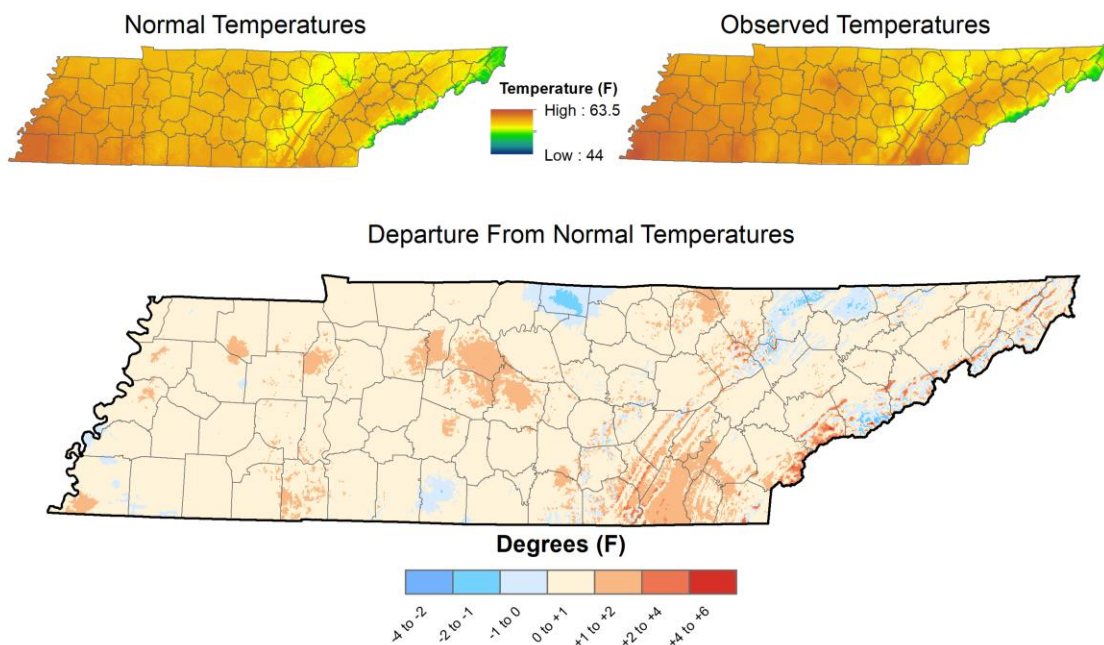
## Annual Temperature Summary:

In 2021, most areas of the state were within 1°F of the 1991-2020 30-year climate normals with the majority of the state being slightly warmer than normal for the year; however, there were many large temperature swings during the year. Looking past the 30-year climate normals, the mean temperature for 2021 was among the top-10 warmest on record for three of the six climate reporting weather stations across the state: 6<sup>th</sup> warmest for Tri-Cities (74-year weather record), 8<sup>th</sup> warmest for Nashville (147-year weather record), and tied for the 8<sup>th</sup> warmest in Chattanooga (143-year weather record).

January brought warmer than normal temperatures, but a cold outbreak in February sent temperatures plummeting to well below normal for most of the state. East Tennessee was slightly cooler than normal in February, but the western-most counties in the state averaged 8-10°F below normal! March then brought much warmer than normal temperatures (4-6°F above normal) for most of the state. April and May were cooler than normal (1-4°F below normal), then June and July brought temperatures that were close to normal ( $\pm 1^\circ\text{F}$  of normal) across the state, with August trending a bit warmer than normal, before returning to close to normal temperatures in September. October brought much warmer than normal temperatures (4-6°F above normal) across the state, November was cooler than normal across the state (2-4°F below normal), but December was much warmer than normal, with the western half of the state recording a mean temperature 10-12°F above normal!



## 2021 Mean Temperature



Stations with the highest mean temperature

Station Name	Station Type	Mean Temperature (F)
MEMPHIS INTERNATIONAL AP	WBAN	64
CHATTANOOGA AP	WBAN	63
SHILOH NMP TENNESSEE	RAWS	62.8
SAVANNAH 6 SW	COOP	62.4
BROWNSVILLE	COOP	62.3

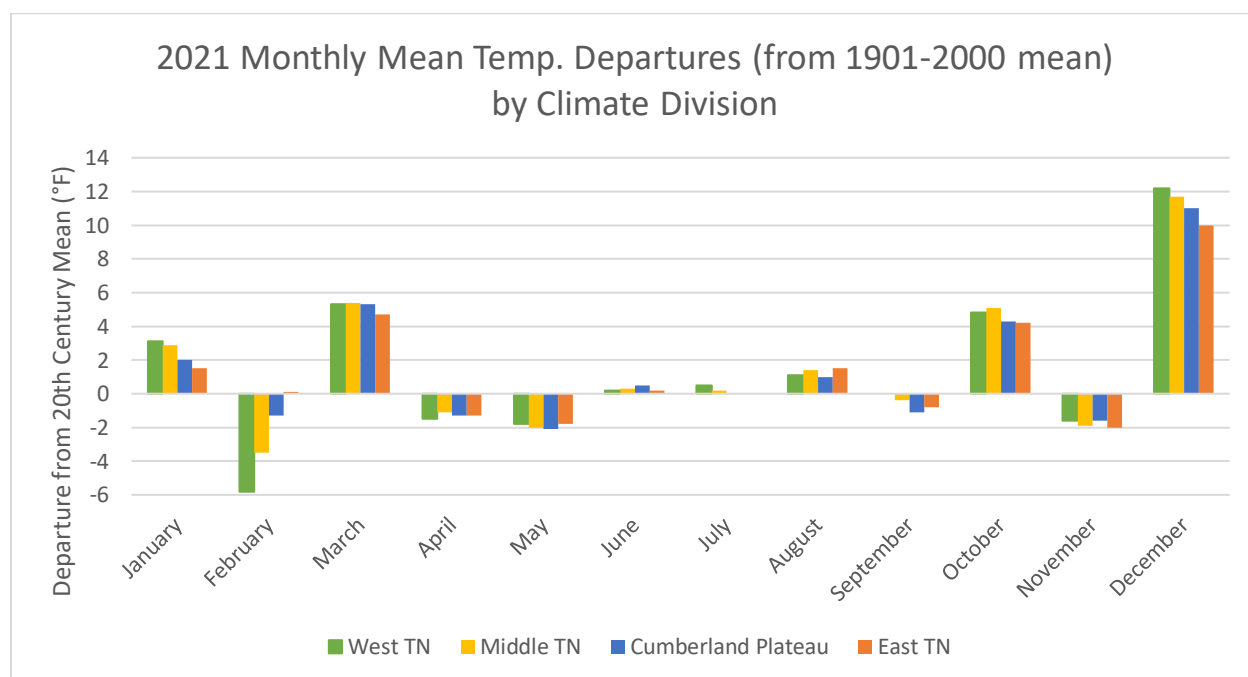
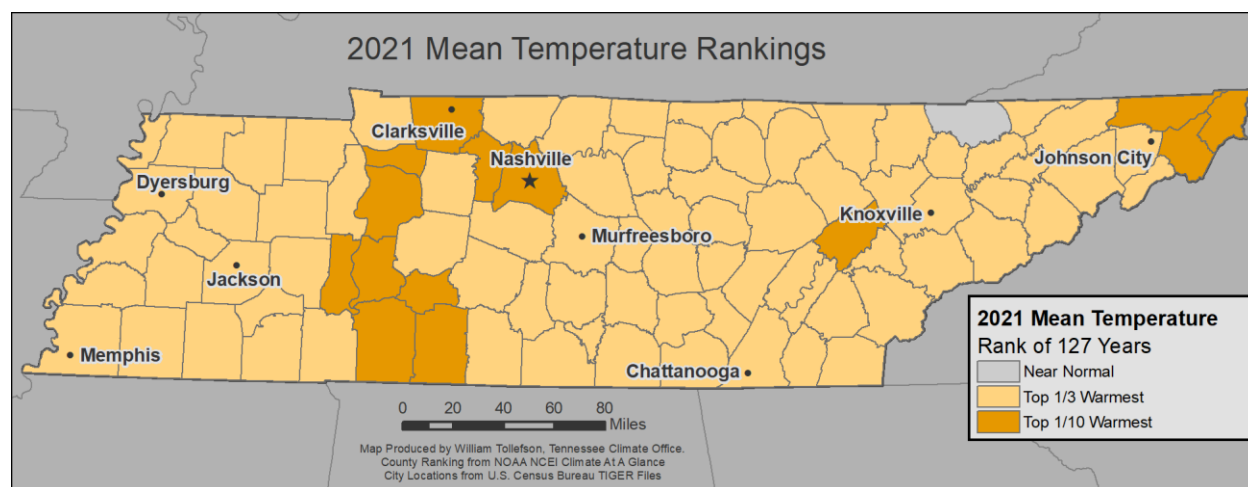
Map Data From: PRISM Climate Group,  
Oregon State University.  
1991-2020 Normals Used  
Station Data retrieved from SC ACIS2

Stations with the lowest mean temperature

Station Name	Station Type	Mean Temperature (F)
MT LECONTE	COOP	43.2
NEWFOUND GAP	COOP	49.9
ROAN MOUNTAIN 3SW	COOP	52.3
MOUNTAIN CITY 2	COOP	54.4
TAZEWELL	COOP	54.9

Pulling from the NOAA Applied Climate Information System (ACIS), the temperature extremes for the year ranged from -5°F at Germantown (Shelby County) on February 16 to 103°F at Woodbury (Cannon County) on August 12.

The NOAA Climate at a Glance tool shows that every county in Tennessee, except Claiborne County had a mean temperature for the year that ranked among the top 1/3<sup>rd</sup> warmest years, with data going back to 1895. Some counties in the northeast corner of the state and western portions of Middle Tennessee recorded an annual mean temperature that was among the top 1/10<sup>th</sup> warmest of the past 127 years. Wayne County had the largest anomaly, recording a mean temperature for the year 2.2°F above the 1901-2000 average temperature. Claiborne county was the closest to average, with 2021 being just 0.4°F above the 1901-2000 average.

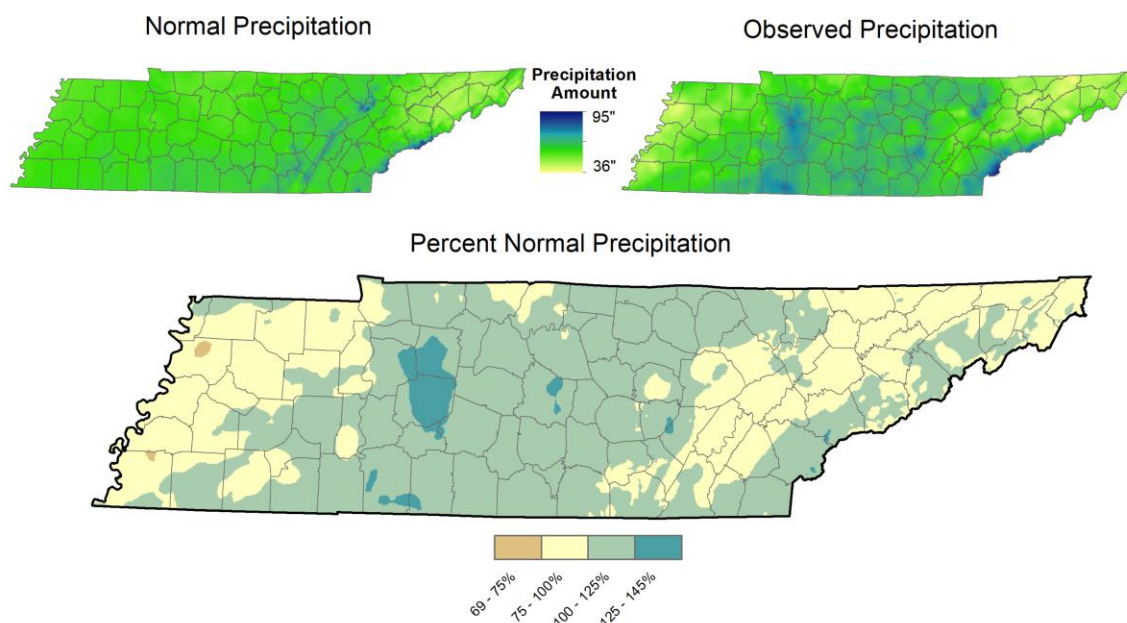


## Annual Precipitation Summary:

2021 precipitation totals across the state varied with most areas  $\pm 25\%$  of the 1991-2020 30-year climate normals. Most of West Tennessee and East Tennessee (except along the mountains and foothills) recorded below normal precipitation for the year, but most of Middle Tennessee and the northern Cumberland Plateau recorded above normal rainfall, with areas in western Middle Tennessee impacted by the August extreme rainfall event recording 125-150% of their normal rainfall for the year. The extremes in recorded total precipitation ranged from a low of 37.75-inches reported at a CoCoRaHS (Community Collaborative Rain Snow and Hail network) rain gauge near Kingsport, TN to a high of 89.17-inches reported at the COOP weather station at Mount LeConte (in the Great Smoky Mountains).



## 2021 Precipitation



Stations with the most precipitation

Station Name	Station Type	Total Precipitation (in)
MT LECONTE	COOP	89.17
BENTON 2.3 ESE	CoCoRaHS	85.26
DICKSON 6.3 WSW	CoCoRaHS	84.91
FRANKewing 4.0 ENE	CoCoRaHS	78.8
NEWFOUND GAP	COOP	78.28

Map Data From: PRISM Climate Group,  
Oregon State University.  
1991-2020 Normals Used  
Station Data retrieved from SC ACIS2

Stations with the least precipitation

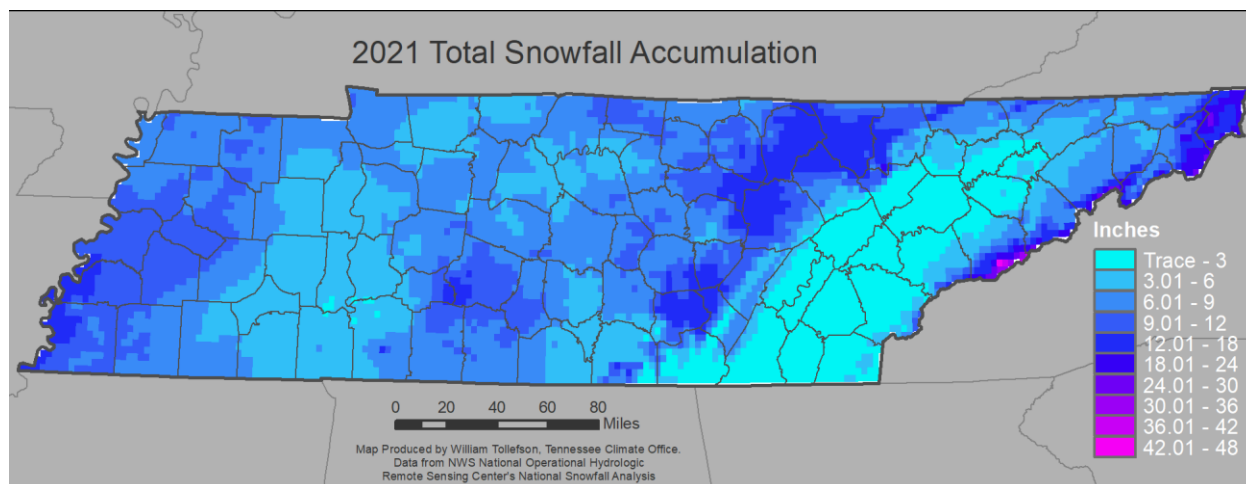
Station Name	Station Type	Total Precipitation (in)
KINGSPORT 4.3 ENE	CoCoRaHS	37.75
SEYMOUR 5.8 N	CoCoRaHS	38.54
BRISTOL AP	WBAN	39.78
BULLS GAP 0.9 SSW	CoCoRaHS	40.64
BAILEYTON 1.0 NW	CoCoRaHS	40.76

January started the year with a drier than normal pattern, but February brought close to or above normal rainfall to most of the state. March brought much above normal rainfall, with some areas recording over 300% their normal March rainfall totals, this rain cleared all areas of drought and abnormally dry conditions from the state in the US Drought Monitor. April was drier than normal for most of the state, except for the northwest corner of the state, and many areas in East Tennessee recorded less than 50% of their normal April precipitation totals. May, June, and July saw a mixed pattern with some areas receiving above normal while others received below normal rainfall.

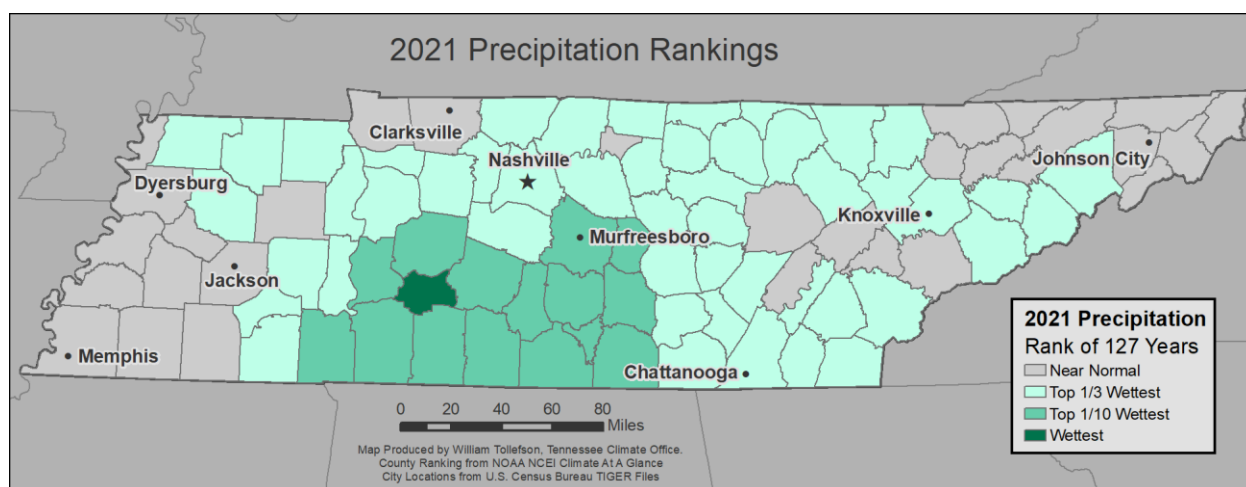
August brought above normal rainfall to most of the state including an area in western Middle Tennessee where some locations recorded over 600% of their normal August Rainfall. Most of that rain fell in just one day, and a new state record was set for most rainfall in a 24-hour period with 20.73-inches of rainfall measured at the McEwen Wastewater Treatment Plant on August 21, 2021. This extreme rainfall produced deadly flash flooding that impacted areas of Hickman, Dickson, and Humphreys counties, most notably the town of Waverly in Humphreys County. However, August was much drier than normal in the southwest corner of the state with parts of Shelby County recording only 20% of their normal August rainfall totals.

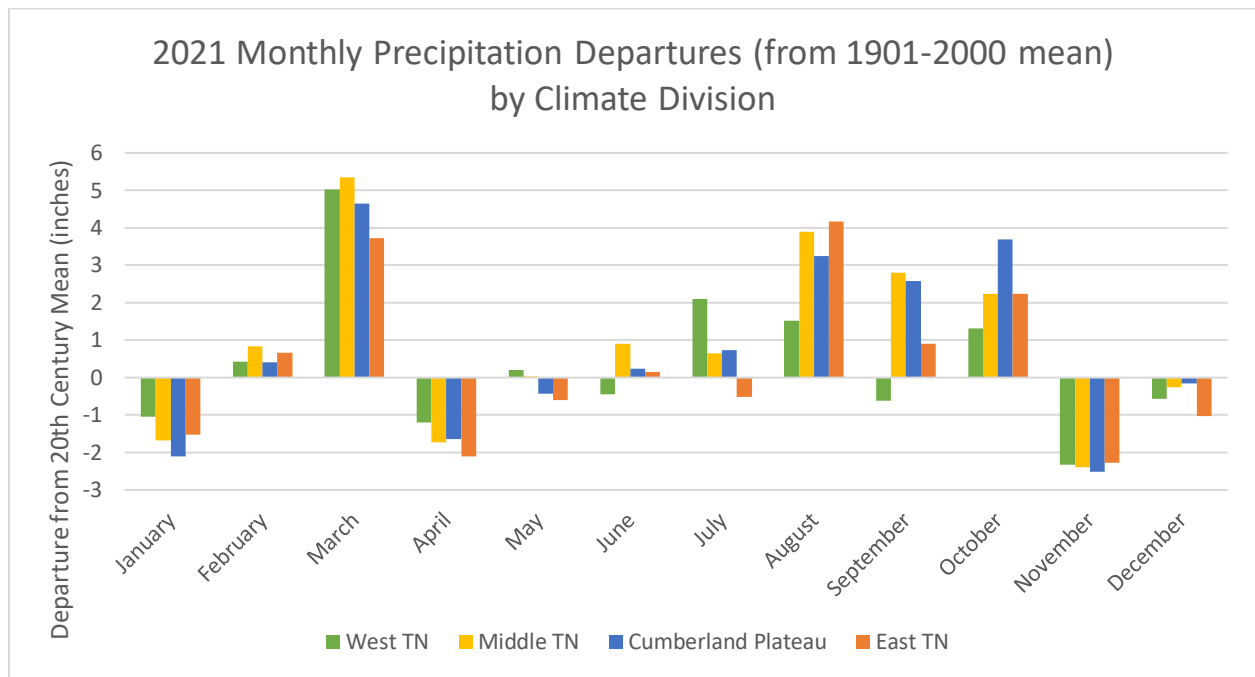
September and October continued this pattern with above normal precipitation in most of East and Middle Tennessee, but below normal precipitation in West Tennessee. November had well below normal precipitation across the state, with most areas recording less than 50% their normal rainfall totals for the month, and the southern valley in East Tennessee only recording 20% of their normal rainfall. December was also drier than normal for most of the state, but closer to normal, with a band of above normal precipitation in central portions of Middle Tennessee.

The western end of the state generally experienced above normal snowfall in 2021 due to the heavy snow associated with two winter storms that were a part of the February cold outbreak, which impacted much of the central US with an eastern extent reaching through Middle Tennessee. Areas in East Tennessee remained mostly on the warm side of the jet stream during that event and overall recorded below normal snowfall for the year.



The NOAA Climate at a Glance tool shows that Lewis County recorded its wettest year in 2021, with data going back to 1895, with an average of 71.78-inches of rain across the county, a surplus of 18.58-inches above the 1901-2000 average annual precipitation. Surrounding counties throughout southern Middle Tennessee recorded one of their top 1/10<sup>th</sup> wettest years, and most of Middle Tennessee along with the Cumberland Plateau and a few counties in West and Middle Tennessee also recorded one of the top 1/3<sup>rd</sup> wettest years.





### Station Data and Top Tenn. (warmest/wettest, coldest/driest stations of the year):

Station data for select airports across the state using WBAN weather stations:

Station Name	Temperatures (°F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	%Norm
<b>Memphis</b>	73.1	54.9	64.0	<b>0.6</b>	96	8/26	1	2/16	53.29	<b>-1.65</b>	<b>97%</b>
<b>Jackson</b>	71.3	49.7	60.5	<b>0.5</b>	95	7/31	0	2/16	52.23	<b>-1.70</b>	<b>97%</b>
<b>Clarksville</b>	69.8	49.1	59.4	<b>1.0</b>	95	8/26	5	2/16	51.35	<b>4.14</b>	<b>109%</b>
<b>Nashville</b>	72.2	51.7	62.0	<b>1.2</b>	98	8/25	11	2/16	59.32	<b>8.81</b>	<b>117%</b>
<b>Chattanooga</b>	73.2	52.8	63.0	<b>1.1</b>	97	8/25	21	2/17	62.82	<b>7.82</b>	<b>114%</b>
<b>Crossville</b>	65.9	46.7	56.3	<b>1.0</b>	90	8/25	11	2/17	56.21	<b>-1.14</b>	<b>98%</b>
<b>Knoxville</b>	70.6	50.3	60.4	<b>0.9</b>	97	7/28	20	2/17	46.54	<b>-5.39</b>	<b>90%</b>
<b>Bristol</b>	70.0	46.3	58.2	<b>1.6</b>	94	8/25	18	1/29	39.78	<b>-4.19</b>	<b>90%</b>

Departures and %Norm Key: **Warmer than Normal**, **Cooler than Normal**; **Wetter than Normal**, **Drier than Normal**

### Hottest Stations (highest maximum temperature)

Station Name	Station Type	Highest Temperature (F)	Date
WOODBURY 1 WNW	COOP	103	08-12
CHEATHAM LOCK & DAM	COOP	100	08-25
SEVIERVILLE	COOP	98	07-30
KNOXVILLE EXP STA	COOP	98	07-29
NASHVILLE BERRY FIELD	COOP	98	08-26
OLD HICKORY DAM	COOP	98	08-26
CAMDEN TOWER TENNESSEE	RAWS	98	08-26
NASHVILLE INTL AP	WBAN	98	08-25
AMES PLANTATION	COOP	97	08-01
SAVANNAH 6 SW	COOP	97	08-01
FRANKLIN SEWAGE PLANT	COOP	97	07-29
CLARKSVILLE WWTP	COOP	97	08-26
WARNER PARK	COOP	97	07-24
GERMANTOWN 4SE	COOP	97	08-01
GLADEVILLE	COOP	97	08-11
SHILOH NMP TENNESSEE	RAWS	97	07-31
CHATTANOOGA AP	WBAN	97	08-25
MEMPHIS WFO	WBAN	97	08-13
KNOXVILLE AP	WBAN	97	07-28

*Eleven stations tied for the ninth highest maximum temperature (97°F).*

**Coldest Stations (lowest minimum temperature)**

Station Name	Station Type	Lowest Temperature (F)	Date
GERMANTOWN 4SE	COOP	-5	02-16
BROWNSVILLE	COOP	-1	02-16
MILAN EXP STN	COOP	-1	02-19
UNION CITY	COOP	-1	02-17
CLARKSVILLE WWTP	COOP	0	02-16
JACKSON MCKELLAR- SIPES AP	WBAN	0	02-16
AMES PLANTATION	COOP	1	02-16
DRESDEN	COOP	1	02-17
UT MARTIN EXP STATION	COOP	1	02-16
JACKSON 4 NE	COOP	1	02-17
MEMPHIS INTERNATIONAL AP	WBAN	1	02-16
DYERSBURG MUNICIPAL AIRPORT	WBAN	1	02-16
MEMPHIS WFO	WBAN	1	02-17

*Seven stations tied for the seventh coldest temperature (6°F).*

**Warmest Stations (highest mean temperatures)**

Station Name	Station Type	Mean Temperature (F)
MEMPHIS INTERNATIONAL AP	WBAN	64
CHATTANOOGA AP	WBAN	63
SHILOH NMP TENNESSEE	RAWS	62.8
SAVANNAH 6 SW	COOP	62.4
BROWNSVILLE	COOP	62.3
MEMPHIS WFO	WBAN	62
NASHVILLE INTL AP	WBAN	62
GERMANTOWN 4SE	COOP	61.8
CAMDEN TOWER TENNESSEE	RAWS	61.6
NASHVILLE BERRY FIELD	COOP	61.4
OAK RIDGE ATDD	WBAN	61.4

*Two stations tied for the tenth warmest temperature (61.4°F).*

**Coollest Stations (lowest mean temperatures)**

Station Name	Station Type	Mean Temperature (F)
MT LECONTE	COOP	43.2
NEWFOUND GAP	COOP	49.9
ROAN MOUNTAIN 3SW	COOP	52.3
MOUNTAIN CITY 2	COOP	54.4
TAZEWELL	COOP	54.9
CHEROKEE TENNESSEE	RAWS	55.1
CROSSVILLE EXP STN	COOP	55.2
ONEIDA	COOP	55.2
CROSSVILLE 7 NW	WBAN	55.2
COALMONT	COOP	55.8

**Wettest Stations (highest precipitation totals):**

Station Name	Station Type	Total Precipitation (in)
MT LECONTE	COOP	89.17
BENTON 2.3 ESE	CoCoRaHS	85.26
DICKSON 6.3 WSW	CoCoRaHS	84.91
FRANKEWING 4.0 ENE	CoCoRaHS	78.8
NEWFOUND GAP	COOP	78.28
CENTERVILLE 4NE	COOP	77.14
DICKSON	COOP	76.82
HERMITAGE 3.2 SSW	CoCoRaHS	76.68
PIKEVILLE 8.2 WSW	CoCoRaHS	76.55
PETROS 0.2E	CoCoRaHS	76.28

**Driest Stations (lowest precipitation totals):**

Station Name	Station Type	Total Precipitation (in)
KINGSPORT 4.3 ENE	CoCoRaHS	37.75
SEYMOUR 5.8 N	CoCoRaHS	38.54
BRISTOL AP	WBAN	39.78
BULLS GAP 0.9 SSW	CoCoRaHS	40.64
BAILEYTON 1.0 NW	CoCoRaHS	40.76
OAK GROVE 3.0 E	CoCoRaHS	41.32
FALL BRANCH 1.2 ENE	CoCoRaHS	42.72
ALAMO 1 N	COOP	43.18
SODDY DAISY-MOWBRAY MTN	COOP	43.3
WHITE PINE 2.0 NE	CoCoRaHS	43.64

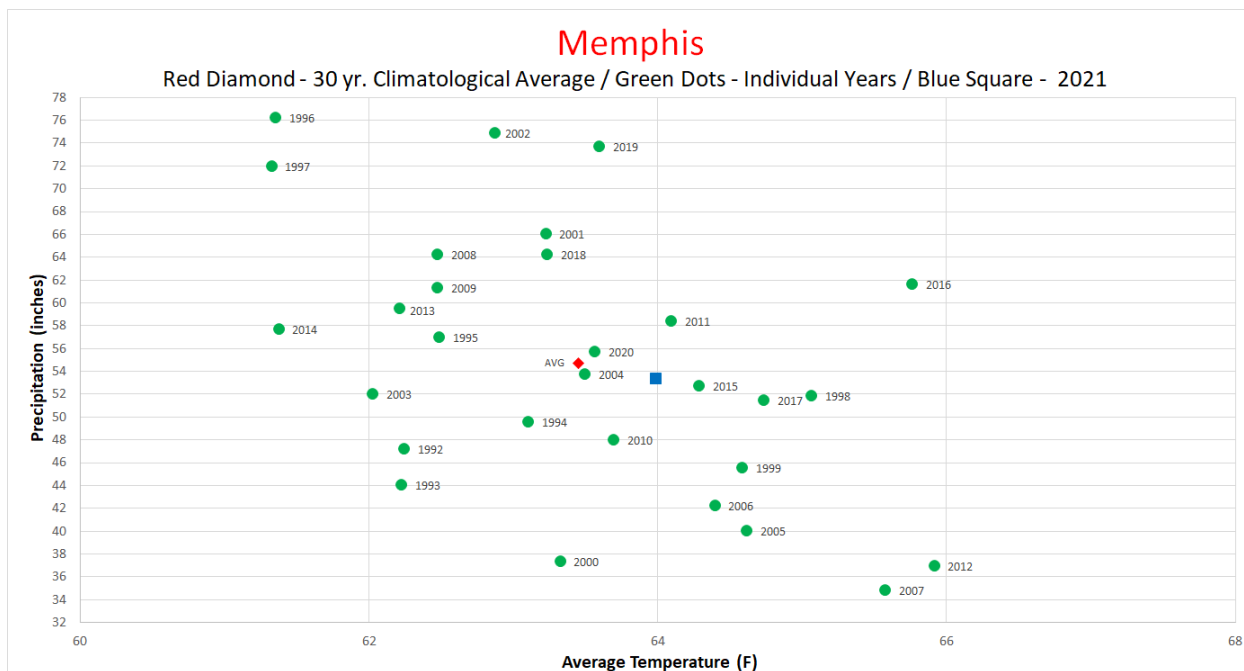
*Each of these stations, except Bristol AP, had at least 1 day without reporting, so actual precipitation totals might be higher.*

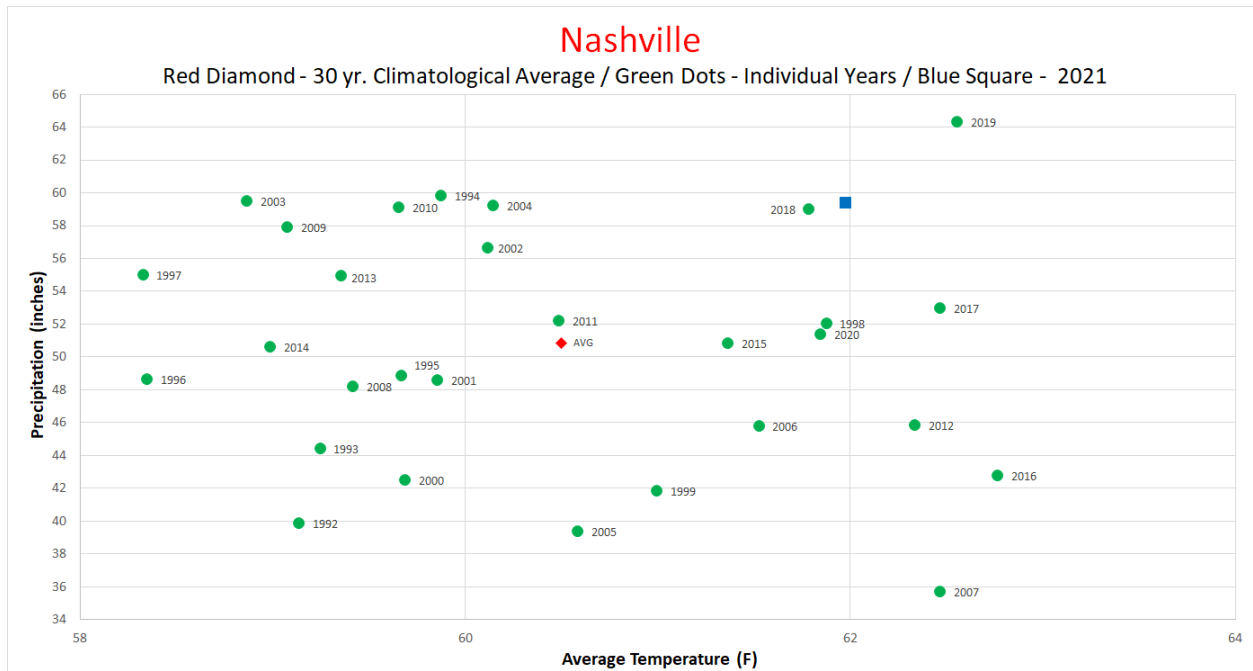
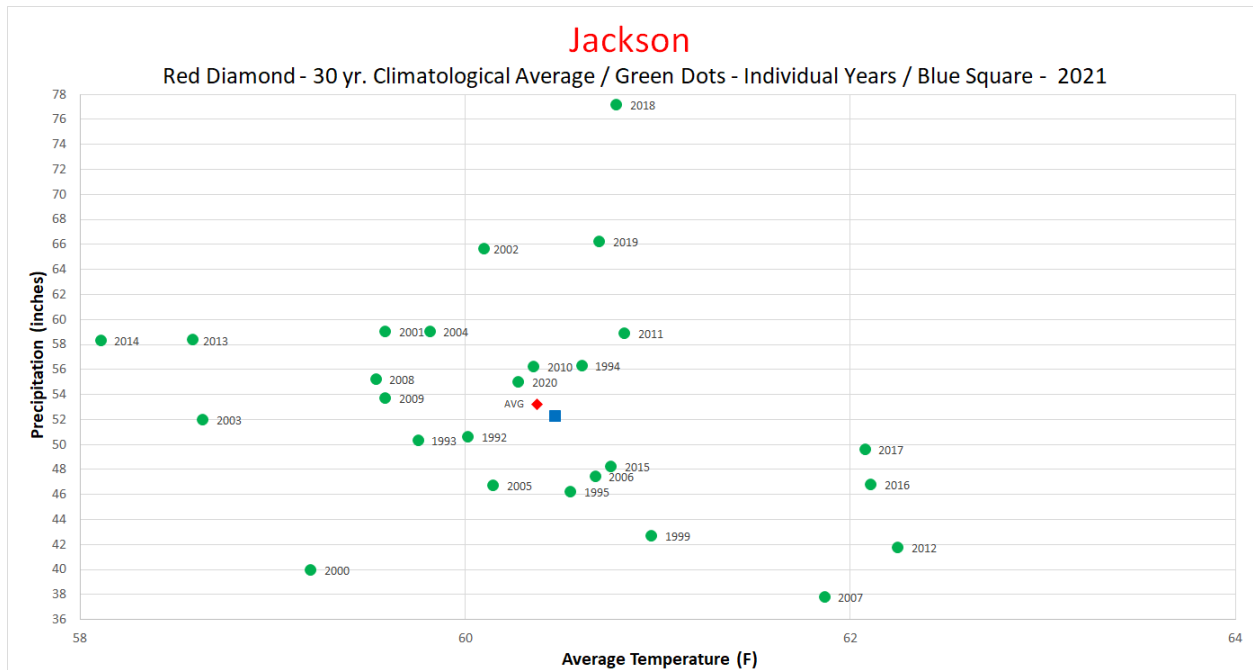
**Snowiest Stations (highest snowfall accumulations):**

Station Name	Station Type	Total Snowfall (in)
MT LECONTE	COOP	44.8
NEWFOUND GAP	COOP	36.4
MCMINNVILLE 8.5 ESE	CoCoRaHS	19.2
CLARKRANGE 6.0 NE	CoCoRaHS	18.9
JAMESTOWN 3.1 SE	CoCoRaHS	18.3
CROSSVILLE EXP STN	COOP	17.4
MONTEREY	COOP	16.7
ROAN MOUNTAIN 3SW	COOP	15.6
COOKEVILLE 3.3 SSW	CoCoRaHS	14.2
CROSSVILLE 5.8 SSW	CoCoRaHS	13.6

**Year in Comparison**

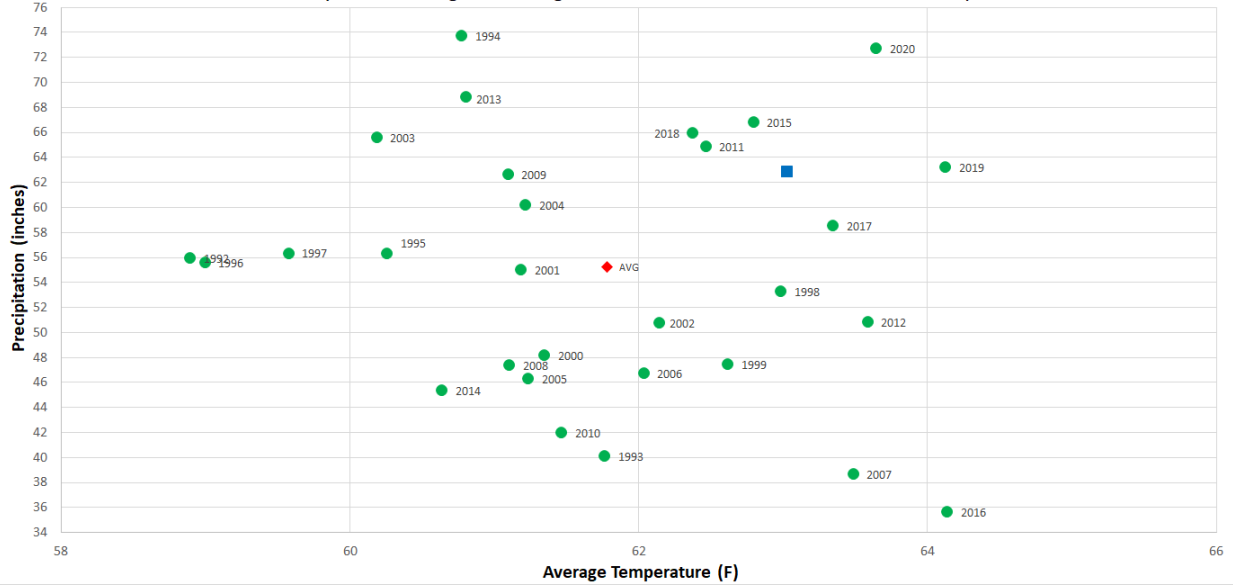
Comparing the annual mean temperature and total precipitation for the year of 2021 to those variables for the previous 30 years, Memphis and Jackson ended up close to normal in both categories. Nashville stood out a bit more from the average of the past 30 years, having the sixth warmest year of the past 30 and the fourth wettest year of the past 30. Chattanooga was also warmer and wetter than the average of the past 30 years, but 2021 didn't stand out from the pack as much as Nashville. For Knoxville and Bristol/Tri-Cities, the year ended up drier and warmer than the average of the past 30 years, with Tri-Cities having their 5<sup>th</sup> warmest year of the past 30.





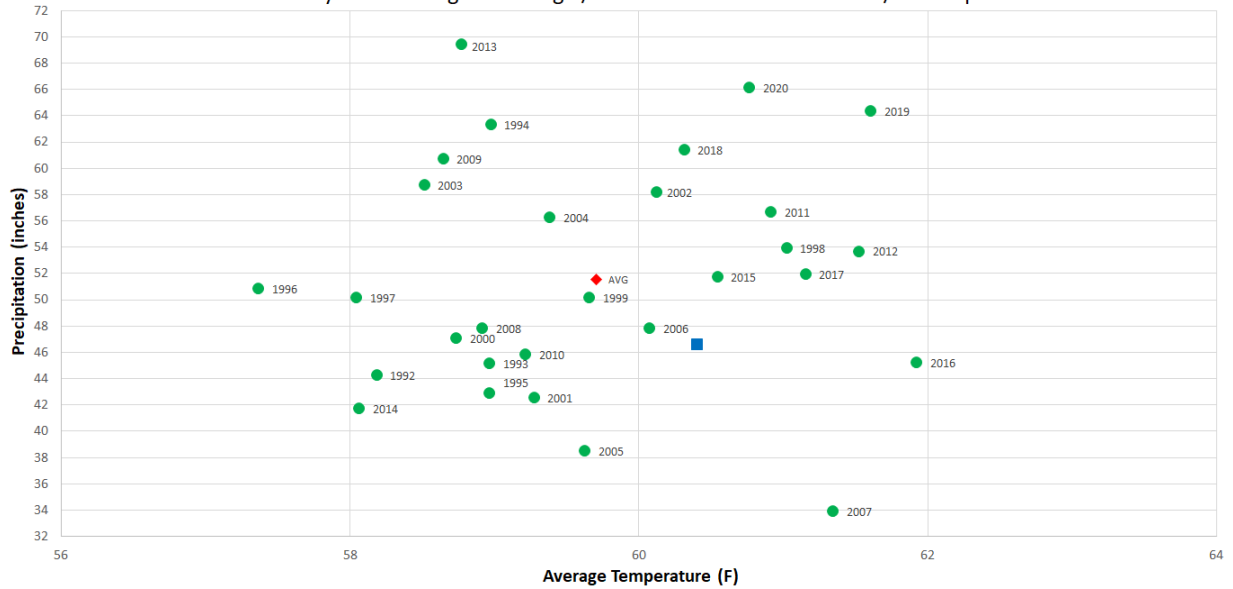
## Chattanooga

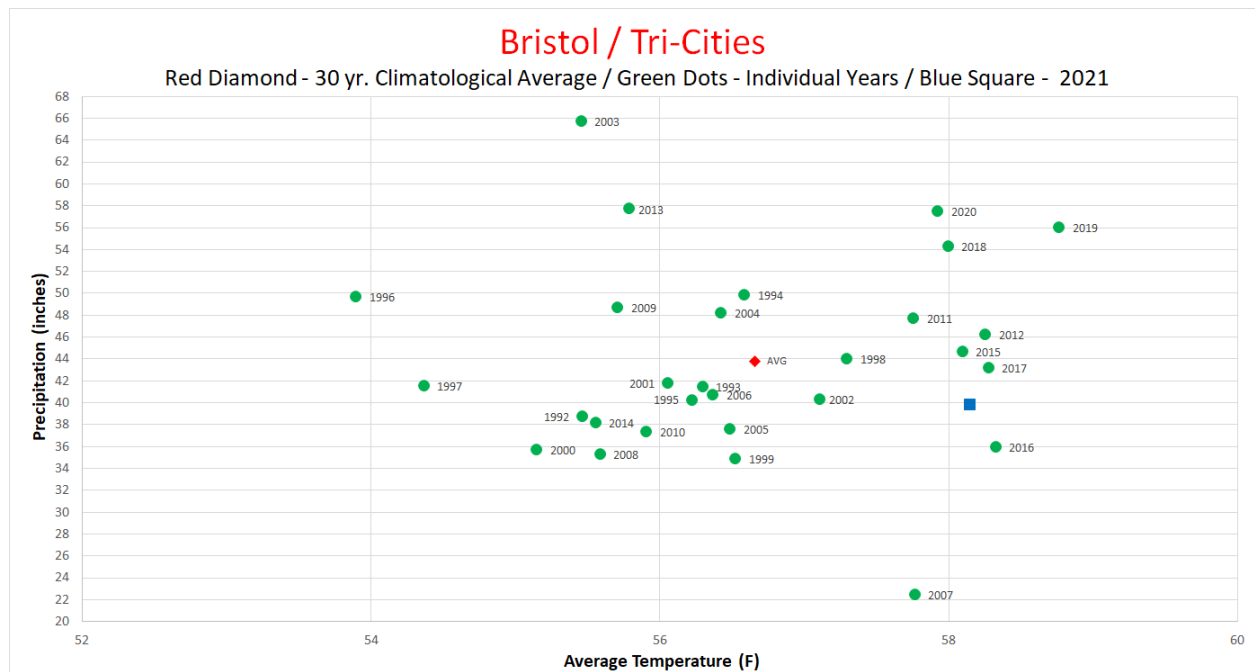
Red Diamond - 30 yr. Climatological Average / Green Dots - Individual Years / Blue Square - 2021



## Knoxville

Red Diamond - 30 yr. Climatological Average / Green Dots - Individual Years / Blue Square - 2021



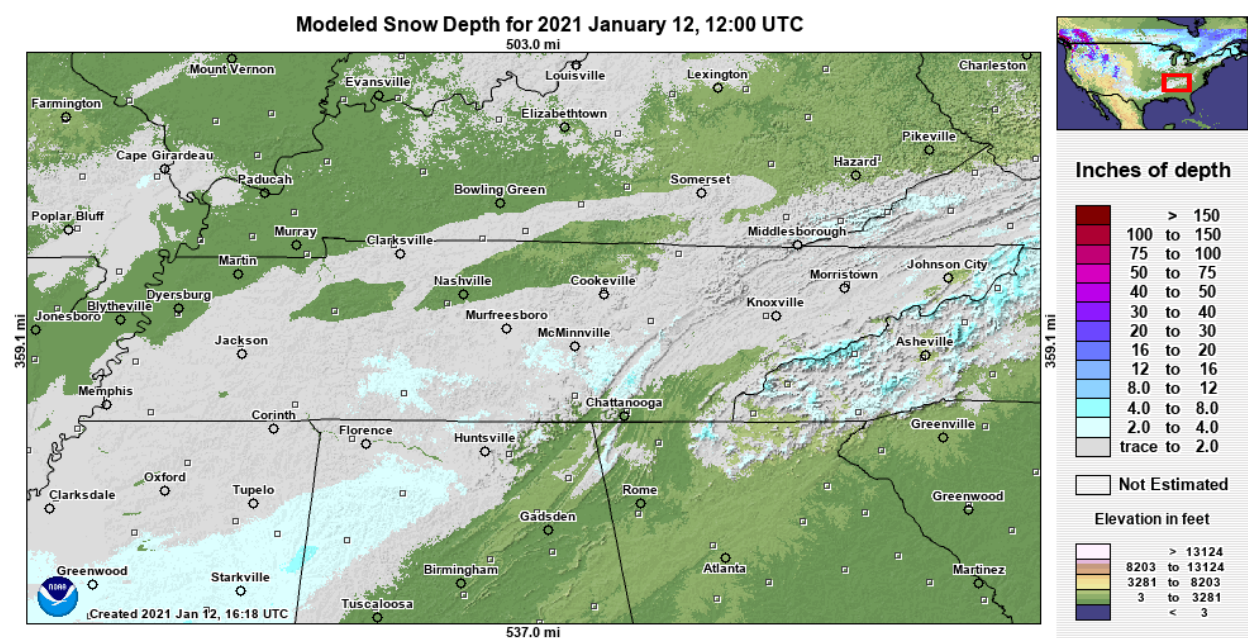


## Major Weather and Climate Stories of 2021:

Tennessee was impacted by several weather-related disasters throughout 2021, with major winter storms and record-setting cold in February, deadly flash flooding in March and August, and severe storm and tornado outbreaks in May and December contributing to a total of 66 tornadoes for the year, the 2nd highest recorded number of tornadoes in Tennessee in a year, behind only 2011 which saw 106 tornadoes.

### January:

January brought a warm start to 2021, with temperatures 2-4°F above normal across most of the state, the highest temperature recorded during the month was New Year's Day when Nashville reported a high temperature of 75°F. Despite the warm weather, a cool spell and accumulating snow occurred across the state in the second week of the month with the highest snow totals outside of the mountains found in southern Middle Tennessee on January 12, 2021.



### February:

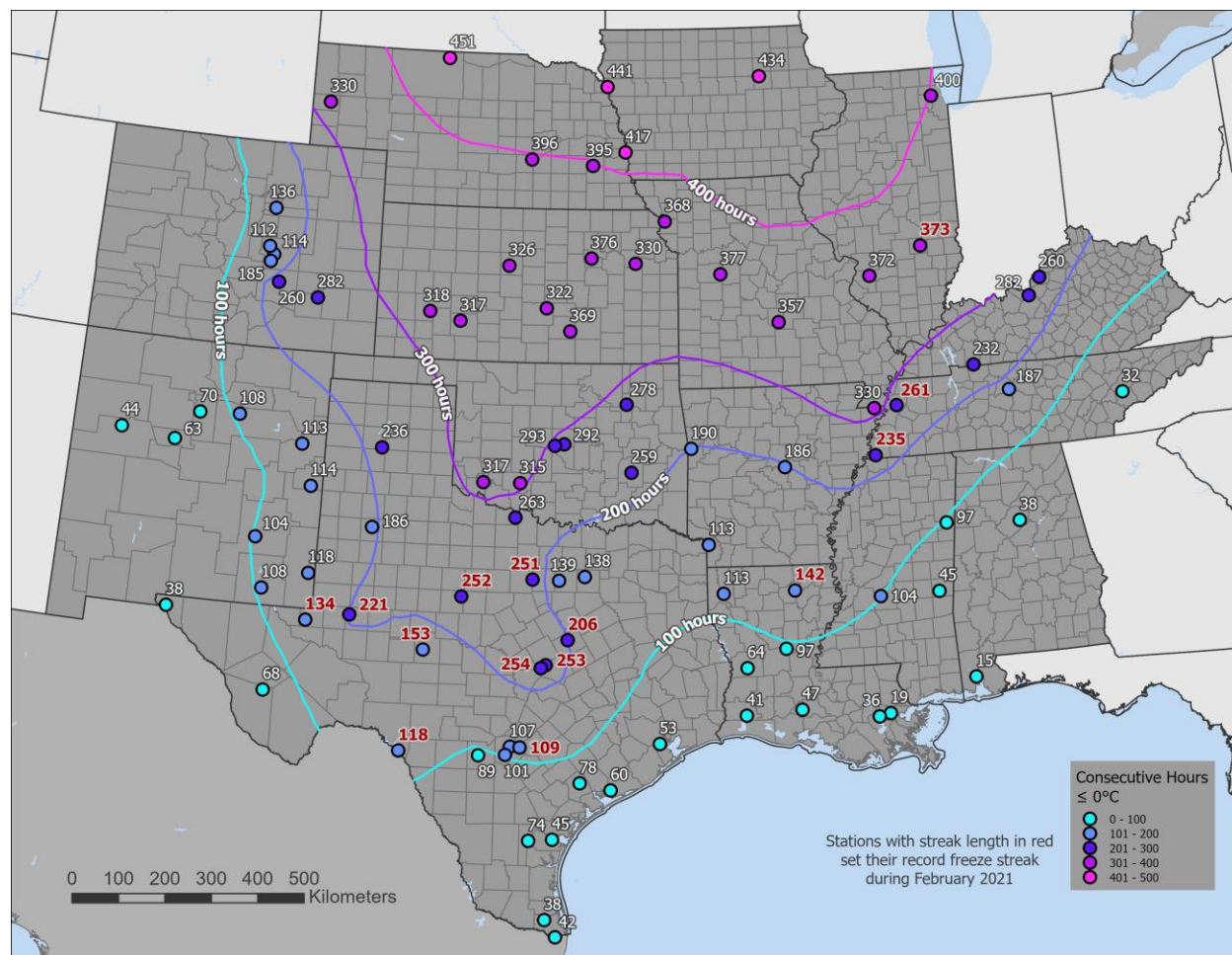
February 2021 brought back-to-back winter storms and extreme cold affecting West and Middle Tennessee, along with most of the central US during the middle of the month. February 2021 saw the first winter storm warnings issued by the Nashville office of the National Weather Service since January of 2018, and the first winter storm warnings issued by the Memphis office of the National Weather Service since December of 2018.

The first winter storm impacted the state from February 14-15 with some snow, but more significant sleet and freezing rain ice accumulations. Icy trees and power lines led to some power outages, and icy roads led to numerous traffic crashes across the state. In this storm, some locations reported over two inches of sleet accumulation.

After the first winter storm cleared out on February 15, the coldest temperatures were reported across the state as many locations didn't warm out of the teens for daytime highs. Morning lows on February 16 reached 0°F in Jackson, 1°F at Memphis, and several COOP weather observers reported conditions below zero. There was a strong west-to-east gradient in temperatures during this cold outbreak. This was due in part to the shallow nature of the arctic air pool which struggled to cross the higher elevations of the Cumberland Plateau, the shallow nature of the cold pool is also what led to so much ice and sleet with the winter storms. The location of the jet stream was also important in the temperature gradient, as East Tennessee had winds out of the south for most of the cold period, resulting in a warmer air mass and down sloping winds from the Appalachian Mountains that produced further warming. This contrast is highlighted by the 40-degree temperature gradient observed on February 15, when Memphis

International Airport recorded a high temperature of 15°F while the Tri-Cities Airport in northeast Tennessee recorded a high temperature of 55°F.

This cold spell was also notable due to its length, the coldest period of the month occurred from February 10 to 19, when there were 79 broken and 9 tied record-low daily high temperatures and 24 broken and 2 tied record-low daily low temperatures (at weather stations in the state with at least a 30-year record). Memphis' high temperatures stayed below freezing for nine days, which tied the record for longest streak below freezing (it happened previously in 1940 and 1899). In Nashville, high temperatures remained below freezing for seven days, which tied the record for 5th longest streak of below freezing temperatures. At weather stations with hourly data, the Memphis International Airport and Dyersburg Municipal Airport both set records for the number of hours at or below freezing, with 261 hours (~10.9 days) at Dyersburg and 235 hours at Memphis (~9.8 days).

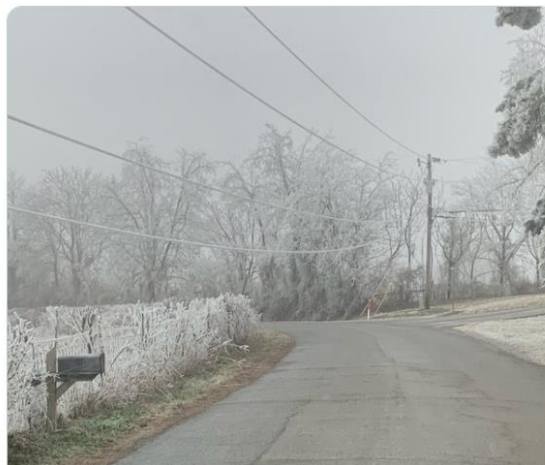


*This map from the Tennessee Climate Office, with data from NCEI and analysis from Amanda Lewis at the Southern Climate Impacts Planning Program (SCIPP) at Louisiana State University, shows the longest streak of hours at or below freezing during February 2021.*



NWS Huntsville  
@NWSHuntsville

[5:25 pm] Here is a photo from Moore county, TN at Bagley Hollow and Mt. Herman Road. Ice has already accumulated on trees, and phone lines are beginning to droop. Now is the time for final last-minute preparations before hunkering down through Wednesday. #HUNwx



*Left: 39-inch icicle in Memphis on February 20<sup>th</sup> after a week of temperatures below freezing!  
(Dr. Dorian Burnette, U. of Memphis)*

*Right: report of icing in southern Middle Tennessee during the first winter storm, February 14-15*

### March:

Overnight flooding in Nashville from March 27 into March 28 led to four fatalities, with an additional 130 people being rescued from vehicles or homes. Many smaller rivers had flash floods, like the one recorded on the Harpeth River at Kingston Springs, which recorded an almost 30-foot rise in stage height over just 24-hours. Even larger rivers, like the Cumberland River at Nashville entered flood stage later in the day on March 28. For the month of March, Tennessee had five of the six wettest counties in the contiguous United States, with each county averaging over a foot of rain for the month! In order, those were Cannon County (13.10"), Rutherford County (12.92"), Williamson County (12.51"), Maury County (12.46"), and Lewis County (12.35").



NWS Nashville @NWSNashville · Mar 28

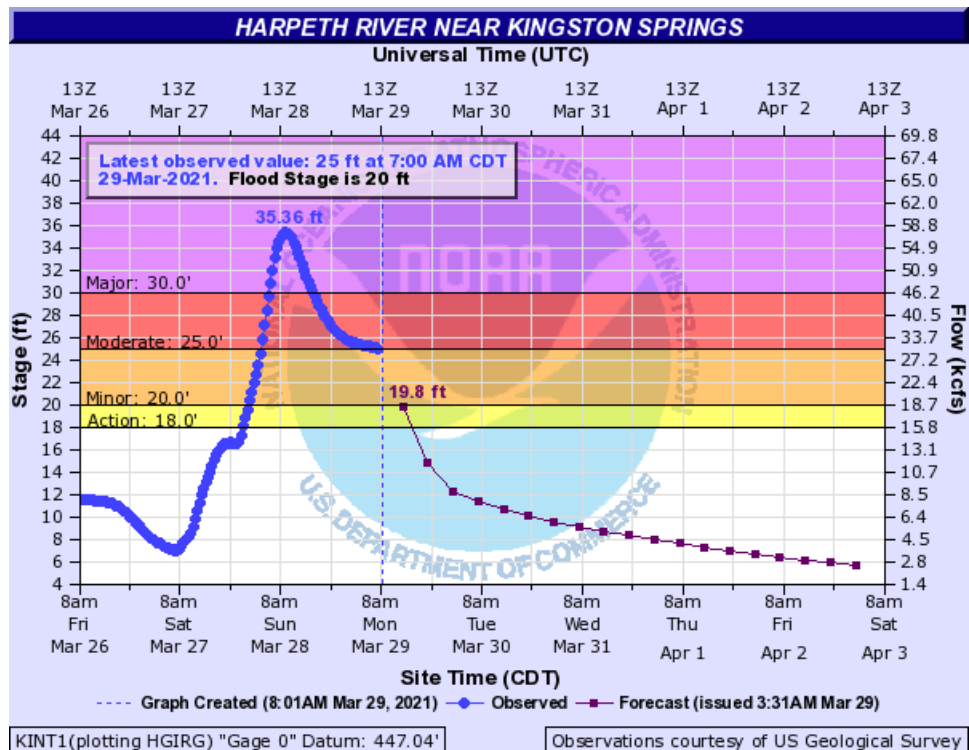
⚠️ FLASH FLOOD EMERGENCY ⚠️ Numerous water rescues continue across southern #Nashville with reports of people clinging to trees. This is a life-threatening situation - do not travel tonight!

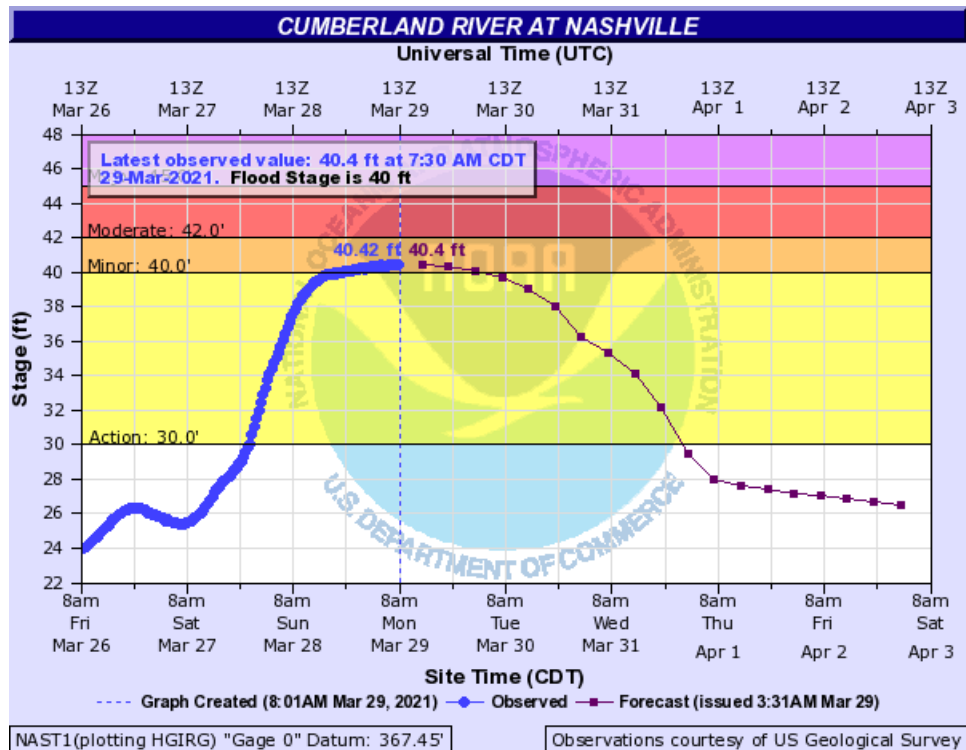


WALMART FLOODING 🌧️ South Nashville Walmart parking lot looking like a lake with multiple vehicles submerged under water



Flooding in South Nashville Walmart parking lot, cars under water  
The parking lot at a South Nashville Walmart is underwater. Video shows the parking lot at Nolensville Pike and Harding Place turned into a lake. Caption: ...  
fox17.com





**NWS Morristown** @NWSMorristown · Mar 28

Might be hard to see, but there's a truck almost completely underwater. This is why you should never drive into flooded waters.



**Ken Weathers** @lucky13wxman · Mar 28

Just got this picture from @KirstieCNews from the Ride Royal Blue ATV resort in the Stinking Creek area of Campbell County.  
LIVE report coming up on @6News  
LIVE stream: [wate.com/live-newscasts/](http://wate.com/live-newscasts/) #flooding #tnwx  
#WeatherAWARE

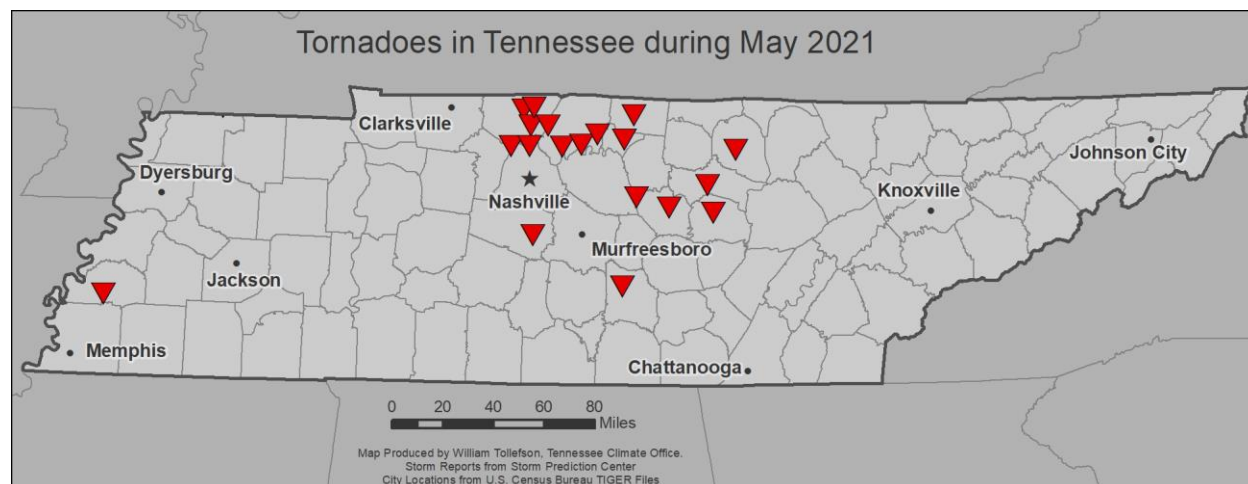


**April:**

April brought several rounds of frost and freeze to the state, which negatively impacted agriculture and home gardens. The first and most widespread freeze event occurred in the first few days of the month, with two or three nights of freezing temperatures reported at many locations. While still within the average last freeze/frost date for most locations across the state, this event did damage some crops/gardens as many plants were already blooming or growing by this time. Later in the month another cold front brought frost and freeze conditions again April 15-16, which was right on time for the average last freeze for many locations in Middle Tennessee and lower elevations of East Tennessee. This was followed by another stronger cold spell on April 20-23 with temperatures dipping into the 20's and 30's across the state. On April 21, Memphis set a record daily low temperature (35°F), then on April 22 Memphis (37°F), Jackson (31°F), Chattanooga (33°F), Knoxville (30°F), and the Tri-Cities (25°F) all set record daily low temperatures.

**May:**

Severe storms occurring May 3-6 were the main story for May 2021, resulting in 15 tornadoes and 56 reports of severe wind damage. The NOAA Storm Prediction Center recorded a total of 19 tornadoes in Tennessee during May, which is more than half of the annual average number of tornadoes that Tennessee recorded from 1995-2020! Tennessee has averaged 30 tornadoes per year in the 1995-2020 time period, but 2021 had produced 33 tornadoes across the state by the end of May. Luckily all of the tornadoes recorded in May of 2021 were rated EF0 (the weakest category on the Enhanced Fujita scale for tornado strength); however, severe thunderstorm winds did result in two fatalities, both caused by falling trees, in the first week of May.

**June:**

June was a relatively quiet month with temperatures near normal, although a strong cold front swept across the state June 21-22 ushering in cool temperatures and low humidity levels for the first few days of astrological summer (with the summer solstice occurring on June 20 this year). Some weather stations set record-cool daily low temperatures during this time period: the Jackson airport, with a 72-year history, broke its daily record low for June 23 at 51°F (3 degrees cooler than the previous record set in 1972). Hohenwald TN, with a 124-year history, broke its daily record low for June 27 at 53°F (1 degree cooler than the previous record set in 1928). On June 24<sup>th</sup>, the Pulaski Water Plant with a 64-year history, and the Memphis National Weather Service Forecast Office, with a 33-year history, tied their daily record low temperatures; 50°F at Pulaski (last recorded in 1972) and 59°F at Memphis (last recorded in 1992). Nashville and Crossville missed out on record lows on the 23rd by a few degrees, but all six of the long-term climate reporting stations across the state did record a low temperature that was in the top-10 coolest for the date. During this period, several stations also set record-cool daily high temperatures. The Chatham Lock and Dam, with a 50-year history, recorded a high of 76°F on June 21, 1 degree cooler than the previous record set in 1976. The Jackson airport recorded a high of 78°F on June 22, 1 degree cooler

than the previous record set in 1992. On June 23, the Pulaski Water Plant recorded a high of 73°F, 5 degrees cooler than the previous record set in 2017, and Mt LeConte, with a 57-year history, recorded a high of only 53°F, 4 degrees cooler than the previous record set in 2017. The cool weather was quickly replaced by a wave of warm air that sent temperatures climbing into the 90's by June 28-30.

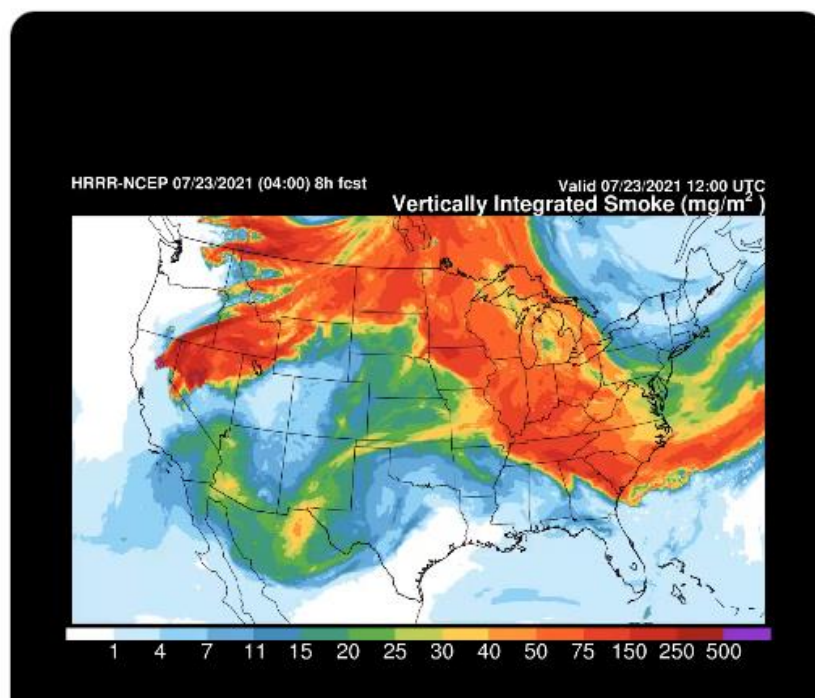
### July:

The main stories of July were the smoke and air quality issues and the heat wave that impacted the state during the second half of the month. Air quality alerts were issued for the major metro areas across the state and smoky/hazy conditions were reported for several days. This smoke and haze came predominantly from large fires impacting the western US and Canada, as the jet stream pushed plumes of smoke from the West and Canada down into the Eastern US. This combined with high pressure in the region that allowed that smoke to push down closer to the ground, impacting surface air quality in Tennessee in the later parts of July. As the jet stream shifted, moving the smoky conditions farther north, it also allowed for high heat and humidity to move into Tennessee for the last week of July. Heat advisories were issued across the state, with West Tennessee having the longest lasting heat wave, with at least one county under a heat advisory July 24-27 and July 29-31. Their heat wave peaked on July 31, with heat index values pushing up over 105°F for many locations, and the ASOS station at Millington Regional Airport in northern Shelby County reported a peak heat index value of 121°F (combining temperatures in the mid-90s with a dew point temperature that reached 80°F)!



**NWS Memphis** @NWSMemphis · Jul 23

Why has it been so hazy across the Mid-South the past few days? Smoke from wildfires across the western US & Canada is being carried across the country by upper-level winds. Here's a simulation of where the greatest smoke concentration is expected today. #tnwx #arwx #mswx #mowx

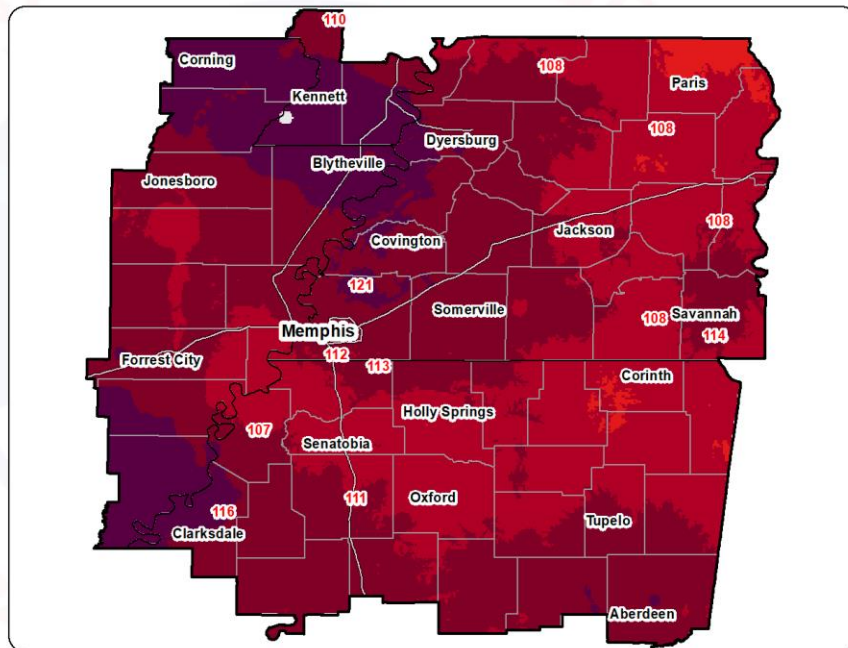
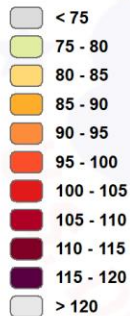




## National Weather Service Memphis Tennessee 24 Hour Max Heat Index Ending 7AM 07-31-2021



Max Heat Index (F)

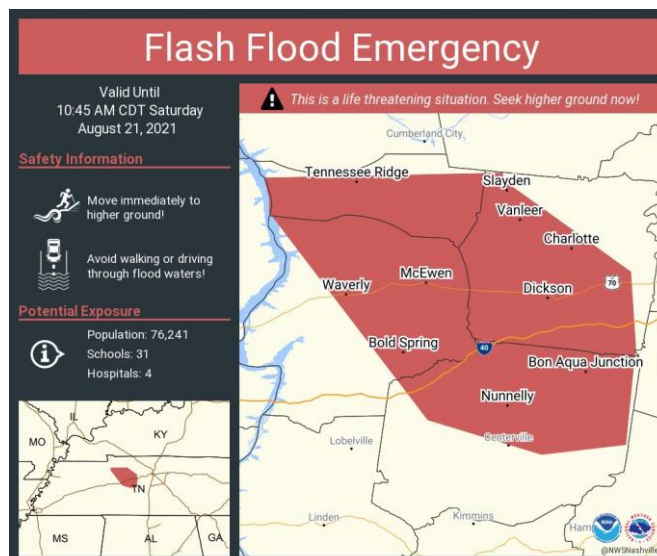


This map is an experimental interpolation of actual reported values as well as the Real-Time Mesoscale Analysis (RTMA), but should be considered an estimation only. Not all reports used in the analysis will be displayed due to space constraints. Reports are 24 hour max heat index from yesterday morning through this morning.

Data Sources: NWS COOP ASO/IAWOS Mesonet  
CoCoRaHS Miscellaneous  
0 10 20 40 60 80 Miles

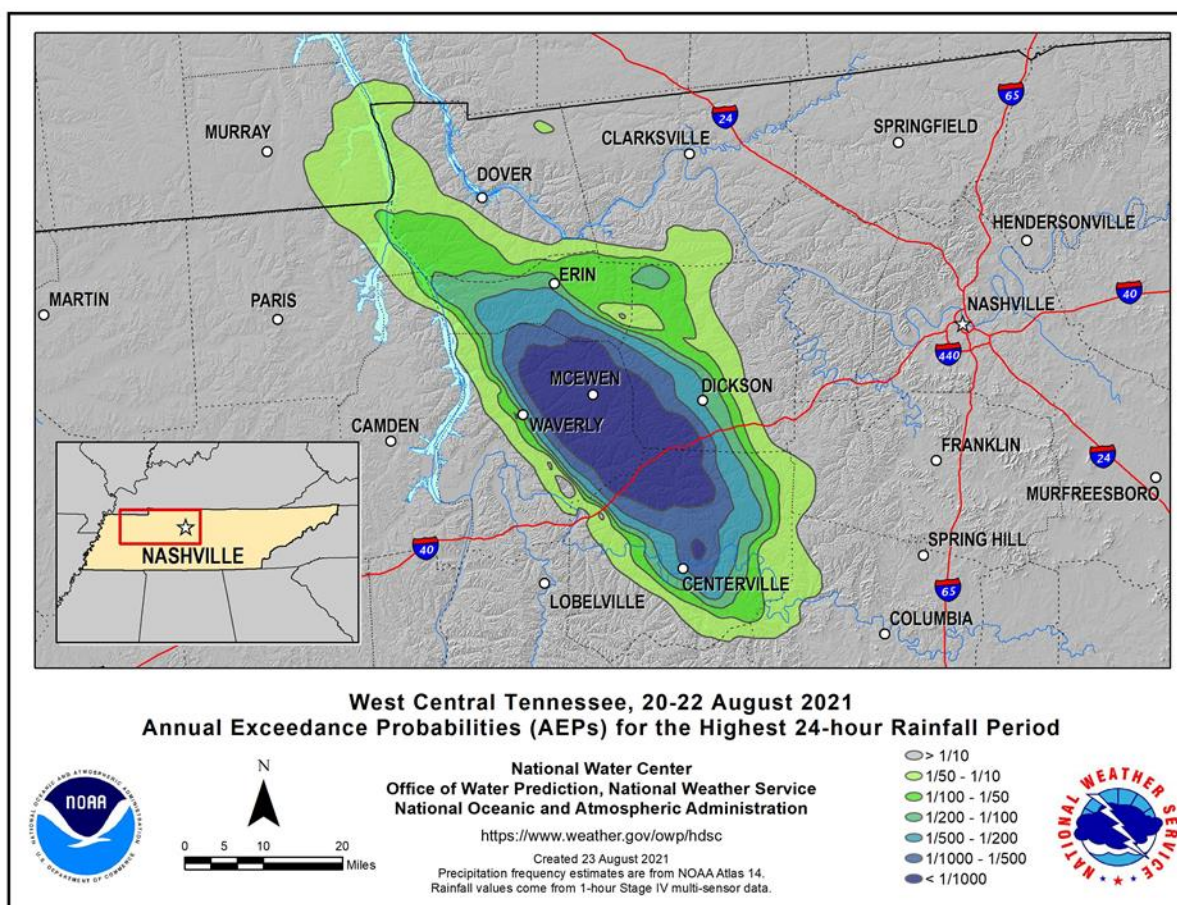
### August:

August brought devastating and deadly flooding to western portions of Middle Tennessee on the 21<sup>st</sup>. This flooding was caused by a series of storms producing extremely heavy rainfall training over the same areas along a weak stationary front extending from western Kentucky down into Middle Tennessee. Rainfall started just after midnight Saturday morning, and increased in intensity through the morning hours, with rainfall rates of over 3-inches per hour between 5:00am and 8:00am CDT. Then a second round of storms formed over the same areas in the early evening hours adding an additional 2+ inches between 7:00pm and 9:00pm CDT to areas that were already flooded.

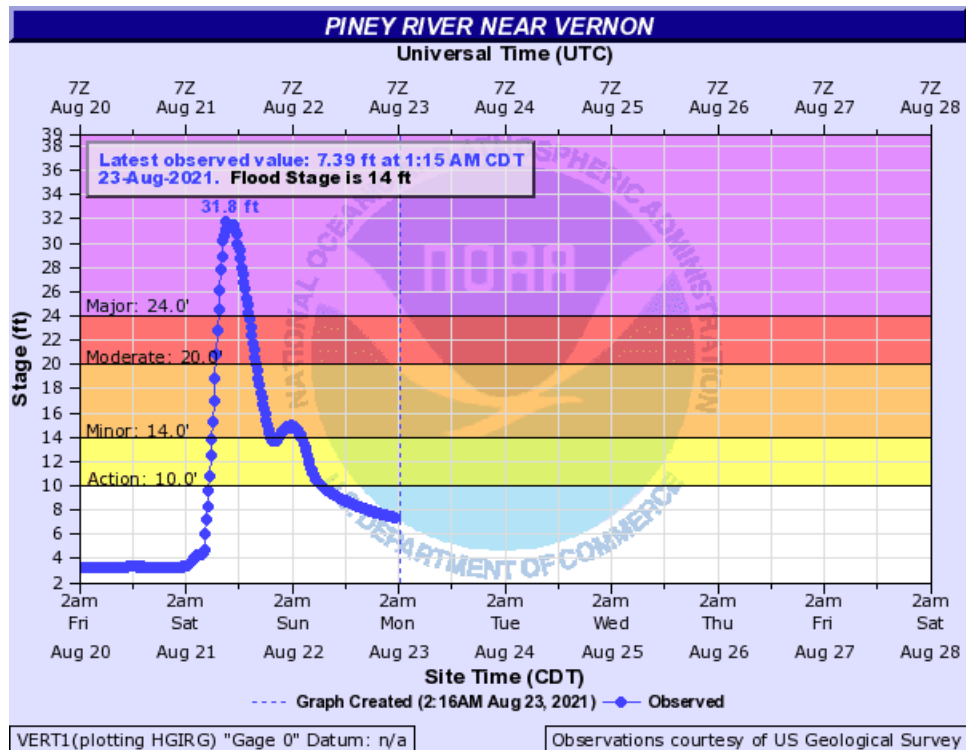


Portions of Humphreys, Dickson, Hickman, and Houston counties reported over 10-inches of rain during the day, leading to devastating flash flooding. A newly installed weather station at the McEwen Wastewater Treatment Plant in Humphreys County recorded a total of 20.73-inches of rainfall on August 21, breaking the state's record for highest 24-hour rainfall amount, which was previously 13.6-inches recorded near Milan on Sep. 13, 1982. These rainfall amounts were well over a 1-in-1,000 return period event for the area, meaning that there is less than a 0.001% chance of a rainfall of this magnitude occurring in any given year.

A State Climate Extremes Committee (SCEC) was convened to evaluate multiple stations and verify the new state record 24-hour rainfall amount. At 20.73", this is currently the highest 24-hour rainfall amount for any non-coastal state in the country. A final report with additional information can be viewed here: <https://www.ncdc.noaa.gov/monitoring-content/extremes/scec/reports/20211220-Tennessee-24-Hour-Precipitation.pdf>



Streams in these areas quickly rose above flood stage and out of their banks. A USGS stream gauge on the Piney River at Vernon (Hickman County) quickly rose from around 4-ft just after midnight, to over 32-ft by noon! This smashed the record gage height of 20.08-ft for this location, previously set in February of 2019. Among the hardest hit areas was Waverly (Humphreys County) where Trace Creek flooded much of the town. TEMA has confirmed that there were 20 weather-related fatalities in Humphreys County, and the Humphreys County Sheriff's Office reported that at least 509 homes were damaged or destroyed by the flooding. In the wider four-county area, the number of homes affected was over 700. Additionally, other public infrastructure was damaged by the flooding with power outages impacting over 4,000 customers, boil water advisories were issued by the Waverly Water Supply, several state and county roads and bridges were washed out or damaged, and I-40 was shut down in both directions for a time on Saturday (8/21).



Nashville Fire Dept   
@NashvilleFD

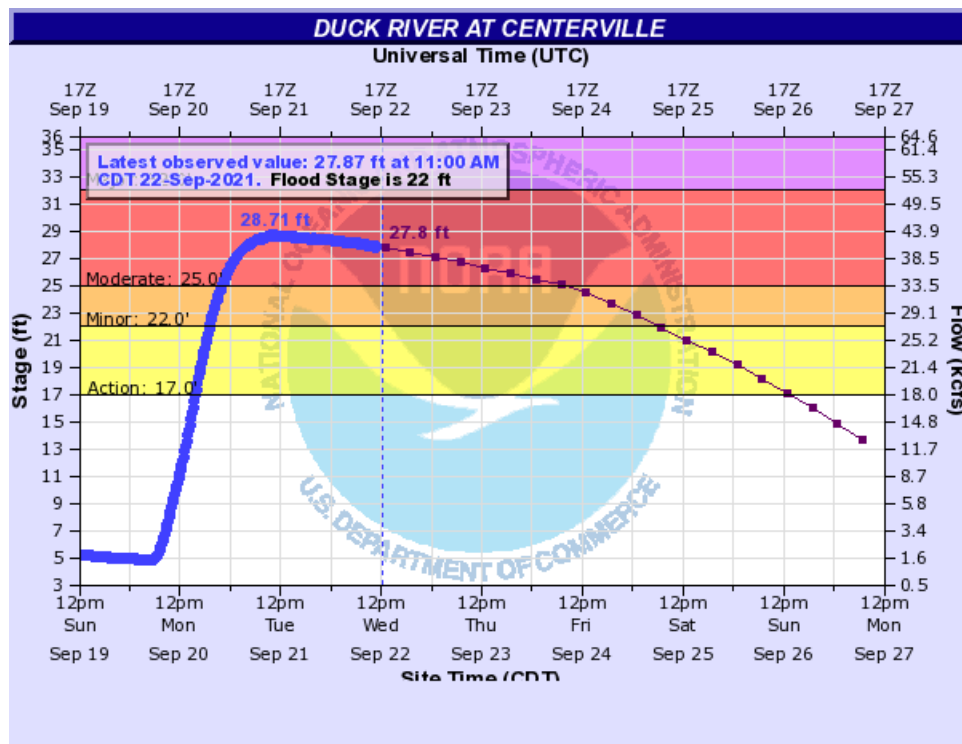
...

This is what our TN-HART team flying missions in Waverly are seeing.



## September:

Once again, the major story of the month for September was heavy rainfall and flooding in portions of Middle Tennessee, although thankfully it was less intense than what occurred in August. Rains were spread out over a longer period, but some areas of southeast Middle Tennessee recorded a foot of rain over the week of the 15-21, which led to moderate flooding on the Duck River. More than 6-inches of rain were reported from the western portions of the Cumberland Plateau westward into Middle Tennessee, with 10-inches of radar estimated totals in parts of Bedford, Rutherford, and Coffee counties. This prompted some localized flash flooding and riverine flooding on the Duck River, with stream gauges at Centerville (Hickman County) and Shelbyville (Bedford County) reaching Moderate Flood Stage, and Hurricane Mills (Humphreys County) and Columbia (Maury County) reaching Minor Flood Stage in the later parts of the week.



## October:

The main story of October was the much above normal temperature pattern in the first half of the month. A frontal system that passed through the state in the middle of the month finally broke the summer-like pattern that had been in place for the first half of the month and allowed temperatures to return to near normal conditions, although most of the state averaged 3-5°F above the 1991-2020 30-year climate normals for the month. From October 1-16, many areas of the state recorded mean temperatures that were 9-12°F warmer than normal driven mostly by overnight temperatures that were very warm. Looking at weather station data from the National Centers for Environmental Information (NCEI) Global Historical Climatological Network dataset, which keeps track of records set at weather stations with at least a 30-year reporting history, there were 11 record-warm daily high temperatures set during the month and 49 record-warm daily low temperatures set during the month. All record low temperatures were set during the first half of the month (Oct 2 - Oct 16).

Additionally, the Allardt, TN COOP weather station in Fentress County (Cumberland Plateau) with a 93-year reporting history (January 1928-present) broke its record-warm October monthly low temperature three times this month! On October 7, the daily low temperature was recorded as 69°F, setting the record for the station's warmest low temperature recorded during the month of October (the previous record was 68°F set on Oct 4, 1954). The next day, October 8, the daily low temperature was 70°F, breaking the

record-warm October minimum temperature set the previous day. Then on October 13, the station recorded a low temperature of 71°F, again breaking the record-warm low temperature for the month of October!

### November:

November was a relatively quiet month, climatologically speaking, across Tennessee. The main story of the month was the drier than normal conditions across that state, but due to cooler than normal temperatures, frequent light rains, and a surplus of moisture in the preceding months, expansion of drought conditions into the state were minimal, with only a small area of Moderate Drought (D1) introduced into parts of Tipton and Lauderdale counties in West Tennessee. In the last release of the Drought Monitor, based on conditions on November 30 approximately ¼ of the state was depicted with Abnormally Dry (D0) conditions.

### December:

The major stories of December 2021 were the severe storm outbreaks of December 10-11 and December 6, as well as the record-setting warmth, which in part fueled these outbreaks. The NOAA Storm Prediction Center (SPC) lists a total of 34 tornadoes occurring in December 2021 in the state of Tennessee. According to data from the SPC going back to 1950 there had only been 29 tornadoes in the month of December in Tennessee through 2020, meaning more tornadoes were reported in Tennessee in December 2021 than all previous Decembers combined. Additionally, the average number of tornadoes reported in Tennessee from 1995 to 2020 was 30, so December 2021 saw more tornadoes in Tennessee than the average year (of the past 26 years). However, there is a large amount of variability year-to-year, but the NOAA Storm Prediction Center lists a preliminary count of 65 total tornadoes in 2021, which is the second highest recorded number of tornadoes in Tennessee falling behind only the 106 tornadoes recorded in 2011.

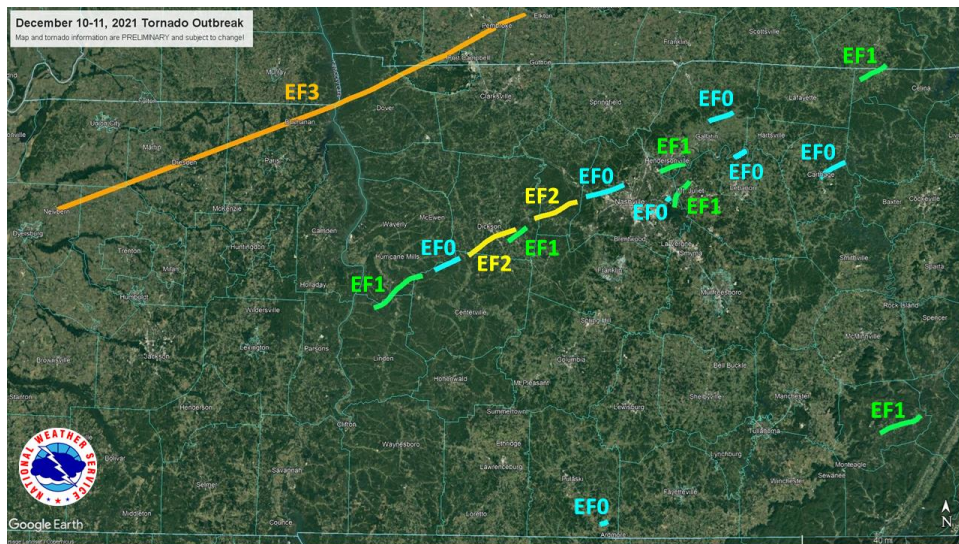
A total of 30 counties had a reported tornado in December 2021. For 20 of those counties it was the first December tornado recorded in that county by the SPC or NOAA NCEI Storm Events Database (with records back to 1950). There were five tornadoes in Middle Tennessee on December 6, but the storm system responsible for the majority of severe weather reports swept the state on December 10 and 11, impacting West and Middle Tennessee in the overnight hours and East Tennessee in the morning hours of December 11. Up to EF-4 level damage was found in West Tennessee, in areas of Lake County along the south shore of Reelfoot Lake. Dresden in Weakley County and areas of northern Henry County also had EF-3 level damage produced by a long-track tornado that started in Newbern (Dyer County) and continued 123 miles across Tennessee and into western Kentucky. In addition to the tornadoes, there were 96 reports of severe wind damage and two reports of severe hail (with a diameter of 1-inch or larger) in December. Unfortunately, there were 3 fatalities and 10 injuries reported due the severe weather.



*EF-3 tornado damage in Dresden, TN (Rachel Whiteman)*



*EF-4 tornado damage at Reelfoot Lake*



*Middle TN Tornadoes (NWS Nashville)*