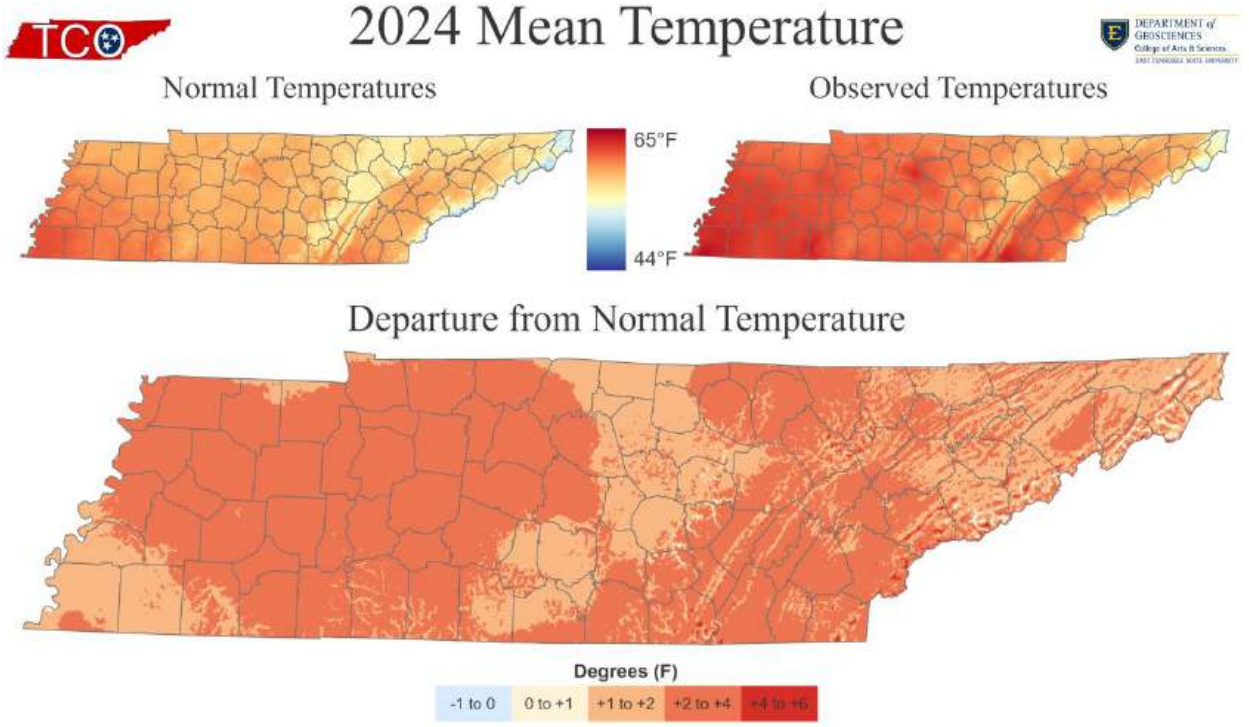
2024 Tennessee State Climate Summary

*Tennessee Climate Office * East Tennessee State University*
Prepared by William Tollefson and Dr. Andrew Joyner
With contributions by Climate Data Representatives

Annual Temperature Summary:

The mean (average) temperature for 2024 was warmer than normal for Tennessee, with most of the state averaging 2-4°F warmer than the 1991-2020 NOAA Climate Normals. However, temperatures had a large annual range. A strong blast of cold air in January brought the coldest temperatures of the year to most locations, with single digits or sub-zero temperatures common. A heat wave in late August brought daily maximum temperatures of 100°F or higher to many weather stations across Tennessee.



Stations with the highest mean temperature

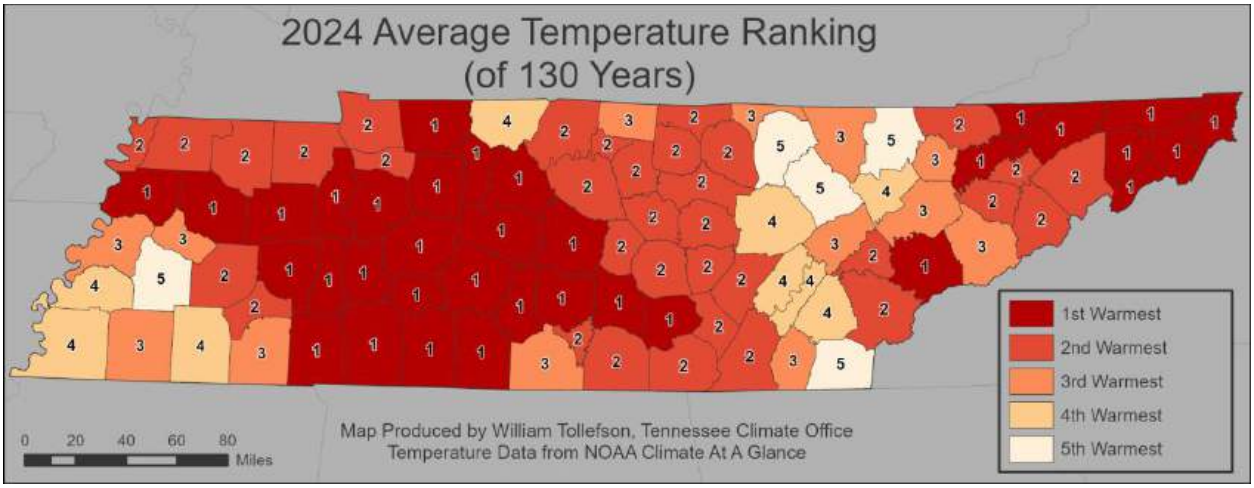
Station Name	Station Type	Mean Temperature (F)
MEMPHIS INTERNATIONAL AP	WBAN	65.1
CHATTANOOGA AP	WBAN	64.6
SHILOH NMP TENNESSEE	RAWS	64.3
MEMPHIS WFO	WBAN	64
NASHVILLE INTL AP	WBAN	63.7

Map Data from PRISM Climate Group, Oregon State University. 1991-2020 Climate Normals Used. Station Data Retrieved From xmACIS2.

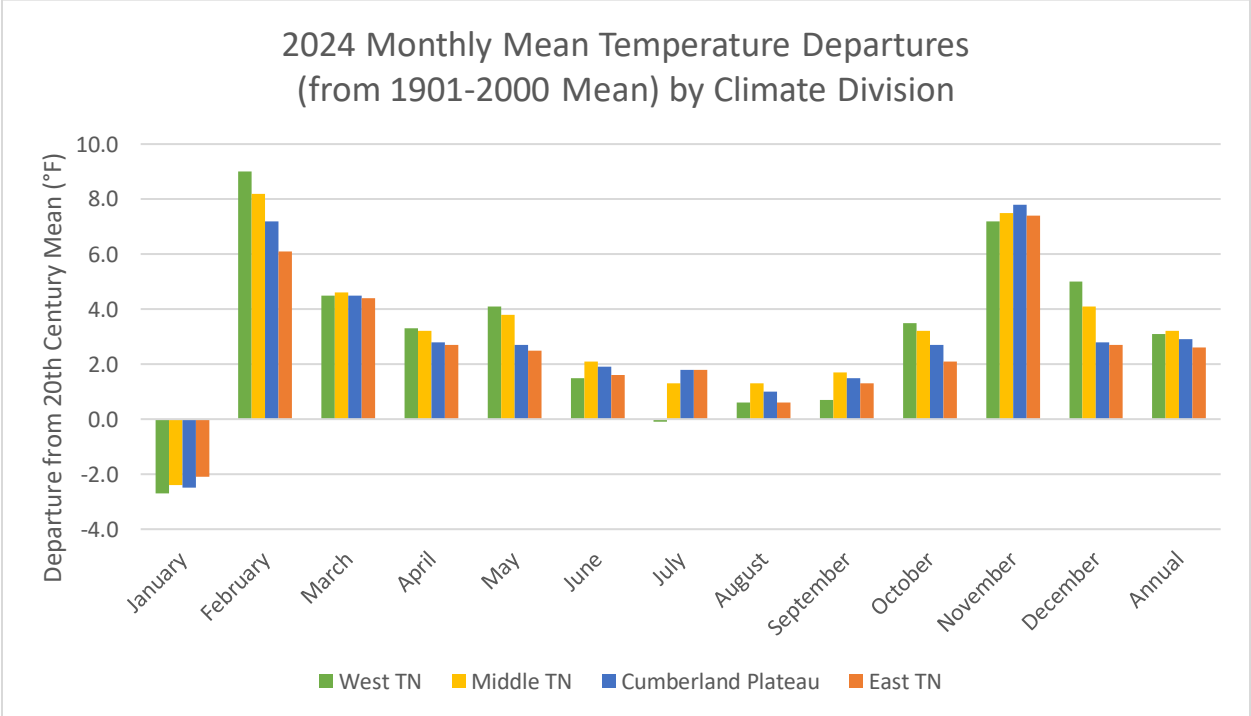
Stations with the lowest mean temperature

Station Name	Station Type	Mean Temperature (F)
MT LECONTE	COOP	44.1
NEWFOUND GAP	COOP	50.8
MOUNTAIN CITY 2	COOP	54.3
CHEROKEE TENNESSEE	RAWS	56.2
CROSSVILLE 7 NW	WBAN	56.5

Comparing this year's average temperature to the 20th century mean (mean temperature from 1901-2000), all four of Tennessee's climate divisions (West, Middle, Cumberland Plateau, and East) were warmer than their 20th century mean by 2.6 to 3.2 degrees Fahrenheit. East Tennessee had the smallest temperature anomaly being 2.6°F warmer than the 20th century mean, followed by the Cumberland Plateau at 2.9°F warmer, then West Tennessee at 3.1°F warmer. Middle Tennessee saw the largest anomaly at 3.2°F warmer than the 20th century mean. Additionally, data from NOAA's Climate At A Glance tool showed that all counties in Tennessee had one of their top-5 warmest years, with the dataset going back to 1895. 34 counties in Tennessee had their warmest year on record and another 34 counties had their second warmest year on record.

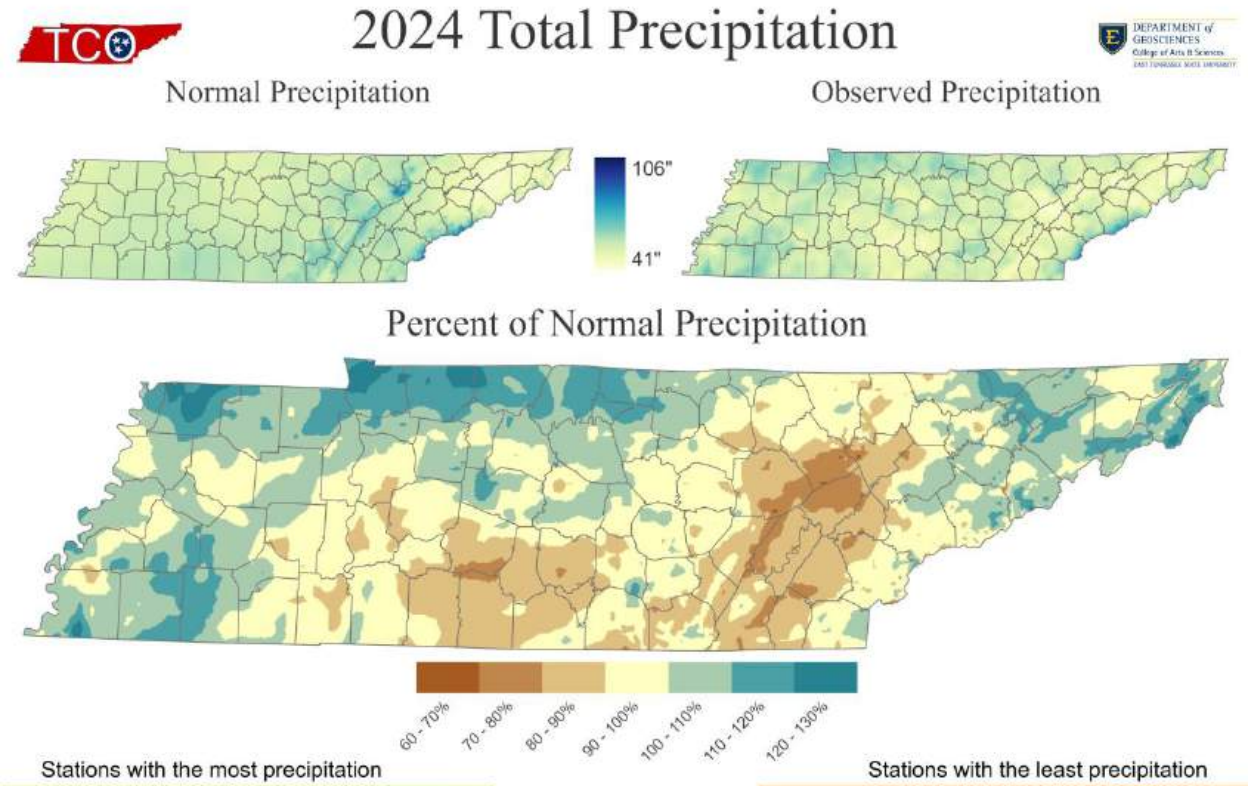


Looking at a month-by-month breakdown at the climate division level, January was the only month where all four climate divisions were cooler than the 20th century mean, and July for West Tennessee was a tenth of a degree below the 20th century mean, but temperatures were warmer than the 20th century mean for all other months in each climate division. February and November were the standout months for warmth across the state with each month bringing average temperatures that were over 6°F warmer than the 20th century mean. The summer months of June, July, August, and September were the closest to average, with temperatures that were less than 2 degrees warmer than the 20th century mean.



Annual Precipitation Summary:

Total precipitation across the state during 2024 was close to average in most of the areas, with many regions being within 10% of the 1991-2020 NOAA Climate Normals. However, there were exceptions with higher precipitation amounts in areas of West Tennessee, northern Middle Tennessee, and the northeastern corner of the state. There were also larger areas of below normal precipitation in southern Middle Tennessee, parts of the Cumberland Plateau, and the southern and central portions of East Tennessee. The summer and fall seasons in particular had long dry stretches that brought moderate to extreme drought conditions to parts of the state. Total precipitation for the year showed a wide range in values with the wettest station reporting more than double the driest station for the year. The driest stations in the state this year were the Smyrna 1.8S CoCoRaHS weather station, reporting 40.56-inches, and the Chattanooga airport weather station, reporting 41.46-inches. The wettest stations in the state this year were the Mt. LeConte and Newfound Gap COOP stations in the Smoky Mountains with 90.38- and 80.08-inches, respectively.



Stations with the most precipitation

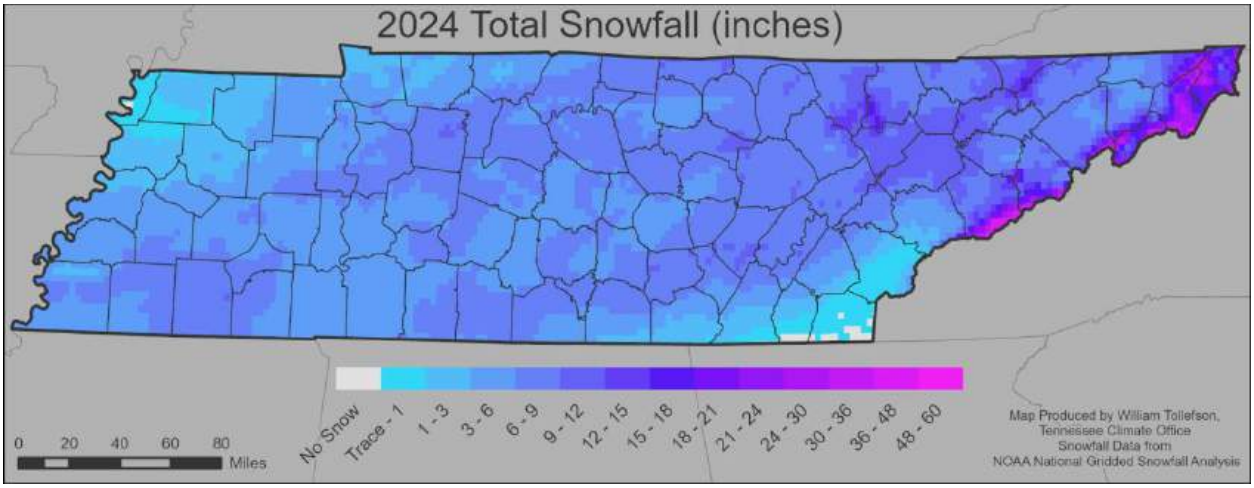
Station Name	Station Type	Total Precipitation (in)
MT LECONTE	COOP	90.38
NEWFOUND GAP	COOP	80.08
BENTON 2.3 ESE	CoCoRaHS	78.75
CLARKSVILLE 4.9 NW	CoCoRaHS	75.15
SEWANEE	COOP	68.9

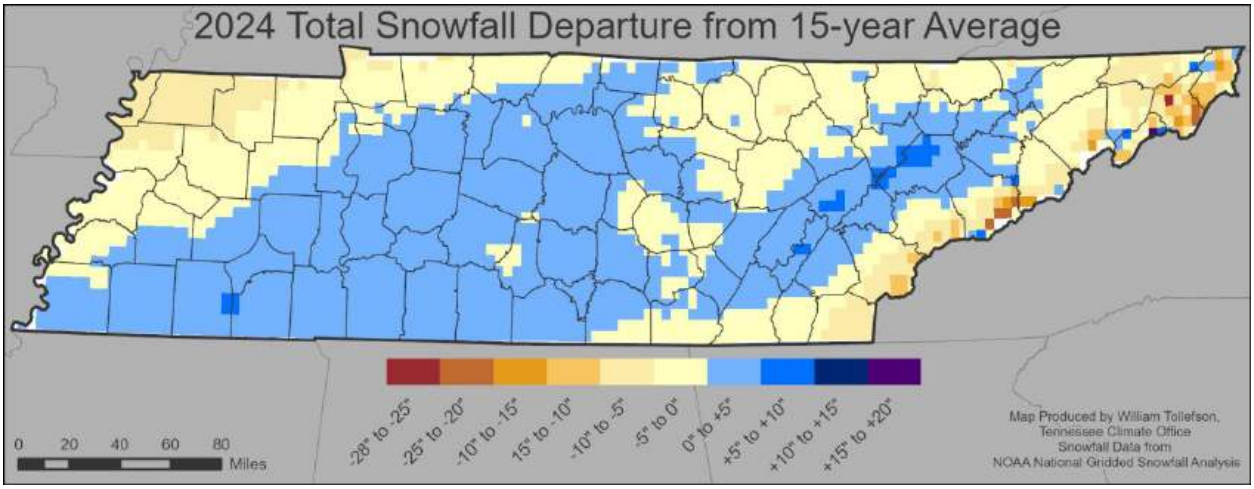
Map Data from PRISM Climate Group, Oregon State University. 1991-2020 Climate Normals Used. Station Data Retrieved From xmACIS2

Stations with the least precipitation

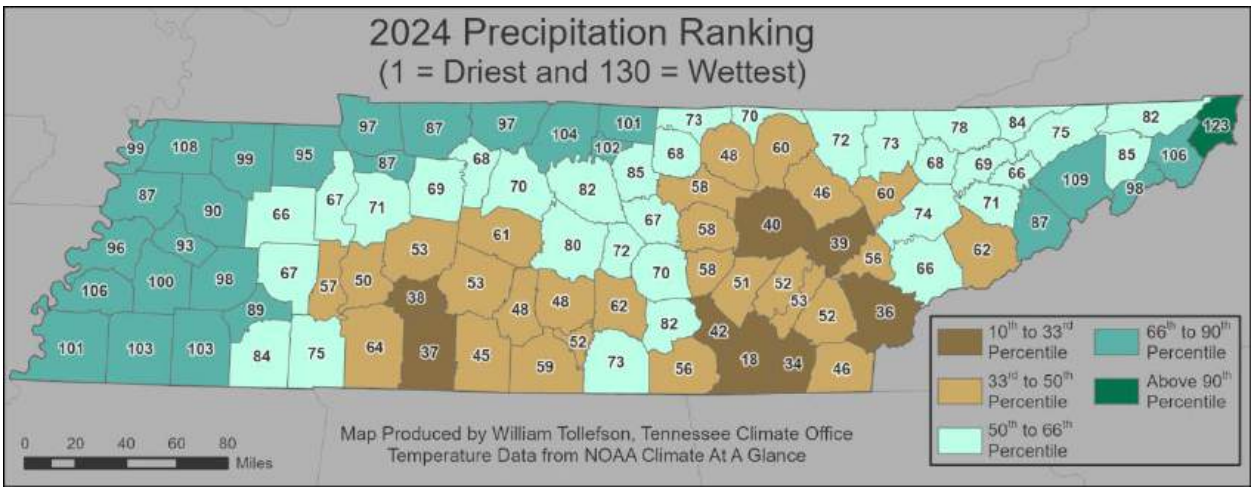
Station Name	Station Type	Total Precipitation (in)
SMYRNA 1.8 S	CoCoRaHS	40.56
CHATTANOOGA AP	WBAN	41.46
KINGSPORT	COOP	42
BRISTOL AP	WBAN	42.99
JONESBOROUGH 2.5 SSW	CoCoRaHS	43.03

2024 brought large parts of the state more snowfall than the average of the previous 15 winters (2008/2009 – 2022/2023), with a widespread heavy snow in January 2024 bringing 4-10-inches of snow to most places. There were a few other light snowfall events in February and November that added another couple inches to annual snowfall totals mostly in Middle and East Tennessee, but the January storm was responsible for most of the annual snowfall totals. Notably, most of the mountains in East Tennessee, the northern Cumberland Plateau, and the northwestern portions of the state recorded less snowfall in 2024 than the average for the previous 15 winters.

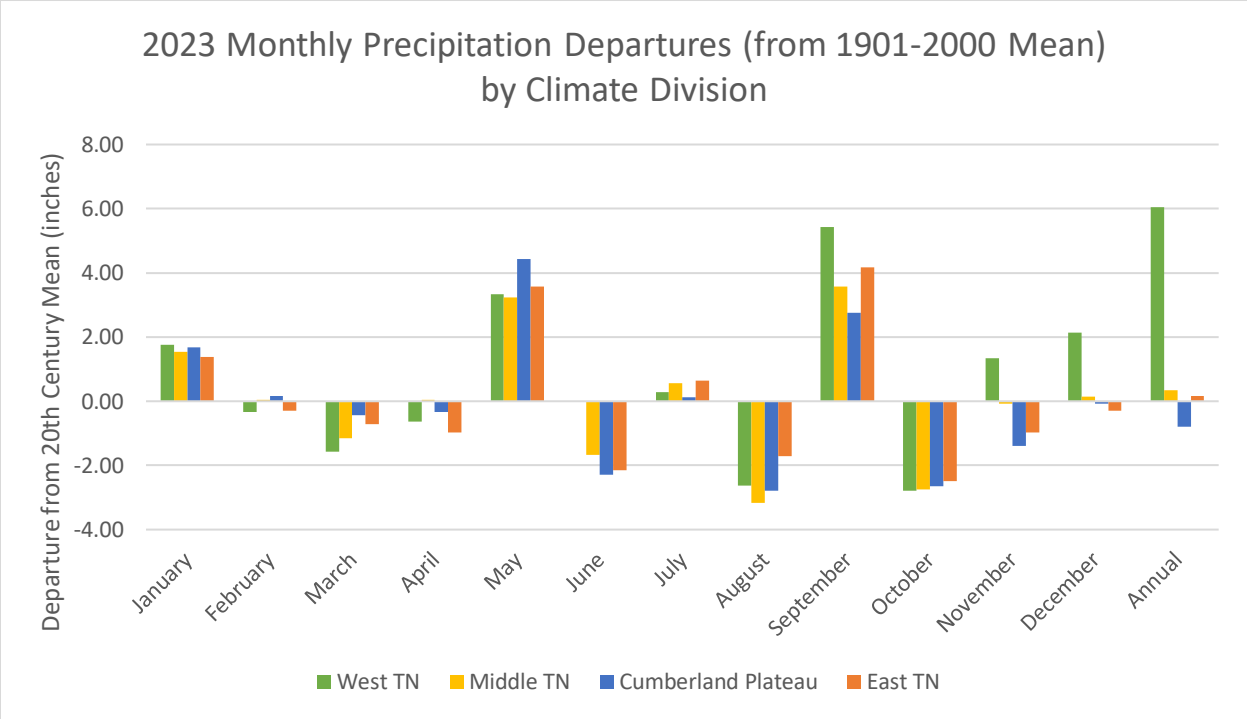




County-level average precipitation from the NOAA Climate at a Glance tool shows a mix with 35 counties drier than their 20th century average precipitation, and 61 counties wetter than their 20th century average. The two areas most impacted by the summer and fall droughts, southern Middle Tennessee and the southern and central portions of the Cumberland Plateau and East Tennessee stand out as having below average precipitation, with eight counties ranking in the driest 3rd of years (within the 10th to 33rd percentile). Almost all counties in West Tennessee finished the year in the top 3rd of wettest years on record (66th to 90th percentile), thanks to a much wetter than normal May and September. Johnson County in the far northeastern corner of the state had its 8th wettest year on record, and the highest departure from their 20th century mean with 10.61-inches more than average. Hamilton County had its second largest departure from the 20th century mean on record, coming in at 9.37-inches below average.



Looking at a month-by-month breakdown at the climate division level, West Tennessee is the standout with 2024 having an average precipitation that was 6.05-inches above the 20th century mean. The other three climate divisions averaged out to within 1-inch of the 20th century average, mostly because one part of the division was wetter than normal while another part of the division was drier than normal. May and September stood out as much wetter than the 20th century mean across all climate divisions, with each division reporting at least 2-inches above normal precipitation in both of those months. October stood out as the driest month, with all climate divisions reporting at least 2-inches below normal precipitation, August was similar with the West, Middle, and Cumberland Plateau climate divisions reporting more than 2-inches below normal but the East Tennessee division was slightly below that threshold, reporting 1.71-inches below normal.



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

Station data for select airports across the state using automated weather stations shows a similar pattern with warmer than normal conditions at all airports for the year and highly variable precipitation departures.

Station Name	Temperatures (˚F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	%Norm
Memphis	74.1	56.1	65.1	+1.7	100	8/29	2	1/17	61.58	+6.64	112%
Jackson	74.1	52.4	63.3	+3.3	101	8/29	-10	1/17	60.45	+6.52	112%
Clarksville*	72.1	50.7	61.4	+3.0	102	8/29	3	1/17	54.94	+7.73	116%
Nashville	74.1	53.3	63.7	+2.9	102	8/29	-1	1/17	48.28	-2.23	96%
Chattanooga	75.1	54.1	64.6	+2.7	101	8/29	11	1/17	41.46	-13.54	75%
Crossville**	67.3	47.4	57.4	+2.1	95	8/29	-7	1/17	46.94	-10.41	82%
Knoxville	72.2	51.2	61.7	+2.2	98	7/14	0	1/17	55.97	+4.04	108%
Bristol	70.9	46.8	58.9	+2.3	96	7/14	3	1/17	42.99	-0.98	98%

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

Departures and percent of normal calculated using the 1991-2020 30-year climate normals.

**Clarksville was missing 6 days of temperature data (from August 30 to September 4), so the average max, min and mean temperatures as well as the departure from normal listed in the table above are likely lower than in reality since all missing days were in the warmer season.*

***Crossville was missing 10 days of temperature data (from May 10 to 12 and July 26 to August 1) and 11 days of precipitation data (from May 10 to 13 and July 26 to August 1).*

Hottest Stations (highest maximum temperature)

Station Name	Station Type	Highest Temperature (F)	Date
CLARKSVILLE WWTP	COOP	105	08-29
LOBELVILLE	COOP	104	08-30
CHEATHAM LOCK & DAM	COOP	104	08-30
MOUSETAIL LANDING SP	COOP	104	08-30
LEBANON	COOP	103	08-30
TENNESSEE RIDGE	COOP	103	08-30
CAMDEN TOWER TENNESSEE	RAWS	103	08-29
SHILOH NMP TENNESSEE	RAWS	103	08-29
SAVANNAH 6 SW	COOP	102	08-30
SODDY DAISY-MOWBRAY MTN	COOP	102	07-08
NASHVILLE BERRY FIELD	COOP	102	08-30
DECATURVILLE	COOP	102	08-30
MERIWETHER LEWIS TN	RAWS	102	08-28
CLARKSVILLE OUTLAW AP	WBAN	102	08-29
MEMPHIS WFO	WBAN	102	08-30
NASHVILLE INTL AP	WBAN	102	08-29

Eight stations tied for the 9th highest temperature (102°F)

Coldest Stations (lowest minimum temperature)

Station Name	Station Type	Lowest Temperature (F)	Date
LEWISBURG EXP STA	COOP	-18	01-17
GLADEVILLE	COOP	-16	01-18
BETHPAGE 1 S	COOP	-14	01-18
KINGSTON SPRINGS	COOP	-13	01-22
GAINESBORO	COOP	-13	01-17
COALMONT	COOP	-13	01-18
BLEDSOE SF TENNESSEE	RAWS	-13	01-17
LYNCHBURG	COOP	-12	01-18
TAZEWELL	COOP	-12	01-18
CROSSVILLE 7 NW	WBAN	-12	01-17

Warmest Stations (highest mean temperatures)

Station Name	Station Type	Mean Temperature (F)
MEMPHIS INTERNATIONAL AP	WBAN	65.1
CHATTANOOGA AP	WBAN	64.6
SHILOH NMP TENNESSEE	RAWS	64.3
MEMPHIS WFO	WBAN	64
NASHVILLE INTL AP	WBAN	63.7
JACKSON MCKELLAR- SIPES AP	WBAN	63.3
NASHVILLE BERRY FIELD	COOP	63.1
CAMDEN TOWER TENNESSEE	RAWS	63
LEWISBURG TOWER TN	RAWS	62.6
CLARKSVILLE WWTP	COOP	62.4

Coolest Stations (lowest mean temperatures)

Station Name	Station Type	Mean Temperature (F)
MT LECONTE	COOP	44.1
NEWFOUND GAP	COOP	50.8
MOUNTAIN CITY 2	COOP	54.3
CHEROKEE TENNESSEE	RAWS	56.2
CROSSVILLE 7 NW	WBAN	56.5
GATLINBURG 2 SW	COOP	57.1
NORRIS	COOP	57.2
COALMONT	COOP	57.4
CROSSVILLE MEMORIAL AP	WBAN	57.4
MAYNARDVILLE	COOP	57.5

Wettest Stations (highest precipitation totals):

Station Name	Station Type	Total Precipitation (in)
MT LECONTE	COOP	90.38
NEWFOUND GAP	COOP	80.08
BENTON 2.3 ESE	CoCoRaHS	78.75
CLARKSVILLE 4.9 NW	CoCoRaHS	75.15
SEWANEE	COOP	68.9
AMES PLANTATION	COOP	67.31
ATOKA 3.2 ESE	CoCoRaHS	67.17
MCMINNVILLE 8.5 ESE	CoCoRaHS	67
JACKSON 6.1 SSE	CoCoRaHS	66.68
HENDERSON 2.2 SSE	CoCoRaHS	66.27

Driest Stations (lowest precipitation totals):

Station Name	Station Type	Total Precipitation (in)
SMYRNA 1.8 S	CoCoRaHS	40.56
CHATTANOOGA AP	WBAN	41.46
KINGSPORT	COOP	42
BRISTOL AP	WBAN	42.99
JONESBOROUGH 2.5 SSW	CoCoRaHS	43.03
GRAY 3.9 S	CoCoRaHS	43.09
SEYMOUR 5.8 N	CoCoRaHS	44.4
GREENEVILLE 2.8 N	CoCoRaHS	44.76
EAST RIDGE 0.9 NW	CoCoRaHS	45.03
NEWPORT 1 NW	COOP	45.04

Stations missing more than 12 days of precipitation data were not considered for the list of driest stations.

Snowiest Stations (highest snowfall accumulations):

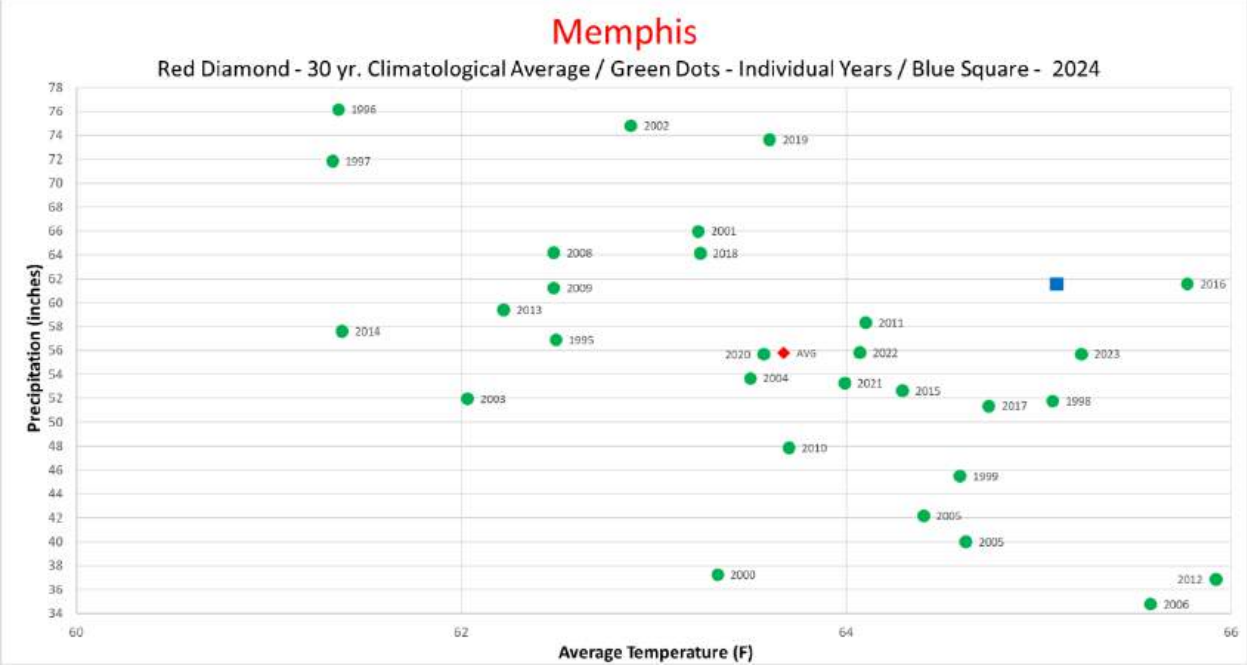
Station Name	Station Type	Total Snowfall (in)
MT LECONTE	COOP	66.8
NEWFOUND GAP	COOP	29.7
ROAN MOUNTAIN 3SW	COOP	20.9
NORRIS 0.6 NW	CoCoRaHS	13.9
MONTEREY	COOP	13.4
TEN MILE 2.2 NW	CoCoRaHS	12.5
MOUNTAIN CITY 2	COOP	12.3
MCMINNVILLE 8.5 ESE	CoCoRaHS	11.9
LENOIR CITY	COOP	11.8
KYLES FORD 1.0 N	CoCoRaHS	11.5

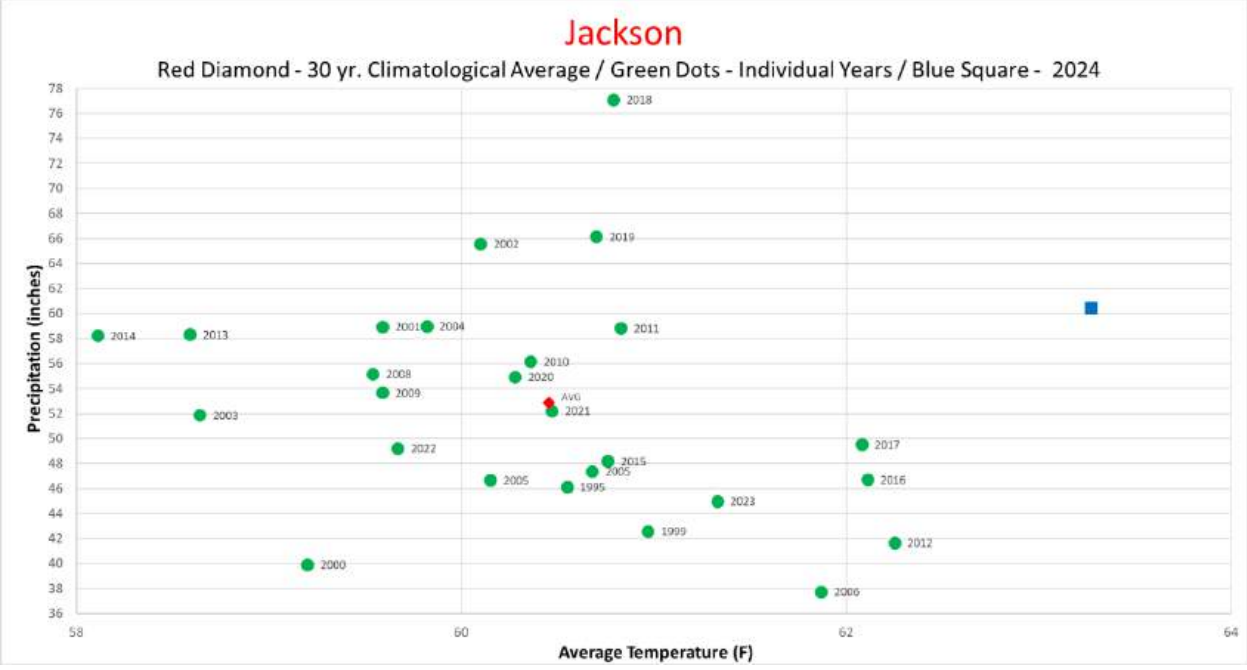
Year in Comparison

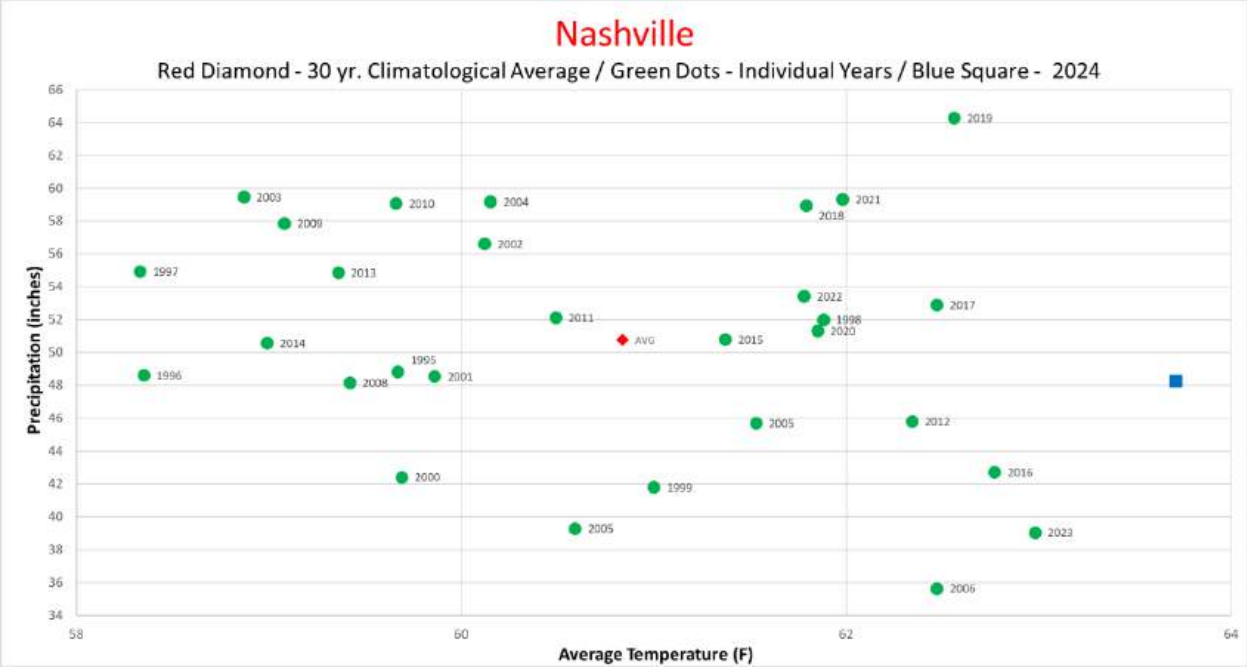
Comparing the annual average temperature and total precipitation for automated weather stations located at select airports across the state, 2024 was warmer than the average of the last 30 years at each station, with Jackson, Nashville, Chattanooga, and the Tri-Cities having the warmest year of the past 30 years, Knoxville having the 2nd warmest year of the past 30 years (behind 2016), and Memphis having the 5th warmest year of the past 30 years. Memphis, Jackson, and Knoxville recorded above average precipitation, while Nashville, Chattanooga, and the Tri-Cities recorded below average precipitation. Only Chattanooga had a top-5 driest year of the past 30 years, with 2024 being the 3rd driest for the weather station.

Looking at the longer-term mean temperature records for these cities and the other climate monitoring station in the state, Oak Ridge, 2024 was the warmest year on record for Nashville (with a 150-year weather history), Chattanooga (with a 146-year weather history), and the Tri-Cities (with a 77-year weather history). 2024 was the second warmest year on record for Knoxville (with a 153-year weather history) being 0.26°F cooler than 2016. 2024 was the 3rd warmest year on record for Oak Ridge (with a 77-year weather history) being 0.17°F cooler than 2019, their warmest year on record. Based on the average high temperatures, Nashville and the Tri-Cities had their warmest high temperatures on record, Chattanooga had its 2nd warmest average high temperature, Knoxville had its 5th warmest average high temperature, and Oak Ridge tied for its 5th warmest average high temperature. Memphis finished the year just outside of the top-10 warmest (based on high temperatures), tying for the 11th warmest on record.

Based on average low temperatures in 2024, Nashville and Chattanooga had the warmest average low temperature on record and Oak Ridge tied for the warmest average low temperature. Knoxville and Memphis both tied for 4th warmest average low temperatures this year, and the Tri-Cities tied for the 6th warmest average low temperature. No long-term climate monitoring station in Tennessee reported a top-10 wettest or driest year. Chattanooga was closest with 2024 being the 18th driest in the city's 146-year weather history.






Nashville
Red Diamond - 30 yr. Climatological Average / Green Dots - Individual Years / Blue Square - 2024
Precipitation (inches)
Average Temperature (F)
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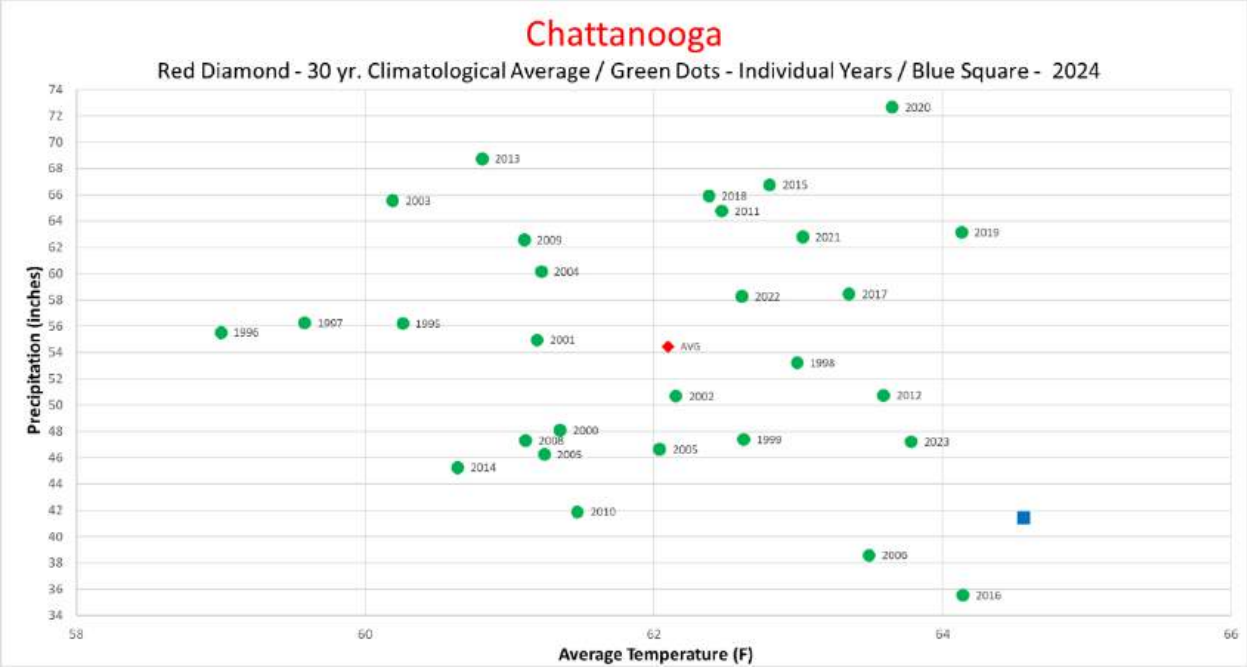
Chattanooga
Red Diamond - 30 yr. Climatological Average / Green Dots - Individual Years / Blue Square - 2024
Precipitation (inches)
Average Temperature (F)
AVG
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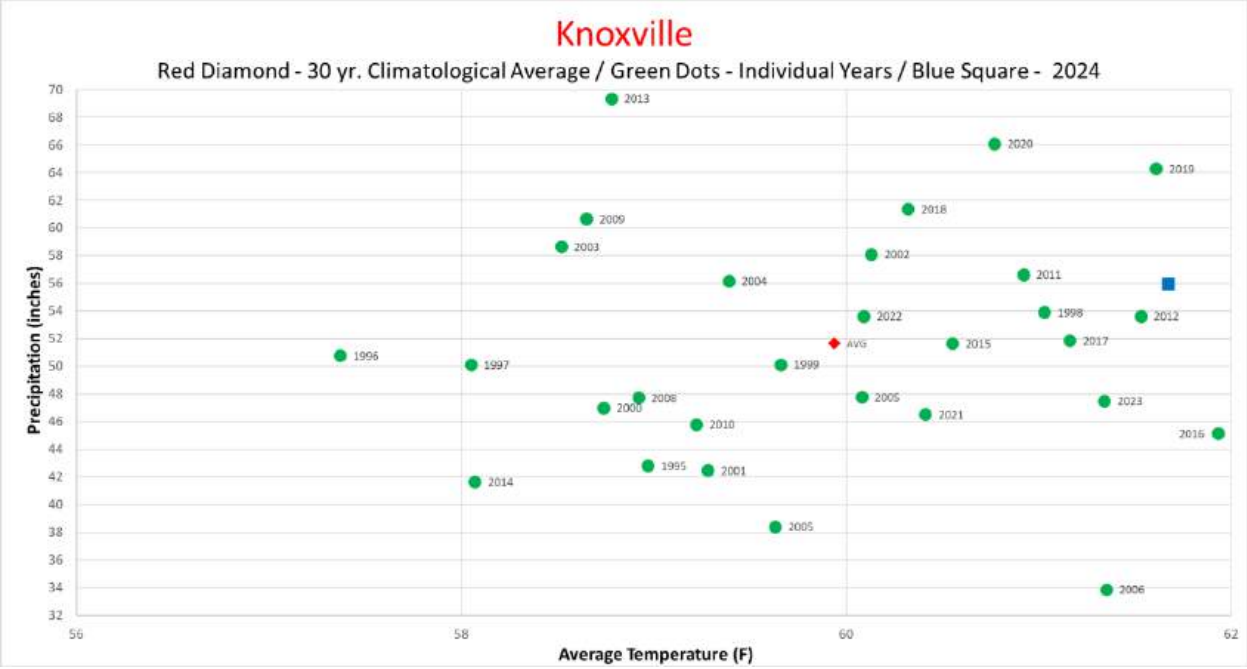
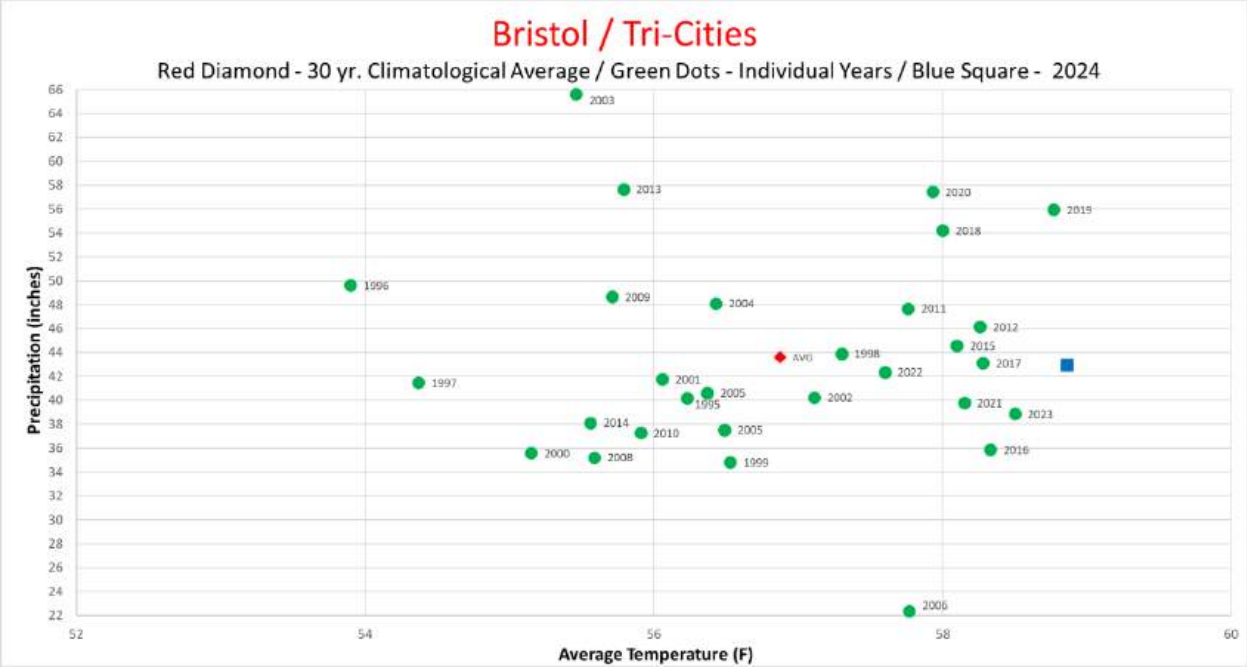




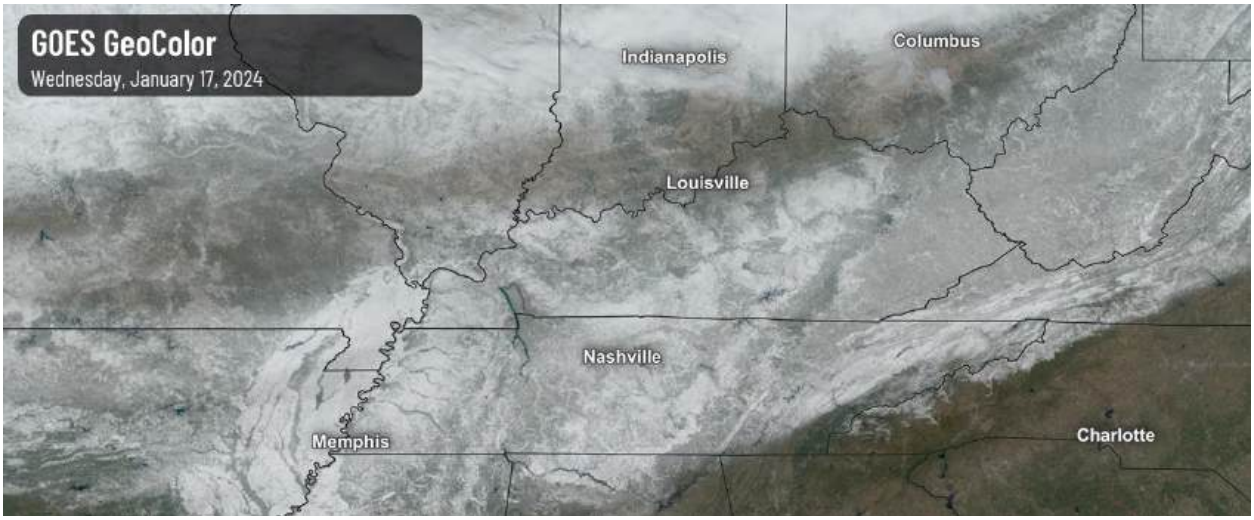
Major Weather and Climate Stories of 2024:

Tennessee had a very active year in terms of weather and climate events with droughts and floods, winter storms, and severe weather. In the sections below the major weather and climate stories for each month of 2023 are recapped.

January:

A strong winter storm and prolonged cold air outbreak impacted the state from January 14-24, with snowfall totals of 2-6 inches common and some areas reporting over 10-inches of snow! As the skies cleared on January 17 the swath of snow across the state was clearly visible in satellite imagery with only a small portion of southeast Tennessee being clear of snow cover. In this area a wedge of warm air was trapped against the mountains leading most of the precipitation to come in the form of rain instead of snow. Temperatures remained below freezing for several days and many areas of the state had snow on

the ground for over a week. Windchill warnings and advisories were issued across the state as air temperatures dropped into the single digits or even below zero across the state with the coldest temperatures reported on the 17th and 18th. Across the state, 74 weather stations reported sub-zero temperatures, with 21 stations reporting temperatures of -10°F or colder! The UT Middle Tennessee AgResearch and Education Center in Lewisburg recorded the coldest temperature, with a low of -18°F on the morning of January 17. Unfortunately, the winter weather proved deadly, with the Tennessee Department of Health reporting a total of 36 weather-related fatalities in connection with the winter storm and cold air outbreak. Numerous communities were under boil water advisories due to frozen pipes and other winter weather-related issues with water supply systems.



Visible satellite imagery from Wednesday January 17 shows most of the state covered in snow, with only a few areas of southeast Tennessee free from snow.

February:

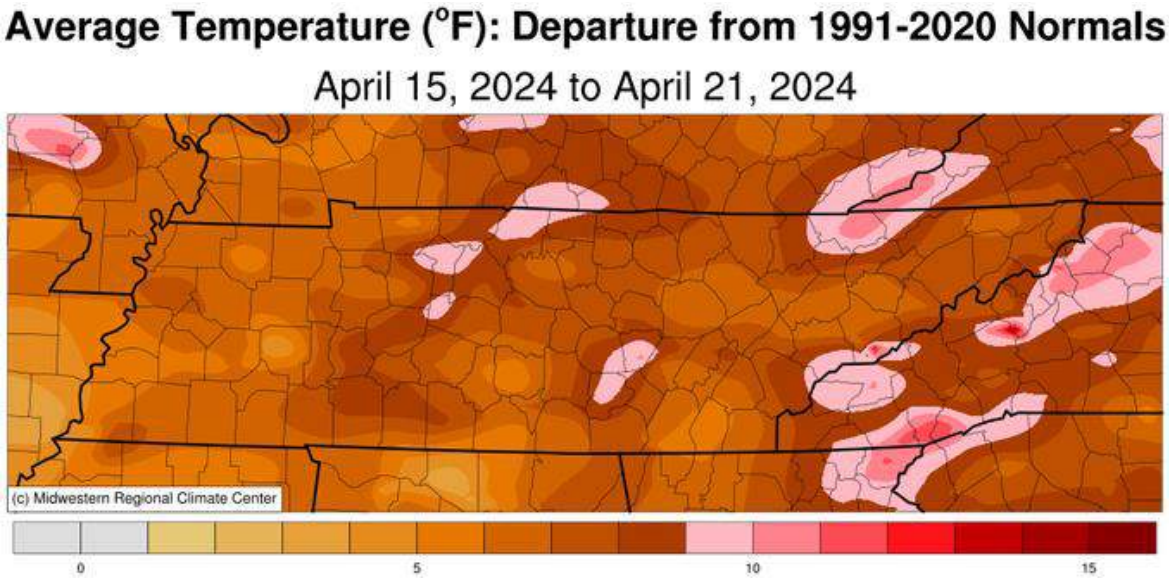
Temperatures rebounded quickly after the cold air outbreak of January and the main weather story for February in Tennessee was warm weather. Average temperatures for the month were 4-8°F warmer than the 1991-2020 climate normals across the state. These much higher than normal temperatures driven by above normal temperatures through most of the month and several rounds of warm weather that sent temperatures into the 70's across the state. Of the 105 weather stations that reported temperature data in Tennessee this month, 87 stations recorded temperatures in the 70's. Most of these weather stations recorded their highest temperatures from February 26-28, with a few others recording their highest temperatures on the 3rd or 4th.

March:

March was a relatively quiet month for weather and climate stories in Tennessee, with one of the biggest stories being the early start to the growing season after a much warmer than normal February and first half of March. This was followed by several cool spells that sent temperatures back to normal or even below normal temporarily. These cool spells prompted frost and freeze advisories/warnings for areas of the state in mid- and late-March.

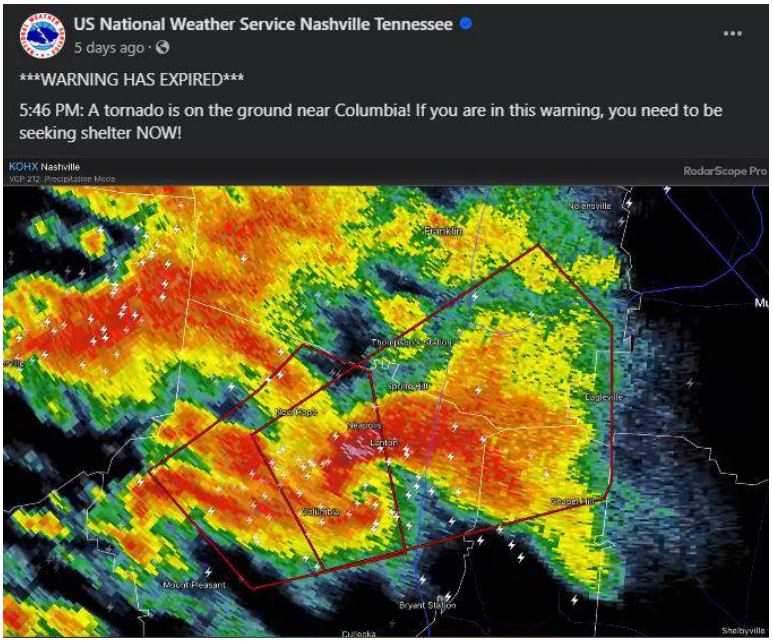
April:

April continued the record-setting warm conditions that impacted the state in the middle of the month. Both the second and third weeks of April brought warmer than normal conditions to the state, but the week of April 15-21 was the warmest with temperatures reaching the upper 80's in most locations and mean temperatures for the week running 6-10°F above normal across many areas of the state. In this two-week period there were 10 tied daily high temperature records, but no new records were set, and there were 8 broken and 14 tied daily records for warmest low temperatures, Lenoir City tied their monthly record for warmest low temperature observed in April during this period. April 1-3 also brought warm low temperatures, with a total of 63 daily records set or tied during those first few days of the month.



May:

May 2024 brought several rounds of severe storms to Tennessee, with many severe storms reported on May 8 and May 26. The storms on May 8 produced two fatalities, with one person killed by a tornado in Maury County, and one by severe thunderstorm winds in Claiborne County, there were an additional 14 weather-related injuries on May 8. The tornado that impacted Maury County was rated an EF3, and this was the strongest tornado in Tennessee in 2024, This tornado prompted the National Weather Service in Nashville to issue a rare Tornado Emergency, which is reserved for storms known to be producing a large and destructive tornado. There were seven other tornadoes confirmed in Tennessee with this storm system, with four tornadoes in Lincoln County. This round of storms also produced 100 reports of severe thunderstorm wind damage across the state, and 47 reports of severe hail 1-inch in diameter or larger, with some hail reported up to three inches in diameter (larger than a baseball)! In addition to the severe weather up to 8-inches of rain fell in a matter of hours for northern Middle Tennessee counties which prompted a flash flood emergency warning in parts of Robertson and Sumner counties. Through the state almost 80,000 customers were without power at some point and several swift-water rescues occurred. Another large round of severe weather impacted the state on May 26 with one tornado, 52 reports of severe thunderstorm wind damage, and 18 reports of severe hail.



Radar image of Maury County tornado.

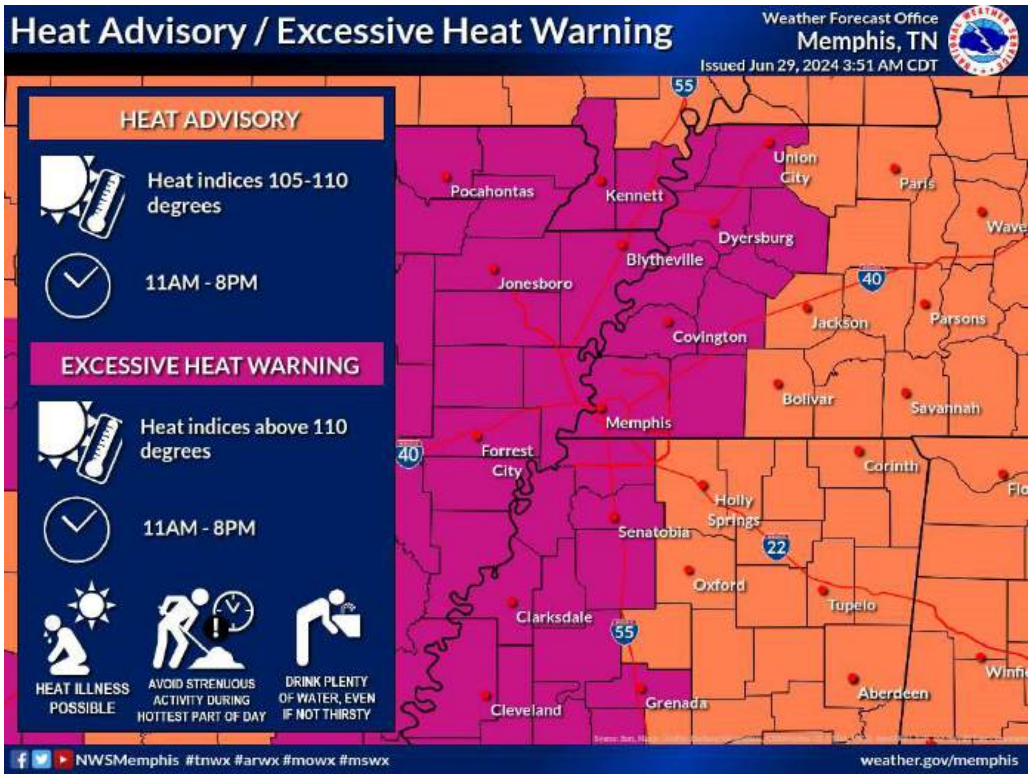
May 8 EF3 tornado seen from a webcam at Columbia Fire Station 3.

June:

Late winter and spring precipitation led to Tennessee being cleared of all drought and abnormally dry conditions on the US Drought Monitor in the first week of June after starting the year with 93% of the state in some level of drought. However, warmer than normal conditions continued into June and was

combined with much below normal rainfall in most areas of the state, and this led to the reemergence of abnormally dry and drought conditions in the state by the end of June.

June started off with close to normal temperatures and even had a solid cold spell in the second week of the month with temperatures falling into the low 50's or 40's in most areas. However, in the second half of the month a persistent heat wave moved from the central US to the east, with above normal temperatures in the third and fourth week of the month. The first Excessive Heat Warning of the year issued in Tennessee was issued for Shelby County on June 25. Several other counties in West TN were also under Excessive Heat Warnings on June 29th and Heat Advisories spread across the state.



On June 26, the Chattanooga airport weather station recorded a high temperature of 100°F, the first 100-degree day for Chattanooga since October 3, 2019, and the first 100-degree day in June since 2012. On the same day, the Tri-Cities airport reach a high of 96°F, their hottest temperature since September 13, 2019, and the highest June temperature since 2012. The text below from a National Weather Service Morristown Facebook post describes these temperatures as well as the lack of rainfall in the cities.

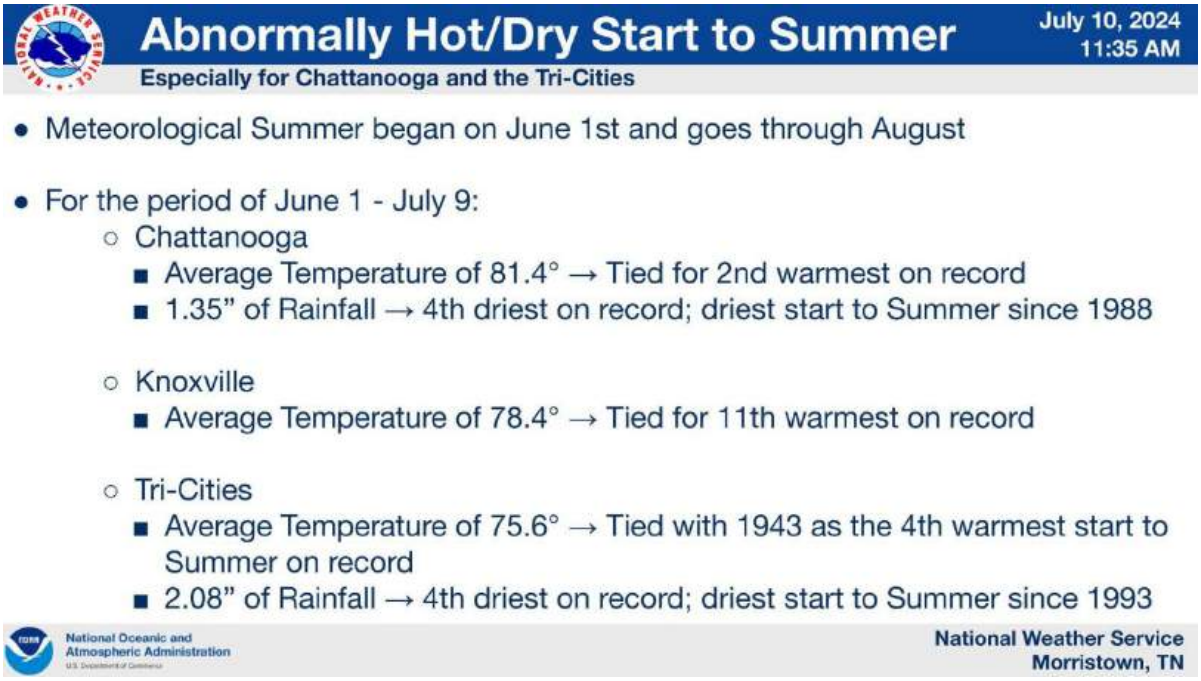
> Yesterday, Chattanooga recorded a high of 100° with a high of 96° in the Tri-Cities. For Chattanooga, this was the highest temperature on any day since October of 2019 and the highest in June since 2012. For the Tri-Cities, this was the highest temperature on any day since September of 2019 and the highest in June since 2012. Both sites are also significantly below on rainfall as well. Unless Chattanooga picks up well over 1" in the next couple of days, this June will be the driest since 2016. Depending on how much rain falls over the weekend, the Tri-Cities could record the driest since 2012 or earlier. #tnwx #ncwx #vawx #mrxwx

The combination of high temperatures and low precipitation led to rapidly emerging dry conditions and set the stage for a flash drought that impacted parts of the state during the rest of the summer. Grasses and other ornamental plants yellowed and showed other signs of stress if they were not irrigated. Hay fields and pastures were the key concern for drought impacts earlier this summer.

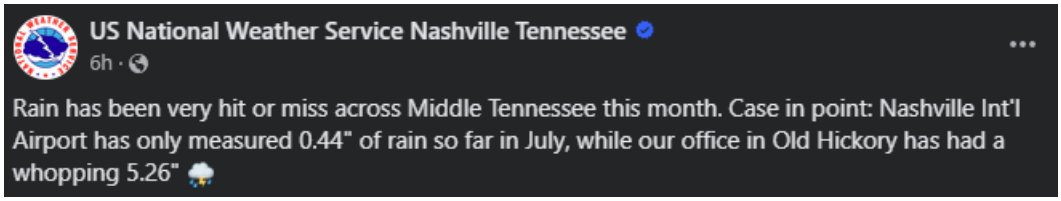
July:

July was an active month for weather- and climate-related stories in Tennessee with drought, floods, heat waves, and severe weather. The first half of the month was mostly hot and dry with only spotty rains and

record-setting heat impacting Middle and East Tennessee. These conditions were a continuation of a warm and dry June, with the first half of the summer season (June-August) being among some of the warmest and driest on record for East Tennessee. West Tennessee was largely spared due to some widespread rain connected to the remnants of Hurricane Beryl and normal to slightly cooler than normal temperatures.

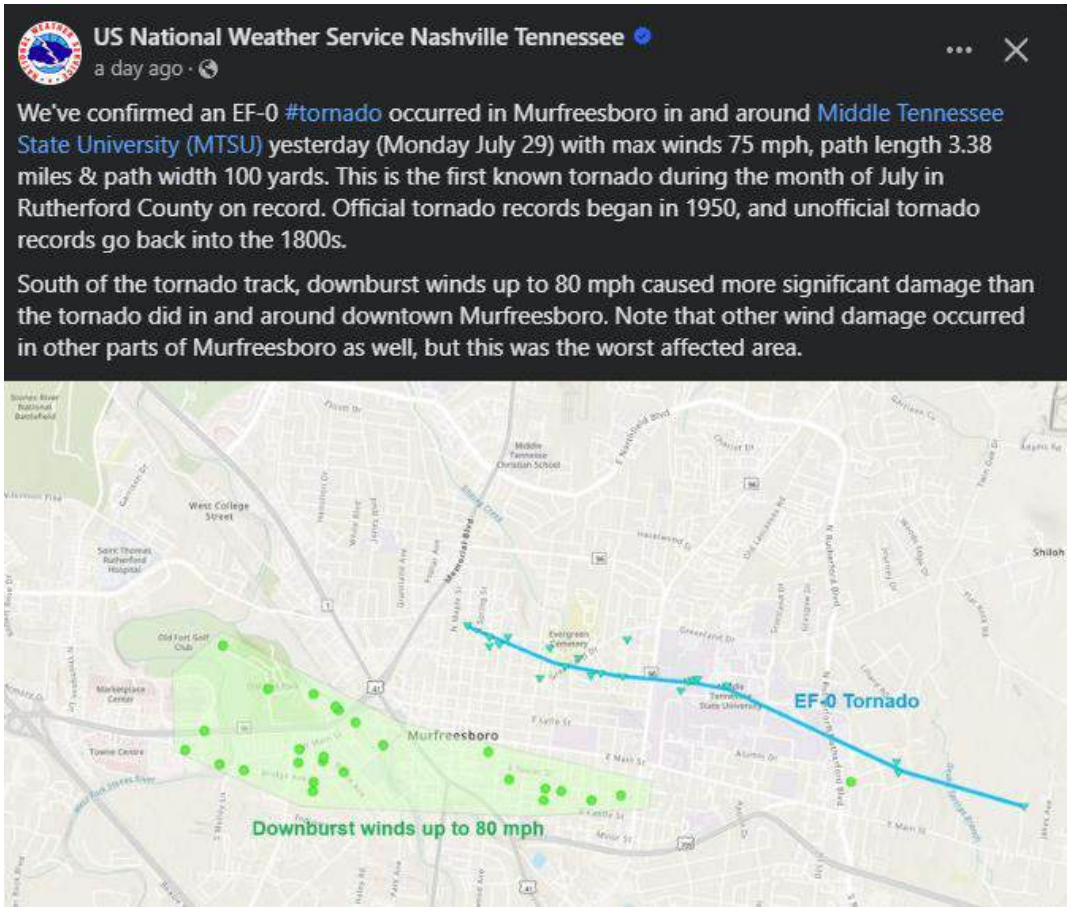


Drought conditions worsened rapidly with lower-than-normal stream flows and agricultural impacts being reported in the first weeks of July. Cattle and corn were the most affected due to the rapid onset and timing of the drought. Scattered storms that moved very slowly produced heavy rains starting after the middle of the month. In many cases a distance of only a few miles made the difference between several inches of rain and no rain. A good example came from the National Weather Service in Nashville, who recorded over 5" of rain by July 22 at their office, while the Nashville International Airport weather station about 10 miles away, recorded less than half an inch in the same time.



More widespread rains came later in the month, but they were also accompanied by severe weather and caused flash flooding in some areas of Middle and East Tennessee. A slow-moving storm dropped several inches of rain on Sevier County on June 28, flash flooding impacted Dollywood and forced the closure of several roads in the county. A strong storm produced an EF0 tornado that impacted Middle Tennessee State University's campus, and a downburst that caused even stronger straight-line winds hit areas near downtown Murfreesboro on June 29. These were among 78 reports of severe wind damage that occurred in Tennessee from June 28-30. More storms produced flooding in and around Knoxville on June 30th with some lanes blocked on I-640 in addition to flooding on some local streets.

Flash flooding at Dollywood, June 28, 2024. Photo via Sophie Elkins-Valenti.



August:

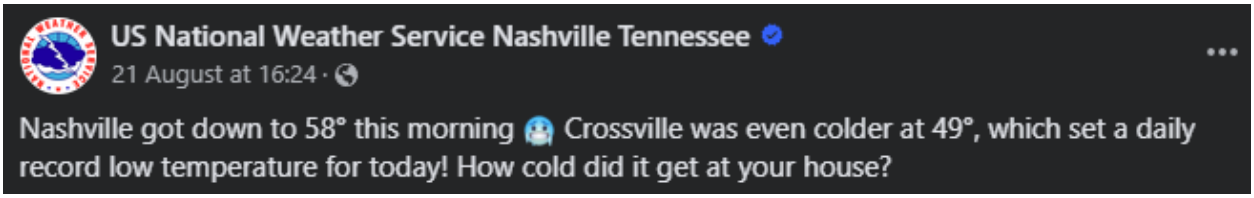
Following a similar pattern to July the main weather and climate stories for August were the very dry conditions mixed with a few days of scattered storms that produced flash flooding and severe wind damage, and the late August heat wave that brought widespread upper 90's and 100-degree highs to the state. August started and ended with localized heavy rains and flash flooding but the majority of the month saw very dry conditions. Many areas of the state recorded less than 30% of their normal August rainfall, with several areas in the western half of the state recording less than 10% of their normal August rainfall! These dry conditions were a major concern for agricultural producers as corn, cattle, pastures,

hay, cotton, and soybeans all saw increases in the percentage of crops rated in poor or very poor conditions. Farm ponds and streams also saw lowering levels or completely dried up. In addition to agricultural concerns, extremely low water levels in streams led to concerns for wildlife. Near Chattanooga, a team from the Tennessee Aquarium, US Fish and Wildlife Service, the University of Georgia, and Tennessee Wildlife Resources Agency worked to rescue endangered Laurel Dace from low streams in an effort to prevent their extinction.

Drought conditions left behind dry rocks and a few pools of water in one of two streams home to Laurel Dace. Image via Tennessee Aquarium Riverwatch.

Areas that received rain during the month often saw it come down in buckets with several storms dropping 1-4 inches of rain over a small area in an hour or two. This led to flash flooding in some cases.

A mostly dry cold front brought cool and less humid conditions to the state in the third week of August, with a peak of the cool spell felt on August 21 when 24 daily low temperature records were set or tied across the state. Coming out of that cool spell temperatures rose for the final days of August with a strong heat wave impacting the state bringing several days of highs in the 90's or 100's to most areas. However, this heatwave was not accompanied by high humidity, so while the air temperature broke 100°F in many locations, the heat index stayed below Heat Advisory or Excessive Heat Warning thresholds. In Nashville the temperature reached 100°F or higher 3 days in a row (August 27-29) for the first time since July of 2012.

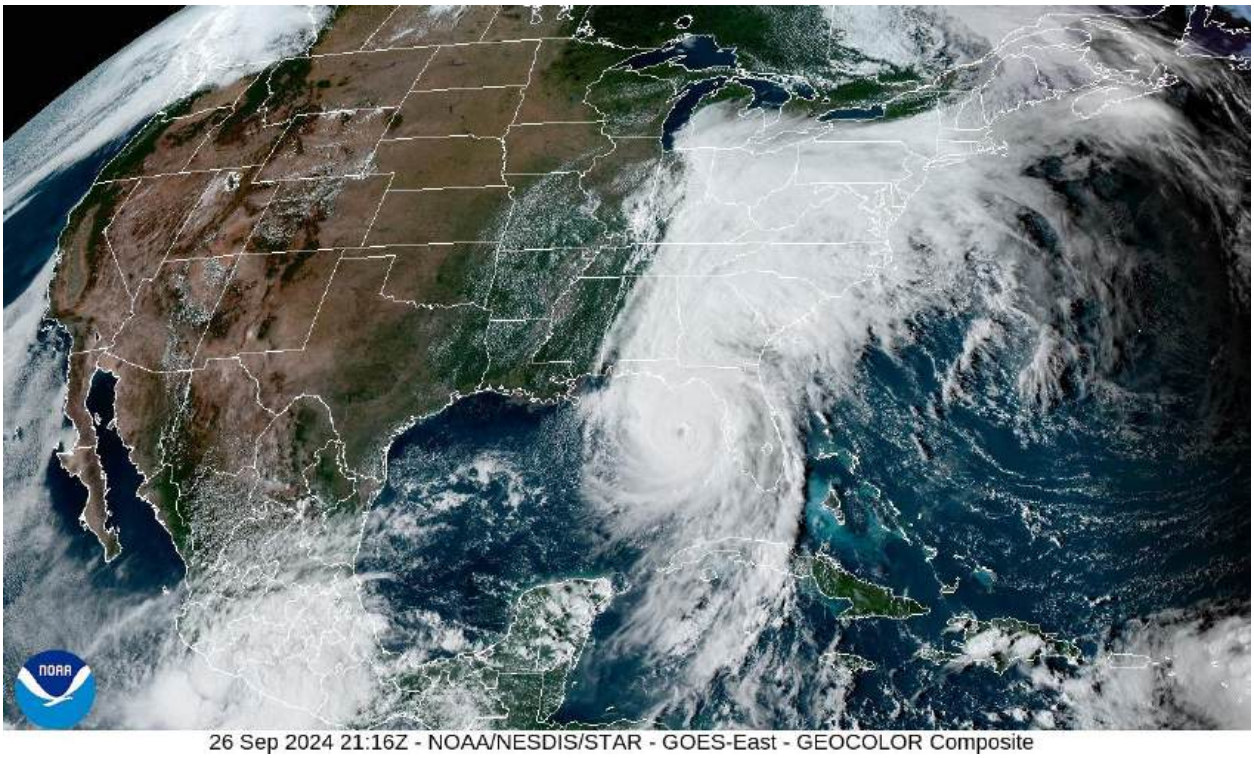


September:

Drought conditions continued to expand during the first three weeks of September, and local utilities issued voluntary or mandatory water use restrictions in several areas of Middle Tennessee and southern East Tennessee. However, the main story from September was the devastating impacts from Hurricane Helene, mostly felt in East Tennessee.

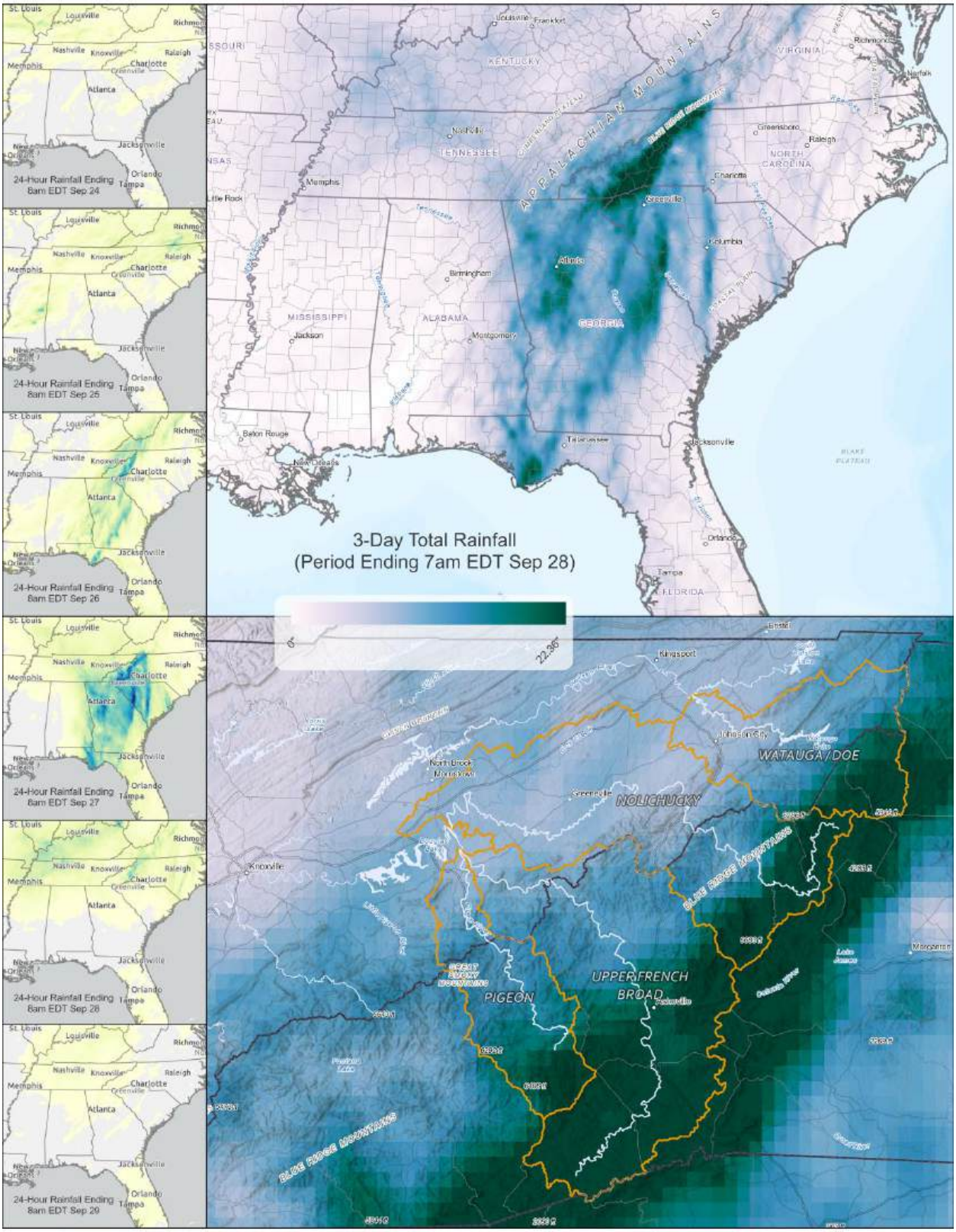
As Hurricane Helene formed in the Caribbean Sea/Gulf of Mexico the National Hurricane Center forecast showed it traveling northward through Florida, Georgia, western portions of the Carolinas and into Tennessee. In the days prior to the storm moving through Tennessee a cold front stalled out in East Tennessee, and produced several inches of rainfall across East Tennessee and Western North Carolina. As seen in the satellite imagery from the afternoon of Thursday, September 26, the clouds from these two weather systems covered the entire eastern US, from Florida north to the Great Lakes and New England. The convergence of this frontal boundary from the west and rain bands from Helene from the east led to record-setting rains along the Appalachian Mountains from Tuesday-Friday (September 24-27) with totals above 15-inches in several areas of Western North Carolina, while totals in Tennessee were generally in the range of 5-9-inches due to the rain shadow effect of the mountains. This extreme rainfall impacted many areas of Western North Carolina but several rivers in upper East Tennessee have their headwaters in this area, and as all of this rain drained into the rivers deadly and devastating flash flooding occurred along these rivers. The most impacted watersheds in Tennessee (from North to South) were the Watauga/Doe Rivers, Nolichucky River, Upper French Broad River, and Pigeon River, all of which entered major flood stage or set record stream heights. From North: the Doe River at Elizabethton crested at 10.76-feet, just about 1.7-inches below the record flood stage set in 1998. Watauga Lake, behind the Watauga Dam set record water levels, about 3-feet above the previous record lake level. The Nolichucky River gauge at Embreeville reported a stage of 19.56-feet, just short of Major flood stage, at 11:30am before the gauge stopped reporting due to an equipment malfunction. This was several hours before peak

water levels arrived along this river section. Post-event, USGS reported a peak of 33.88-feet at the gauge location. The French Broad River near Newport, reported a peak of 23.34-feet, just 8-inches short of the record flood height from March 1867. The Pigeon River at Newport peaked at 28.90-feet, well above the previous record flood stage of 23.4-feet set in February 1902.



Satellite imagery showing the clouds from Hurricane Helene and the stalled frontal boundary across the eastern U.S. on Thursday evening, Sep 26.

Extreme Rainfall From A Stalled Frontal Boundary And Hurricane Helene Across The Southeast
With A Focus On Rainfall That Produced Deadly Flooding Along Rivers in East Tennessee

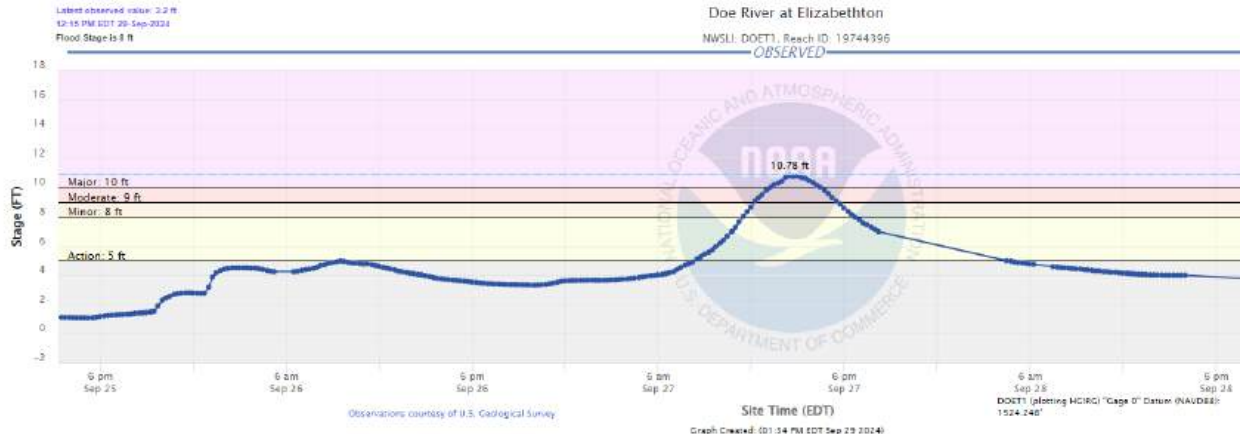


Maps produced by Wil Tollefson at the Tennessee Climate Office, Department of Geosciences, East Tennessee State University

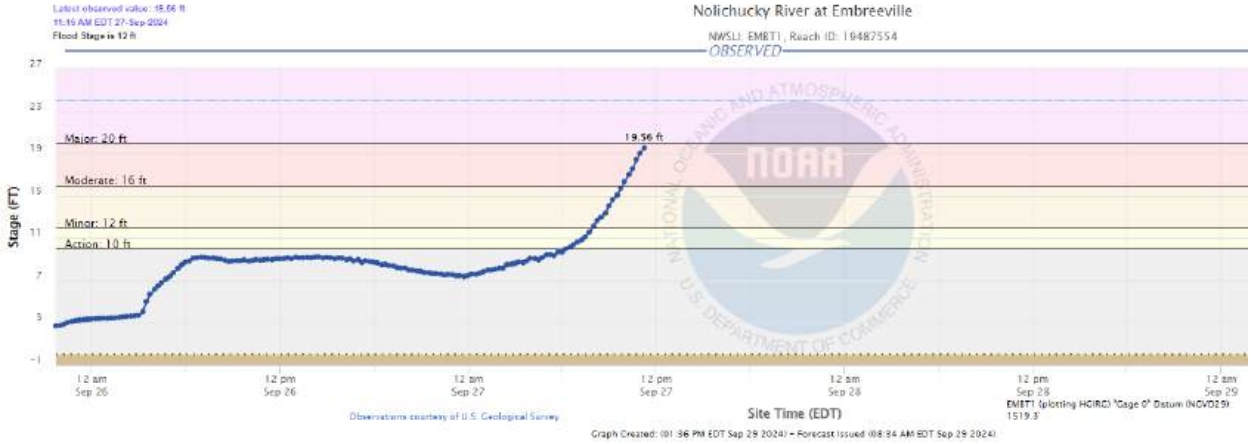
EAST TENNESSEE STATE UNIVERSITY

Rivers in Tennessee
Most Affected Watersheds in TN
Lakes in TN
State Boundaries
County Boundaries

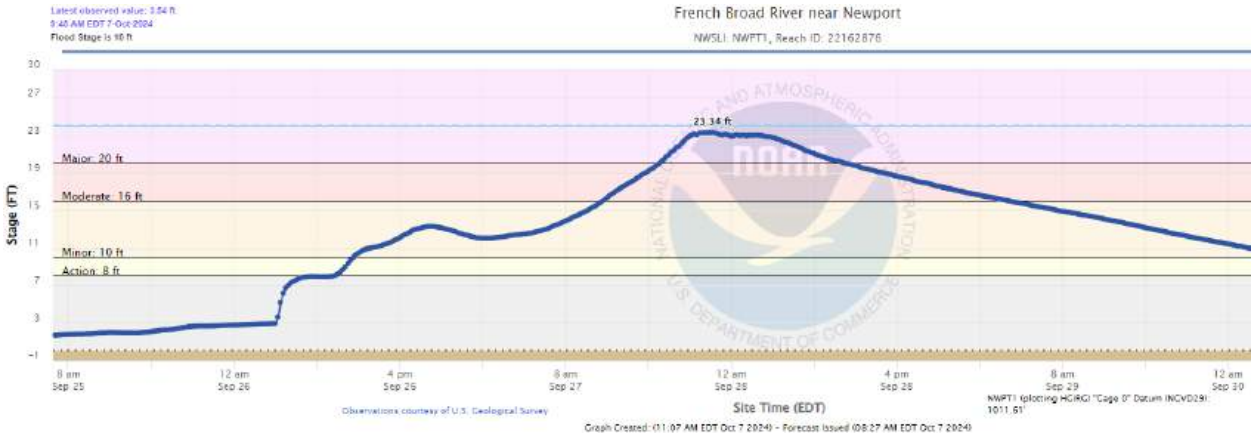
Precipitation Data from: PRISM Climate Group, Oregon State University, https://prism.oregonstate.edu, data accessed 2 October 2024
Basemap Data from: Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS, Esri, CGIAR, USGS, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, USFWS, Esri, USGS



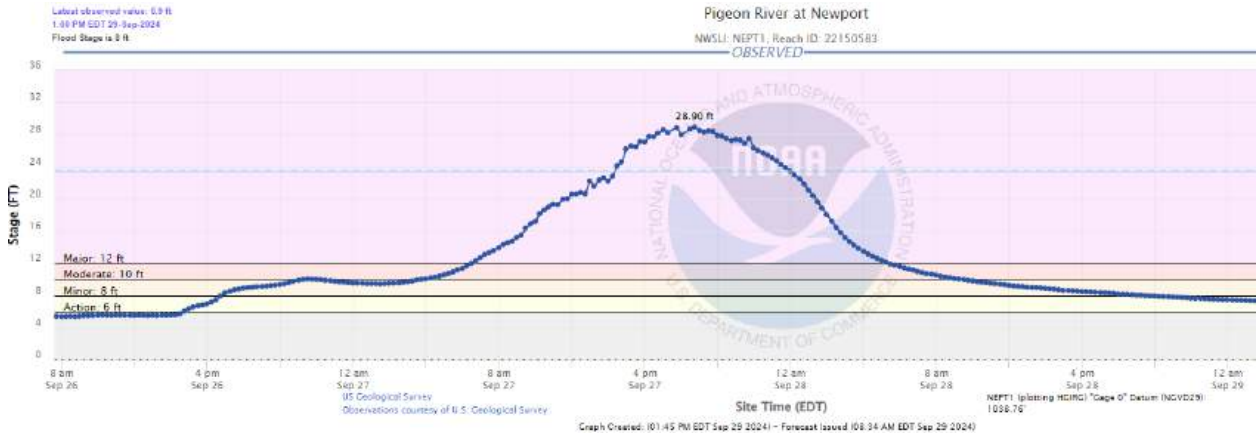
Doe River at Elizabethton, with a peak flood stage just about 1.7-inches below the record flood stage of 10.92-feet, set in January 1998.



The Nolichucky River at Embreeville recorded a peak stage of 19.56-feet before a malfunction caused the gauge to stop reporting data just below major flood stage, at 11:30am on Friday, September 27, several hours before the peak of 33.88-feet at this location.



French Broad River Near Newport reached a flood crest of 23.34ft, about 8-inches below the record flood stage set in March 1867.



Pigeon River at Newport reached a new peak flood stage of 28.9-feet, surpassing the previous record flood stage of 23.4-feet set in February 1902.

Flooding on the Nolichucky washed out bridges on I-26 in Erwin, TN, and flooding on the Pigeon River eroded the road-bed causing portions of I-40 to collapse into the river. While the section of I-40 between Tennessee and North Carolina remained closed through the rest of 2024, a two-lane (temporary repair) I-26 bridge was able to reopen to traffic on October 30, 2024. In addition to the interstates, several other state and US highways were closed due to flooding and many bridges over the Nolichucky were washed away in Washington and Greene counties.

Doe River flooding on Hwy 19E in Hampton, TN. Source: Facebook, Elizabethton/Carter County Priority News & Alerts

Debris near what was Taylors Bridge on State Route 81 in Washington County, TN Source: Facebook

Remains of the Kinser Bridge on Hwy 107 over the Nolichucky River in Greene County. Source: Facebook

As it became clear that life-threatening flash flooding was occurring, the National Weather Service office in Morristown issued flash flood emergencies for Unicoi, Washington, Greene, and Cocke counites. In addition to flash flooding, it was reported that the Walters Dam on the Pigeon River and the Nolichucky Dam in Greene County were at risk of imminent failure. Luckily the dams did not fail, but devastating flooding still occurred downstream. Along the Nolichucky River, southern sections of Erwin, TN were flooded, as the river quickly rose out of its banks and swept away several bridges. Unicoi County Hospital was evacuating when rising waters cut off escape routes before the evacuation was finished. The water was moving so fast and filled with so much debris that boats could not be used to safely ferry people to high ground, so about 50 people were moved to the roof of the hospital to await airlift rescue. This was also the area where the I-26 bridges were taken out by fast-flowing debris in the river, along with the Chestoa Pike Bridge that served as the Nolichucky River crossing for the Appalachian Trail. Several other

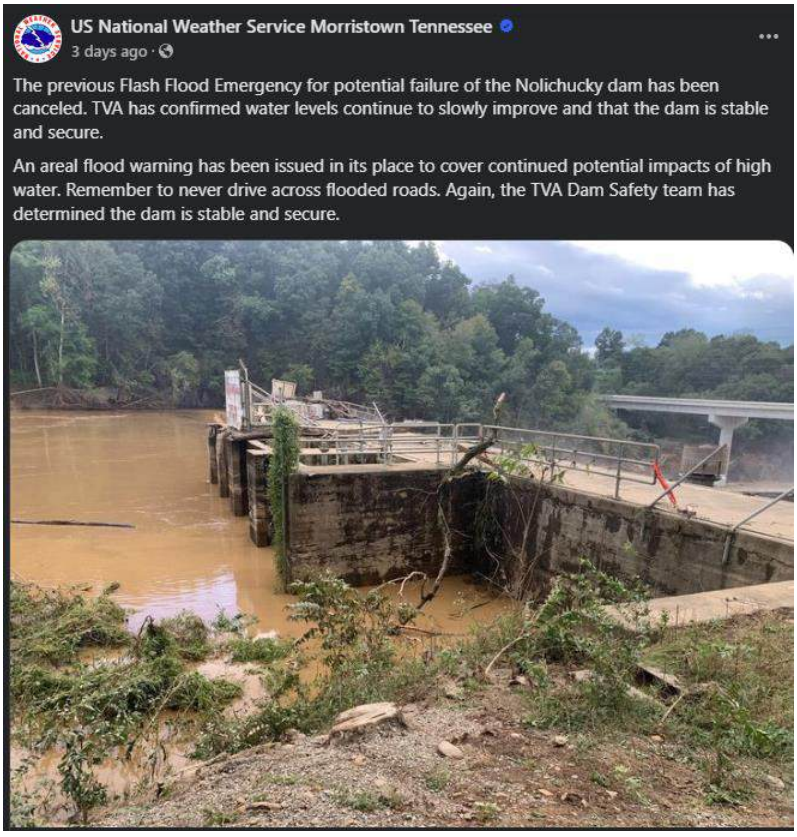
businesses, homes, and churches were destroyed by the river as it came out of the Nolichucky Gorge into the broader Unicoi valley.

People waiting on the roof of Unicoi County Hospital, after the Nolichucky River inundated the building Source: NewsNation

Area around the I-26 Jackson-Love Exit in Erwin, TN after the flood including the Unicoi County Hospital on the right side of the image. Source: Johnson City Aerial Photography

The Nolichucky River then cuts through another mountain ridge into Washington County and out onto the broader Tennessee Valley flowing south into Greene County, where at the Nolichucky Dam the TVA reported that peak discharge occurred around 11pm on September 27, with around 1.3 million gallons of water flowing over the dam each second! That is about twice the average flow rate of Niagara Falls, which averages 700,000 gallons of water per second.

Nolichucky Dam, Greene County, near the peak of the flood. Source: Facebook



Reports that a dam had failed upstream in North Carolina on the Pigeon River led to the emergency evacuation notice for Newport, TN. That dam did survive, but flooding on the Pigeon River enveloped all of downtown Newport Friday afternoon and evening.

Downtown Newport, TN flooded by the Pigeon River. Source: WBIR

The French Broad, Pigeon, and Nolichucky rivers all empty into Douglas Lake, operated by the TVA and the lake filled with water and debris from the floods. The TVA deployed a 4,000-foot floating barrier in the lake to protect Douglas Dam intake from damage as they also set record levels of water flow through the dam, with minor flooding downstream of the dam.

Flooding along these rivers also led to the loss of drinking water supplies and wastewater treatment plants in several communities, with up to 5 counties issuing boil water advisories. In addition to flooding, large portions of the state also saw high winds that downed trees and powerlines, and at one point there were over 100,000 customers without power in the state. As of October 14, the Tennessee Emergency Management Agency and Tennessee Department of Health confirmed 17 weather-related fatalities in Tennessee.

Heavy rainfall and high winds also impacted Middle and West Tennessee, with northern parts of Middle Tennessee reporting 4-6-inches of rainfall, but due to severe to extreme drought conditions in that region, there were no notable reports of flooding, although Nashville did break a record for September 27, with a total of 4.45" of rain. Nashville also recorded their 9th lowest pressure ever recorded with a barometric pressure of 988.4-millibars on September 27, as the center of Helene passed nearby. All airport locations in East and Middle Tennessee recorded barometric pressures below 990-millibars (a very strong low pressure reading), with Knoxville reporting the lowest atmospheric pressure in the state at 980.9-milibars, less than 3-millibars from their all-time record lowest pressure and the average central pressure of a strong category 1 hurricane.

October:

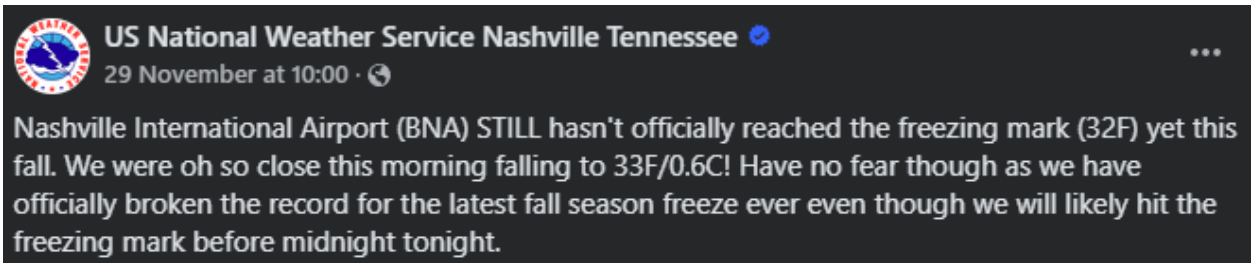
Following an intense and devastating September, October was a much quieter month for weather stories across Tennessee, with the main weather events being the lack of rainfall for most of the month and temperature whiplash from two weeks with record heat interrupted by a week with record cold temperatures. Dry conditions were observed across the state for most of October, with little widespread rainfall anywhere until Halloween. The weather station at the Nashville International Airport, with data from 1940 through 2024, had its 4th longest dry streak, with 26 days in a row without precipitation from September 30 – October 25, 2024. In several parts of Tennessee daily high temperature records were set between October 6 and 14, followed by a strong cold front that sent temperatures tumbling, producing frosts around the state and even snow for the highest mountains in East Tennessee. Mt LeConte set a daily snowfall record with 2.99-inches on October 16, 2-inches above the previous daily record set in 2023. This also ties with last year for the 2nd earliest snowfall in the station's 37-year weather history, behind only 2010's first snowfall measured at the Mt. LeConte station on October 4.

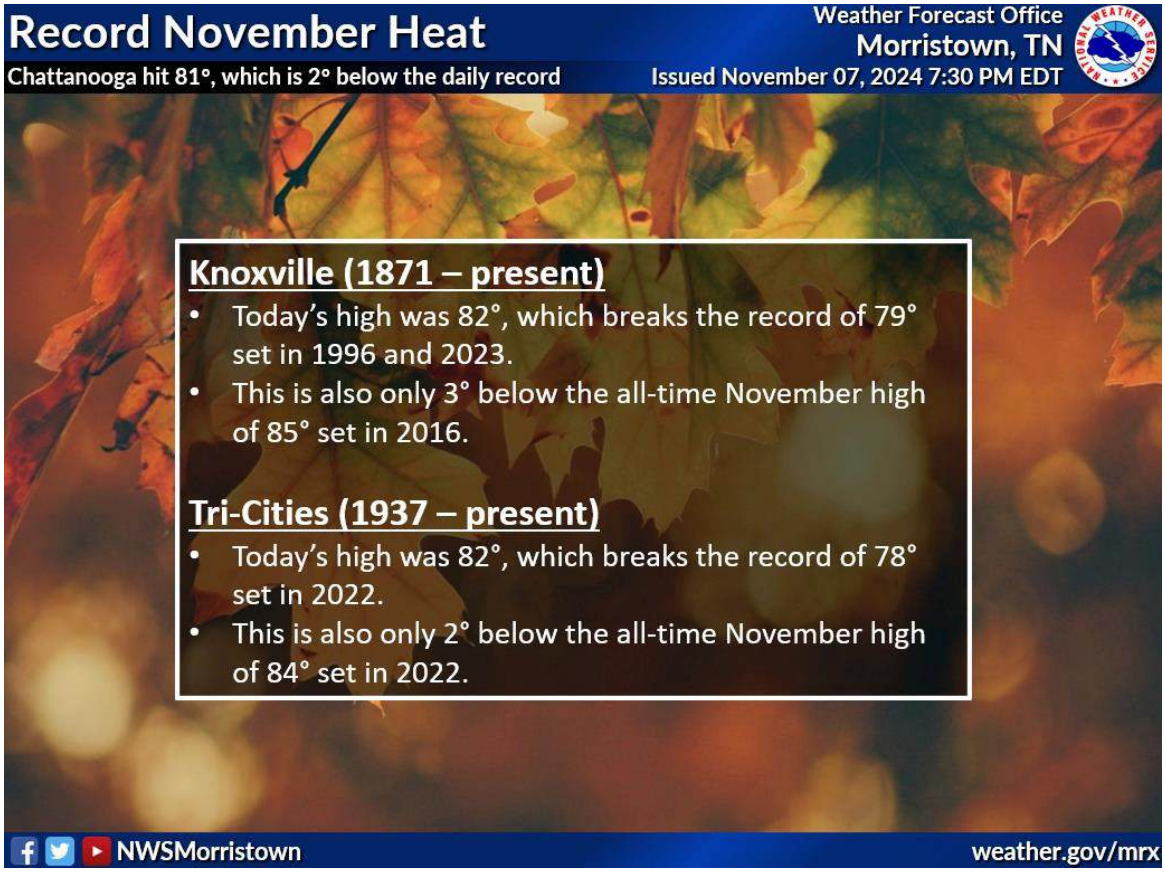
Snow at LeConte Lodge on October 16. Source: Facebook

The cold air set daily low temperature records and record-cool high temperatures from October 15 to 17. A few days later warm sunny skies and southerly winds brought record heat back to the state from October 23 to 31.

November:

The warmer conditions continued from the final days of October into the first three weeks of November. During the month, there were 32 broken and 25 tied daily high temperature records set in Tennessee and 99 broken and 20 tied daily records for warmest low temperature. Of the record warm low temperatures, 9 broke and 7 tied the monthly records for the warmest low temperature ever recorded at that station during the month of November. In addition to the record temperatures, the Nashville airport set a new record for the latest first freeze, not recording a temperature of 32°F or colder until November 29, beating the previous latest freeze date from 2009 by 2 days. The record heat also contributed to deterioration in drought conditions in the eastern half of the state where drier than normal weather persisted since after Hurricane Helene at the end of September.



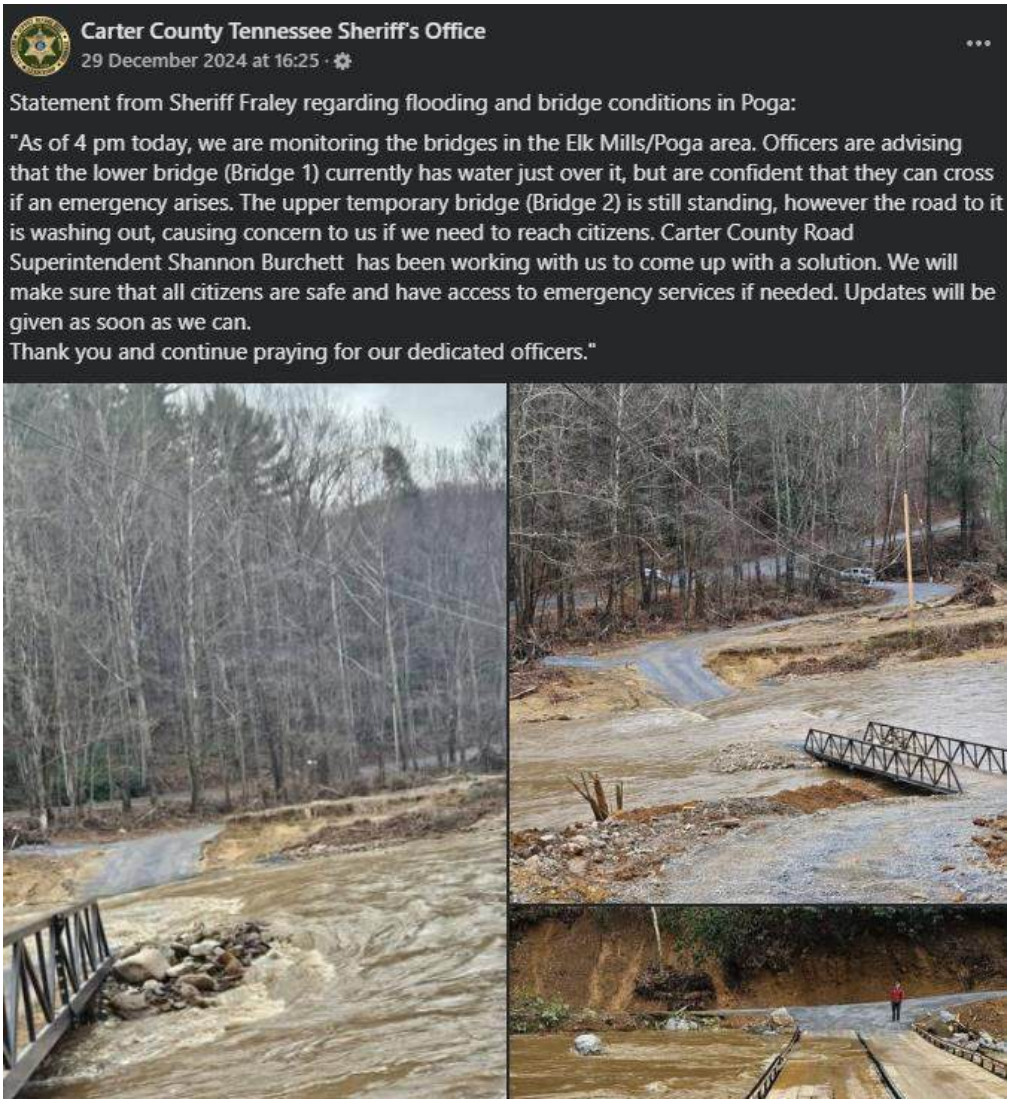


December:

The main weather and climate stories of December 2024 were the strong blast of cold air early in the month that led to widespread light snowfall and record cold temperatures from December 3-6, as well as two cold fronts that brought strong thunderstorms that led to localized flash flooding, some small hail, and strong winds to the state on December 18 and December 28-29.

December started out with a blast of cold air across the state and measurable light snow in parts of Middle and East Tennessee from December 2-6. There were 20 broken and 7 tied daily low temperature records this month, with all broken records occurring on December 5th or 6th. Additionally, there were 10 broken and 8 tied daily records for coolest high temperatures set this month, with all broken records set between December 3rd and 6th. This cold blast was accompanied by snow for some and there were 3 daily snowfall records set on December 3: Mt LeConte in Sevier County with 5-inches, Newcomb in Campbell County with 0.39-inches, and the Murfreesboro 5N weather station in Rutherford County with 0.12-inches. This was the first measurable snowfall reported on a December 3rd for the Murfreesboro and Newcomb weather stations with an 88- and 73-year weather history, respectively.

Strong thunderstorms and heavy rains associated with cold fronts sweeping the state on December 18 and 29 led to localized flash flooding and reports of strong winds, and small hail. Although no hail crossed into the severe category (1-inch diameter or larger) there were some reports of severe thunderstorm wind damage in Lincoln County on December 28, this was the first report of severe weather in Tennessee since late September. Heavy rains on the 29th led to flash flooding and temporary closure of roads and temporary bridges in parts of Carter County that were impacted by severe flooding in September from Helene.


Carter County Tennessee Sheriff's Office
29 December 2024 at 16:25 ·
Statement from Sheriff Fraley regarding flooding and bridge conditions in Poga:
"As of 4 pm today, we are monitoring the bridges in the Elk Mills/Poga area. Officers are advising that the lower bridge (Bridge 1) currently has water just over it, but are confident that they can cross if an emergency arises. The upper temporary bridge (Bridge 2) is still standing, however the road to it is washing out, causing concern to us if we need to reach citizens. Carter County Road Superintendent Shannon Burchett has been working with us to come up with a solution. We will make sure that all citizens are safe and have access to emergency services if needed. Updates will be given as soon as we can.
Thank you and continue praying for our dedicated officers."