July 2023

CliSciPol

Climate Science and Policy for Nonscientists

One picture is worth a thousand words.

Tornadoes, The Texas Heat Dome, The July 4 Heatwave

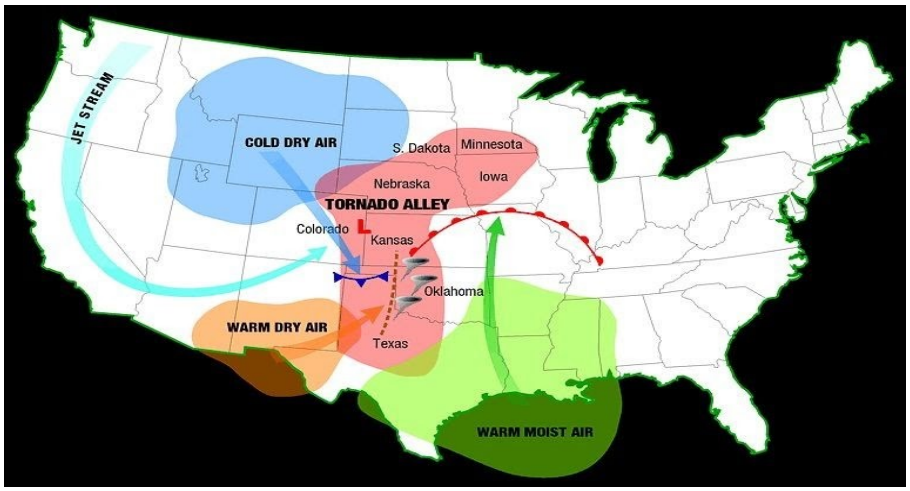
Tornadoes kill more Americans than any other form of violent extreme event, an average of 71 per year. Fortunately most tornadoes have wind speeds of less than 110 miles per hour, are only about 250 feet across and, travel only a few miles along the ground before dissipating. But the Tri-State Tornado of 1925 had wind speeds over 260 miles per hour. It moved forward at over 70 miles per hour, and its path of destruction was 219 miles long. It killed over 700 people and injured over 2,300.

Tornado Fujita Scale

F Number	Wind	Damage
f 0	45 - 78	little damage
f 1	79 - 117	minor damage
f 2	118 - 161	roof gone
f 3	162 - 209	walls collapse
f 4	210 - 261	blown down
f 5	262 - 317	blown away

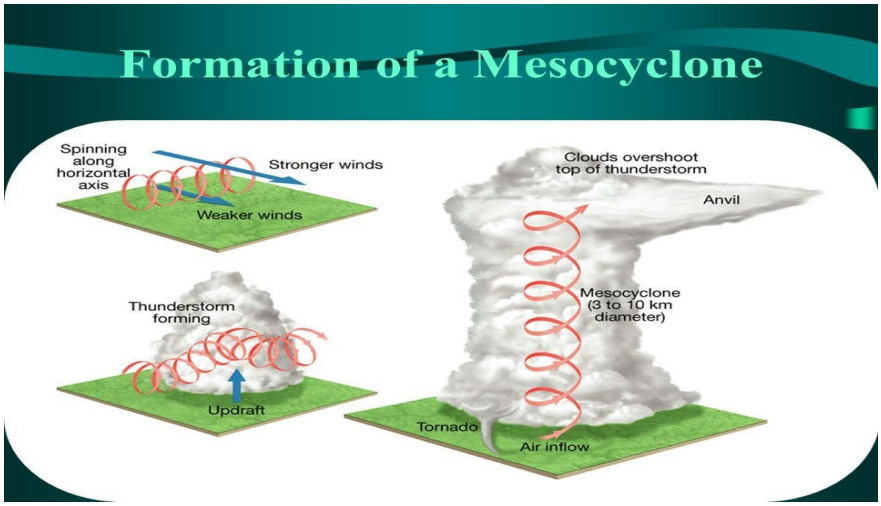
As with hurricanes, tornadoes are graded by strength. The Tri-State Tornado was EF5. Fortunately in the US roughly 80% of the tornadoes are EF0 or EF1.

The US has far more tornadoes than any other country in the world, more than 1,300 per year, whereas Canada, the country with the second most tornadoes, has only around 100 per year.



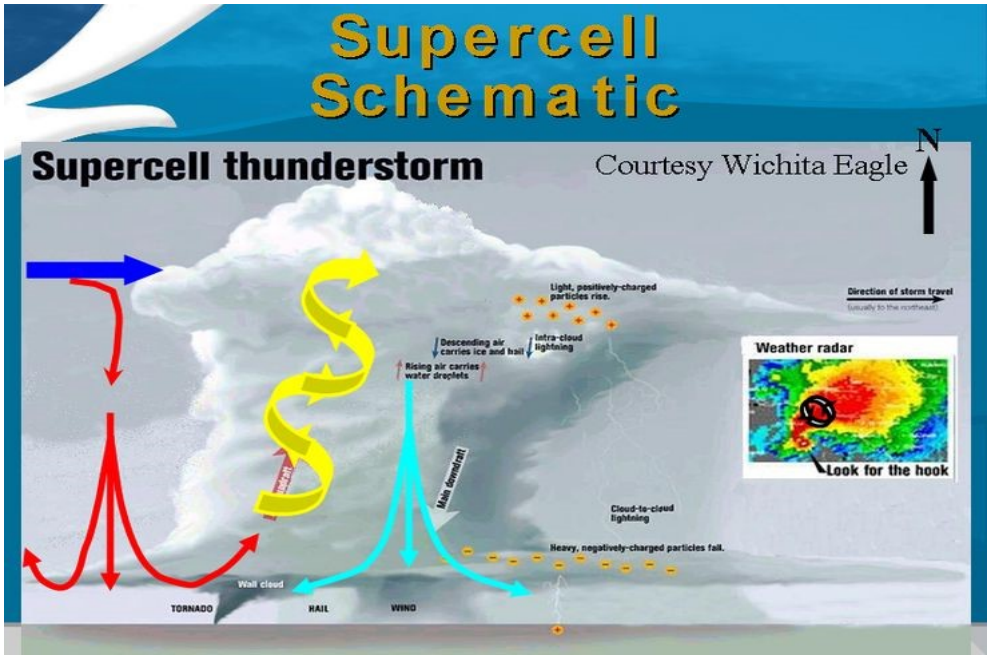
The central US provides ideal conditions for tornadoes to form. The tornado region is known as Tornado Alley. High altitude, cold, dry winds sweep down from the Rocky Mountains while low altitude, warm, moist winds move up from the Gulf of Mexico.

When these winds collide, they create spinning, horizontal cylinders of air.



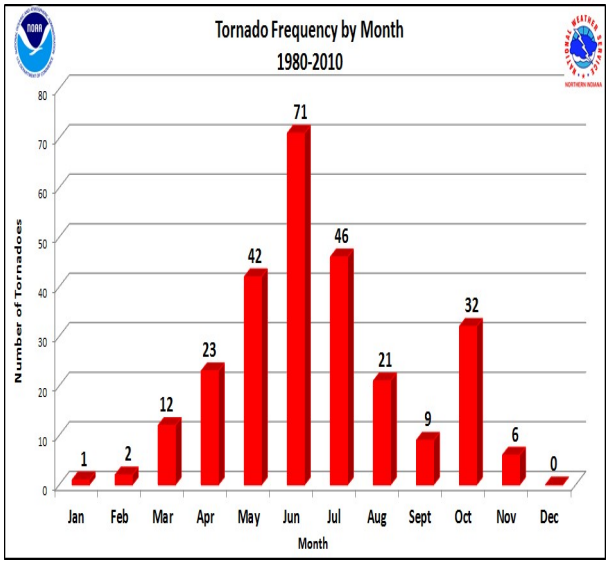
Thunderstorms have very strong updrafts that can exceed 150 miles per hour. When a thunderstorm encounters a spinning horizontal air cylinder, it can lift the cylinder into a vertical position, which can then "touch down" forming a tornado.

Tornadoes are often accompanied in the area by torrential rains, hail, and lightning. Scientists have learned that, when the radar pattern of a thunderstorm displays a feature known as "the hook," a tornado is likely to be formed.



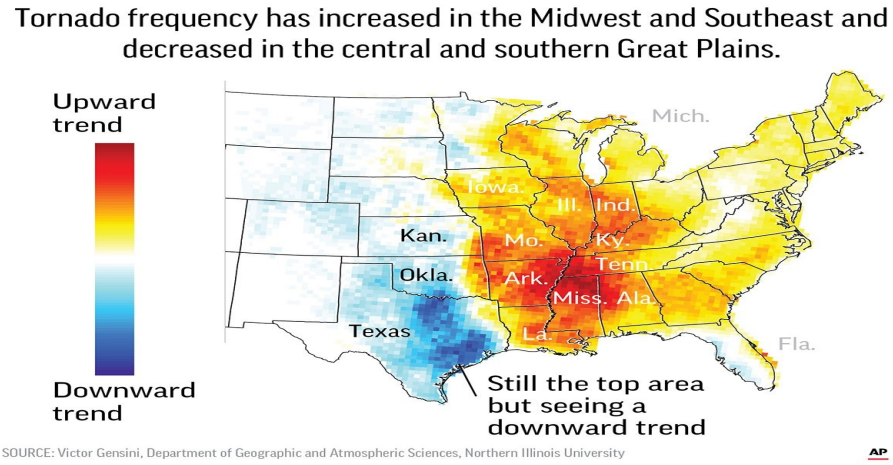
In Tornado Alley systems for spreading tornado warnings have been developed, but predicting tornadoes remains significantly problematical.

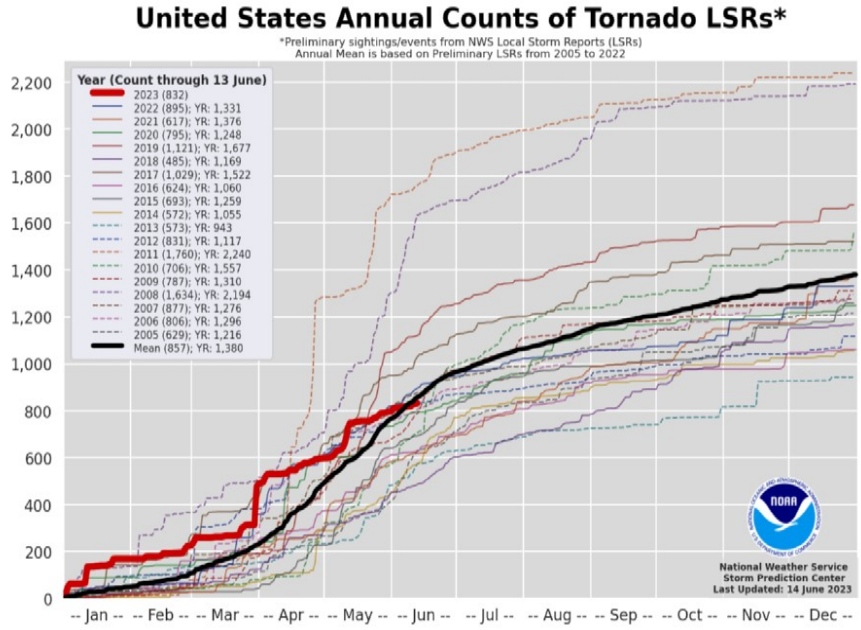
A common practice for homes in Tornado Alley is to have an underground, backyard tornado shelter.



June is the peak month for tornado activity. For example, on June 16, 2023, a tornado hit Perryton, Texas (population of about 8,000). It was EF3, strong enough to blow off roofs and collapse walls. It lasted 11 minutes. Its path on the ground was 6.39 miles long and half a mile wide. A tornado's destruction depends on whether it strikes a populated area. Cities and towns occupy only about 0.5% of the earth's surface, so tornadoes usually miss densely populated areas. Unfortunately this tornado went right through the center of Perryton. Three people were killed. Many homes and businesses were destroyed. Over 200,000 people in the area lost electric power.

Some analyses show that Tornado Alley is moving Eastward, and some scientists attribute this to climate change, but there is no consensus on these issues.



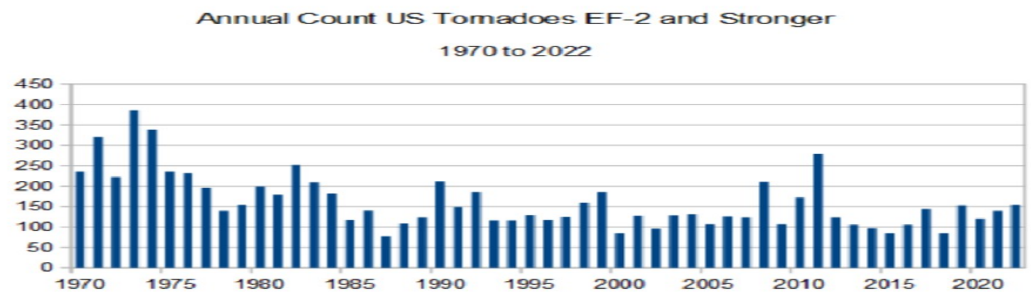


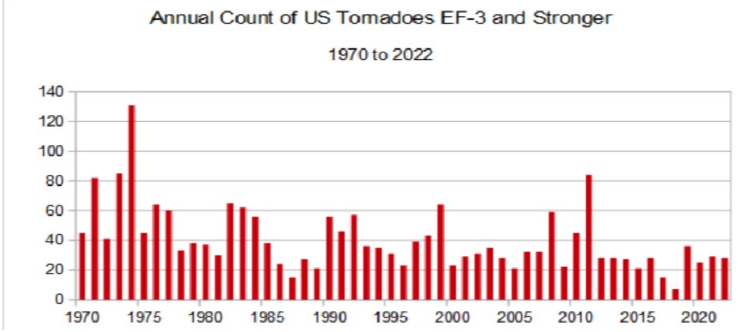
The frequency of US tornadoes varies significantly from year to year, but for 2023 through mid-June the frequency was at the mean for the period 2005-2022. Each of the years 2020, 2021, and 2022 had fewer tornadoes than the mean of 1,380. The IPCC agrees that the mean annual number of US tornadoes remains "relatively constant." [AR6 WGI p.1595 (2021)]

https://www.spc.noaa.gov/wcm/#data (https://www.spc.noaa.gov/wcm/#data)

NOAA's Storm Prediction Center (SPC) has now published the full data for US tornadoes last year.

The frequency of EF2+ (EF2-5) tornadoes has been declining since 1970.





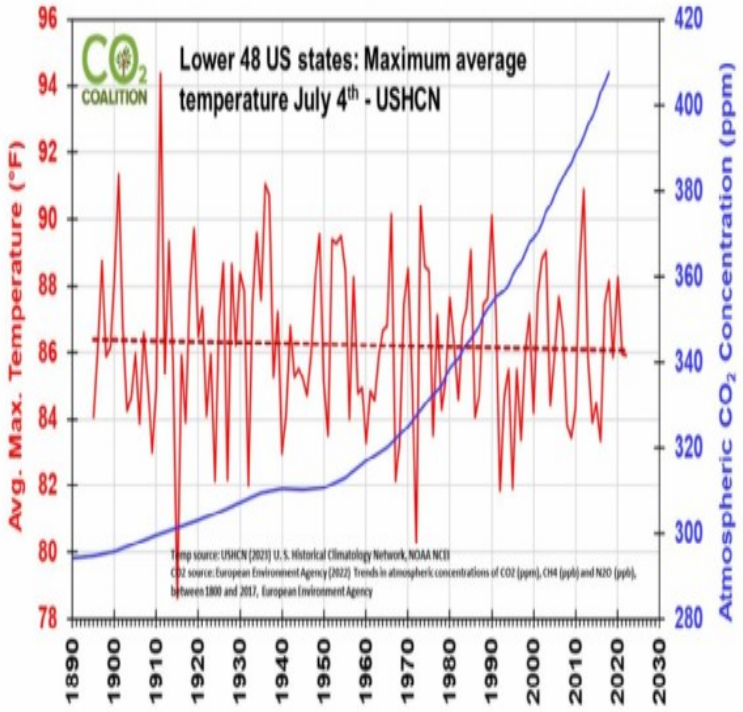
The frequency of EF3+ (EF3-5) tornadoes has also been declining. Less than 1% of tornadoes are EF4+ (EF4 or EF5). There have been no EF5 tornadoes in the US since the Moore Tornado in 2013. The 10 years since 2013 is the longest period on record without an EF5 tornado.

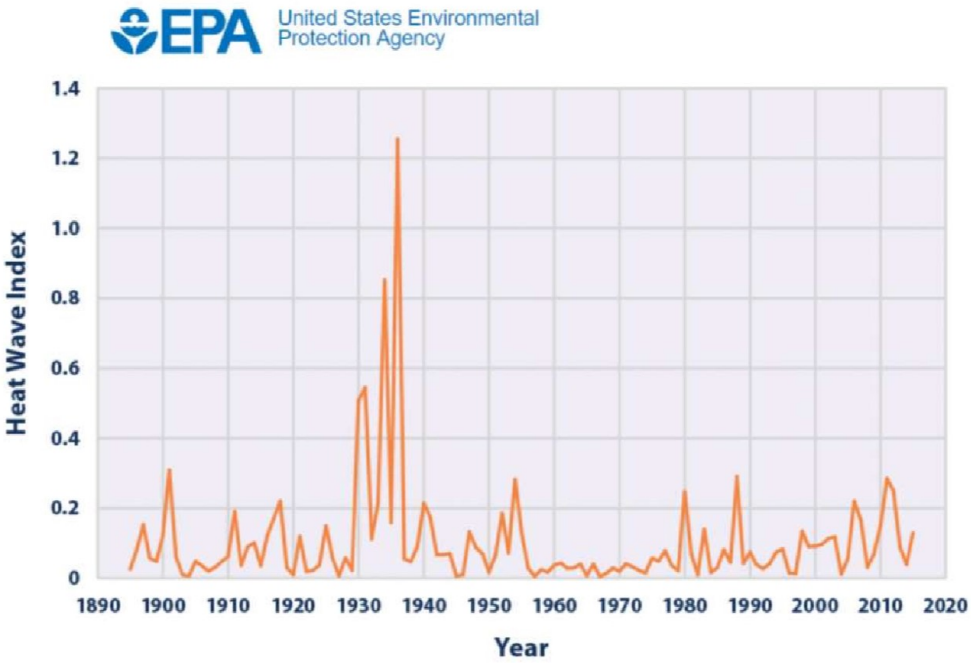
CONCLUSION AS TO TORNADOES

Based on the actual measured data, the frequency and strength of US tornadoes is remaining the same or declining. As to the future, scientists have not yet been able to create models to predict the future number or strength of tornadoes, wind gusts, hail storms, or lightning [IPCC AR6 WGI p.1825 (2021)], so there are no models (and there is no data) suggesting that the number or intensity of any of these events will be increasing over the 21st century.

THE TEXAS HEAT DOME, THE JULY 4 HEATWAVE

Last month (June 2023) a "heat dome," a form of heatwave, settled over Texas. Then this past July 4 the Eastern US experienced a significant heatwave. Both events attracted extensive media coverage Both of these events are examples of extreme weather, but climate change is a change in the frequency or intensity of some weather variable over an extended period of time, usually understood to be at least 30 years. Over the last 130 years the US maximum average July 4 temperature has been declining with very substantial year-to-year variability. A single hot July 4 is not evidence of climate change, nor is a single heat dome incident.





The heat wave index for the continental US shows a slight upward trend since the 1960s, but the data for recent decades resembles the data for 1900-1955, so it is difficult to conclude that there has been much, if any, climate change with respect to this variable. What stands out in this dataset is the extraordinary heat wave spike of the 1930s. This is an example of how extreme short-term, natural variability can be.

The 1930s were the years that heat and drought turned the Great Plains into a wind-blown desert, known in history as the "Dust Bowl."

Max. Temp. 77.2 deg. (at 12.45 p.m.) Weather Forecast: Fine.

The Daily News

FINAL

VOL. LV, No. 19033 Perth, W.A., Friday Evening, March 20, 1936 (10 Pages)

ALL EASTERN AMERICA UNDER FLOOD WATERS

Terrible Duststorm Rages In West

Menace Of Mining Accidents

IMPORTANT CONFERENCE

W.A. Mannequin

W.A. Girl For Mannequin Parade

PRESIDENT SIGNS APPEAL AS CAPITOL FLOODED

100 Cities And 14 States Affected

NEW YORK, Thursday.

A quarter of the area of the United States was under flood waters today. It is a disaster ranking with the worst calamities from natural causes that have occurred in the history of the nation. Property damage is so great that it is almost incalculable. Loss of life may exceed 1000 for already 160 fatalities are known and 40 people are missing.

As Eastern American States became almost covered with water, terrible dust-storms raged across the central and western States, tearing the crops out by the roots and laying waste thousands of square miles of country. Where the dust struck snow storms, it rained mud.

Washington Inundated

CANADIAN BORDER

OREGON

NEVADA

COLORADO KANSAS OKLAHOMA NEW MEXICO DUST STORMS TEXAS

MEXICO

World Conference To Discuss Peace And Arms

LONDON, Thursday.

The most dramatic day in European diplomacy ended with a note of qualified optimism, the grounds for which will be stated in the House of Commons tomorrow. In the meantime, experts are working on the text of an agreement.

It is understood that a plan has been evolved for a great world conference at which not only Herr Hitler's proposals, but disarmament and economic problems would be discussed and a big effort made to restore confidence and a sense of security to the harassed world.

During the horrible month of March 1936 dust storms ravaged the Great Plains while "all Eastern America [was] under flood waters."

TENTATIVE CONCLUSION AS TO HEATWAVES

Heatwaves present a complicated bundle of scientific issues, which the media usually distorts and misrepresents. In general, the world has, in fact, been warming at a rate of slightly less than 1 C per century. [IPCC AR6 WGI p.5 (2021)]. Hot extremes including heatwaves have, in fact, been becoming more frequent and more intense across most land regions. [IPCC AR6 WGI p.8 (2021)]. So key issues become quantification and significance. How much more frequent are heatwaves getting? How much more intense? How good or how bad are these changes? These issues will be addressed in a future newsletter.

Work Cited

Intergovernmental Panel on Climate Change Assessment Report 6, Working Group I Report, The Physical Science Basis (2021) ("AR6 WGI")