

Are Tornadoes Becoming More Frequent and Severe?

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“2011 marked the second deadliest tornado season for the U. S., with [about] 1,700 tornadoes... and 553 deaths according to the AP” (Ferro). The Tornado outbreak of 2011 made the discussion concerning whether or not tornadoes have increased in frequency and severity even more seriously debated. Many people want to point to global warming as the reason for why tornadoes have increased in frequency and severity. This discussion has even become a political debate. Just last year, Senator Barbara Boxer pointed to global warming as being the cause for tornadoes and other severe storms increasing in frequency and severity when she said, “This is climate change. We were warned about extreme weather... You’re gonna have terrible storms. You’re going to have tornadoes and all the rest” (Morano). Some scientists and individuals believe that global warming is the sole process responsible for the increasing frequency and severity of tornadoes. But, there are other alternative findings that can explain this environmental phenomena.

According to NOAA's National Weather Service, a tornado by definition is "a violently rotating column of air, usually pendant to a cumulonimbus, with circulation reaching the ground. It nearly always starts as a funnel cloud and may be accompanied by a loud roaring noise. On a local scale, it is the most destructive of all atmospheric phenomena.” If someone looked at a graph or chart of data showing the number of tornadoes in the United States since 1950, he/she would see an increasing trend in the number of tornadoes recorded. This data alone might cause him/her to conclude that the frequency of tornadoes has risen in the United States and Illinois. But, these numbers do not tell the whole story. In fact, most scientists do not believe that tornadoes have been occurring more frequently. Illinois State Climatologist, Dr. Jim Angel,

stated that tornadoes in Illinois have not really increased in frequency when he said, "If we look at the number of stronger tornadoes since 1950 in Illinois, we see a lot of year to year variability. However there is no significant trend over time – either up or down (Figure 1). What we have seen is a dramatic increase in the number of F-O (EF0) tornadoes from 1950 to 2010 (Figure 2). These events were overlooked in the early tornado records." (Angel).

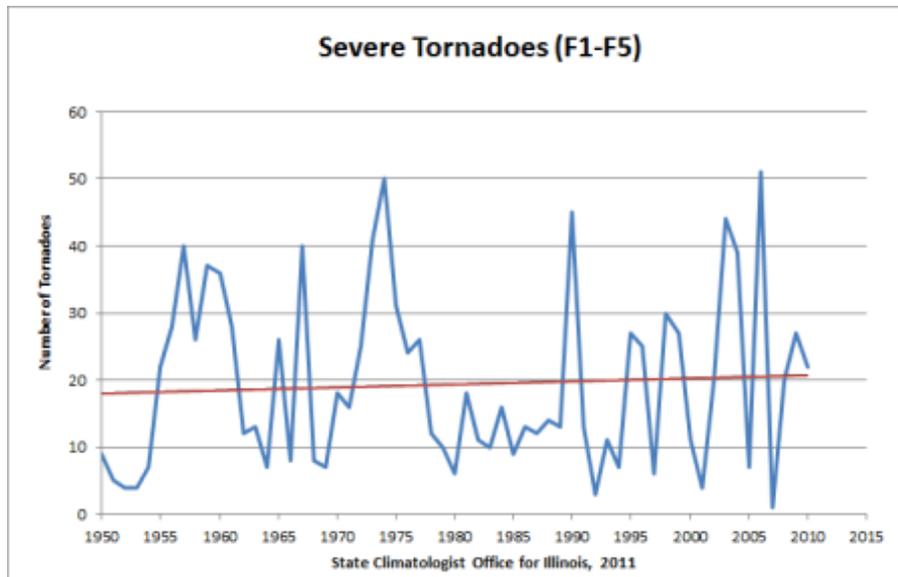


Figure 1. Angel, Jim. "Trend in Tornado Activity in Illinois - Yes and No." *Illinois State Water Survey*. Illinois State Water Survey, 25 May 2011. Web. 21 March 2014.

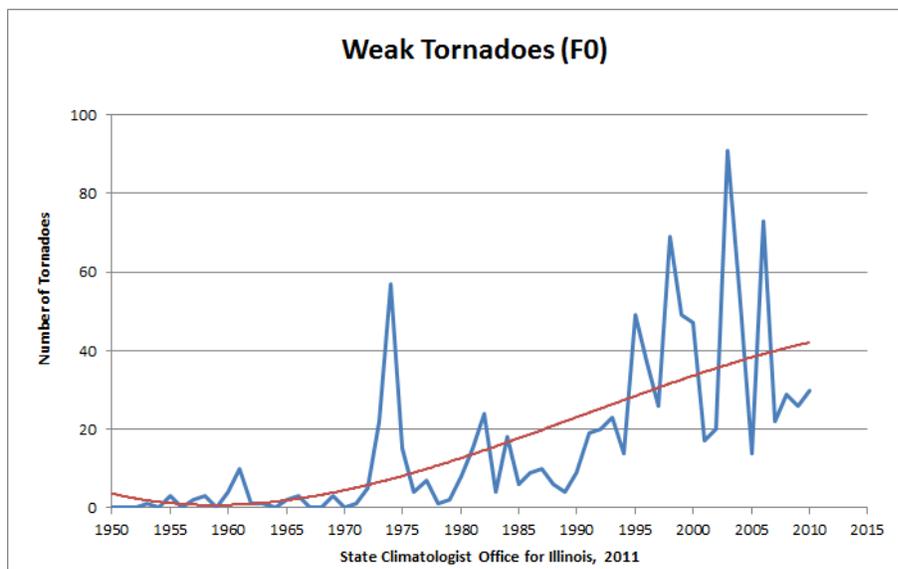


Figure 2. Angel, Jim. "Trend in Tornado Activity in Illinois - Yes and No." *Illinois State Water Survey*. Illinois State Water Survey, 25 May 2011. Web. 21 March 2014.

"Monitoring and Understanding Trends in Extreme Storms," published in the *Bulletin of the American Meteorological Society* also has concluded that the United States is not experiencing an increase in the severity of tornadoes. Figure 3 from this paper shows "The occurrence of F1 and stronger tornadoes on the Fujita scale shows no trend since 1954, the first year of near real time data collection, with all of the increase in tornado reports resulting from an increase in the weakest tornadoes, FO."

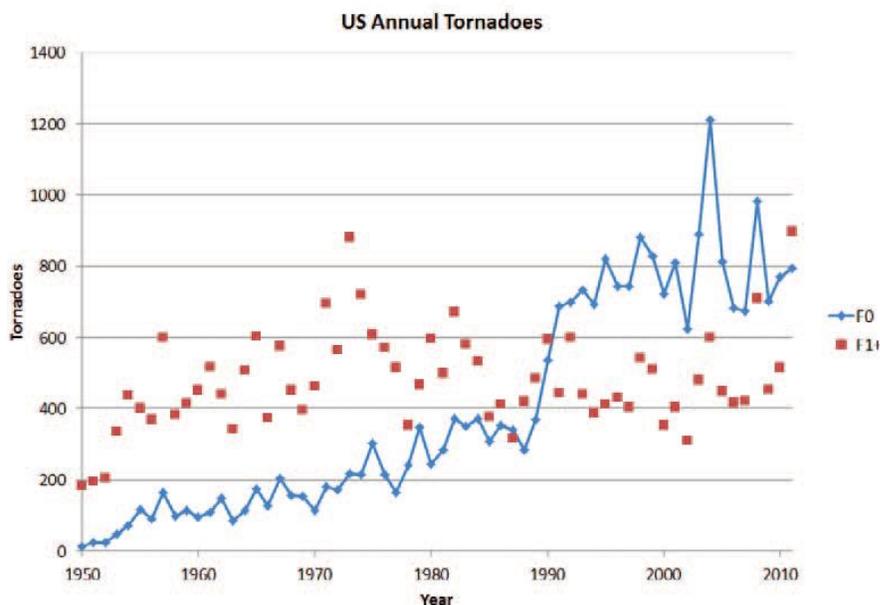


Figure 3: Reported tornadoes in NWS database from 1950 to 2011. Blue line is F0 tornadoes; red dots are F1 and stronger tornadoes.

There are multiple reasons to explain why there seems to be an increase in the frequency of tornadoes in Illinois and the whole United States since 1950.

Tornado records have been kept in the United States since 1950. While we are fortunate to have records that date back about 64 years, “ the disparity between tornado records of the past

and current records contributes a great deal of uncertainty regarding questions about the long-term behavior or patterns of tornado occurrence” (“Historical Records and Trends”). Inconsistent tornado records have made it difficult to identify tornado trends. In the last several decades, scientists have done a better job of making tornado data more consistent and uniform. Overtime, this will help scientists to be able to identify trends in tornado data. In addition to inconsistent records, changes in reporting systems have had an effect on tornado data and possible trends.

Prior to the 1970's, tornadoes were usually not reported unless they caused substantial damage to property, caused injuries, or deaths; consequently, there was an under reporting of tornadoes. At this time, scientists were able to define what a tornado was, but they struggled to define the intensity of each tornado, in terms the size and wind speed of each tornado, and therefore, they struggled to compare one tornado to another. This changed in 1971 when a meteorologist named Ted Fujita, “established the Fujita Scale (F-Scale) for rating the wind speeds of tornadoes by examining the damage they cause” (McDaniel). Once the Fujita Scale was established, scientists were more easily able to classify tornadoes based on their wind speed and the damage they caused. After a few years, structural engineers and Theodore Fujita realized that the Fujita Scale was not as accurate as they wanted and “needed adjusting” (McDaniel). Starting in 1998, “an engineering group of scientists from Texas Tech... an elite group of three engineers and three meteorologists ... developed the Enhanced Fujita Scale (EF) with considerably lower wind speeds” (McDaniel). Scientist also employed another measure to try to make the EF scale more accurate. These scientists, “felt that the lack of calibration of the F scale’s wind-speed-damage relationship was associated with over-estimated of the wind speeds for F3-F5 damage. They believed that much of the observed damage... could actually have been caused by F3 wind speeds” (“Tornadoes: A Rising Risk?”). Instead of just basing the scale on, “a

single primary damage indicator, damage to a 'well-constructed' frame house, the EF scale took into account 28 different damage indicators" ("Tornadoes: A Rising Risk?"). This new scale, the Enhanced Fujita Scale, was first used during the 2007 tornado season. Even with this new scale, it is still hard to classify the strength and severity of a tornado. The use of the F and EF scales has helped to more accurately report tornadoes. The use of other new technologies in reporting systems has also affected the frequency of tornado reports in the last several decades. "There was a significant increase in tornado occurrence during two periods in the last 33 years – in the early 1980s when National Weather Service (NWS) warning verification began, and in 1990 when the WSR-88D [Doppler system] became operational" (McCarthy). The NWS warning verification caused the public to be more aware of tornadoes which increased the number of reported tornadoes. The WSR-88D Doppler system was more sensitive than the previous WSR-57 radar. The new WSR-88D Doppler system could detect EF0 tornadoes; as a result, the reporting of these weaker tornadoes greatly increased, which made it appear that tornado frequencies were increasing. Scientists call this a reporting effect, meaning that "reports of a phenomenon increase but actual occurrences do not" (Lamb). Illinois has seen an increase in reported EF0 tornadoes which was explained by Illinois State Climatologist, Dr. Jim Angel when he said "what we're seeing is a lot more of the weaker tornadoes because of better radars now, spotter networks, and smartphones with cameras with video capability. So something [a tornado] 30 years ago that would have just spun out in some farmer's field used to be just ignored...So, there has kind of been this big jump in the weaker ones. In fact, they hardly even ever bothered reporting weaker tornadoes back before 1970" (Angel). Much like Doppler radar has increased the number of tornadoes reported, increased public awareness has had the same effect.

Public awareness of tornadoes has also had an effect on the reporting of tornadoes. Spotter networks, storm chasers, media, and personal cellular devices have greatly impacted the reporting of tornadoes in the last 30 years. "More tornadoes are now reported than in years past, but that's probably due to an increase in the number of eyes scanning for tornadoes than the number of tornadoes" (Madrigal). One of the major spotter networks operating in the United States is SKYWARN. SKYWARN was started in the 1970s by the National Weather Service. "SKYWARN is a volunteer program with nearly 290,000 trained severe weather spotters. These volunteers help keep their local communities safe by providing timely and accurate reports of severe weather to the National Weather Service" ("SKYWARN"). In more recent years, the number of people involved in storm chasing has increased. "Ginger Zee, a meteorologist and veteran storm chaser with ABC News, said the number of storm chasers had "boomed" in the last decade" (Schwartz). Storm chasers provide additional information about tornadoes that Doppler radar cannot provide. At the same time, they have sparked public interest and awareness of tornadoes with the use of tornado footage that can be seen on televisions, computers, and cell phones. The reporting of tornadoes by the media on television and radio has greatly increased the public's awareness and understanding of tornadoes. More recently, the use of cell phones to record, Snapchat, text, and tweet about tornado activity has become more frequent. As a result, public awareness and interest in tornadoes has become greater which has affected the number of reported tornadoes.

An increase in the human population and urban sprawl/spreading have also had an impact on tornado reporting. It stands to reason that a larger population would provide more chances for people to see tornadoes. "One reason for the increasing number of tornado reports is due to the geographical dispersion of people. The link between increasing population growth and number of reported tornadoes is arguably not entirely coincidental. As populations have increased, so has urban sprawl, and fewer areas remain completely un-populated" ("Tornadoes: A Rising Risk?"). As rural areas in

Illinois have become more populated, the chances for a tornado to be spotted and reported have increased.

Some scientists believe that the inconsistencies with tornado reporting, since 1950, have caused problems with linking increased tornado frequency and intensity to global warming, and it will take several more years of data collecting to see if global warming is playing a role in the frequency and severity of tornadoes in the United States. "There is evidence that global warming has caused an increase in very heavy precipitation events - the kind most responsible for major floods. However, there is no evidence that climate change has caused an increase in tornadoes and severe thunderstorms" (Masters). Specifically, in terms of the state of Illinois, scientists also agree that global warming has not really had an effect on the frequency and severity of tornadoes. According to the State Climatologist Office for Illinois, "the number of observed tornadoes in Illinois has increased over time, but without an indication of any underlying climate change" ("Tornado Trends in Illinois").

It is clear that inconsistent record keeping, changes with tornado reporting systems such as the Fujita Scale and Doppler radar, increased public awareness, the use of technology to report tornadoes, and the shifting populations have all played a role in increasing the number of reported tornadoes in Illinois and in the United States. The role that global warming has played in the increased number of tornadoes and their severity since 1950, is still unclear. Several more years of tornado data collecting is needed for us to have a more definitive answer as to whether tornadoes are increasing in frequency and severity and the role global warming may or may not be having on tornadoes.

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