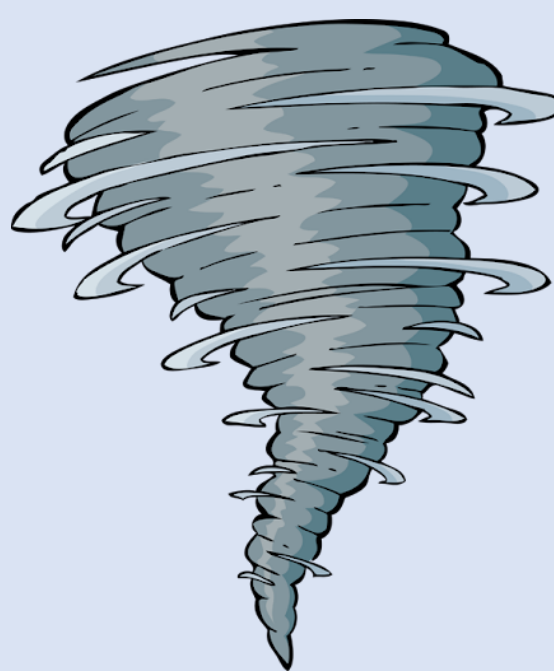


Don't Get it Twisted:

An environmental case study in the historic misrepresentation of US spatial tornado frequency

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DATA, DETAILS, AND ANALYSIS

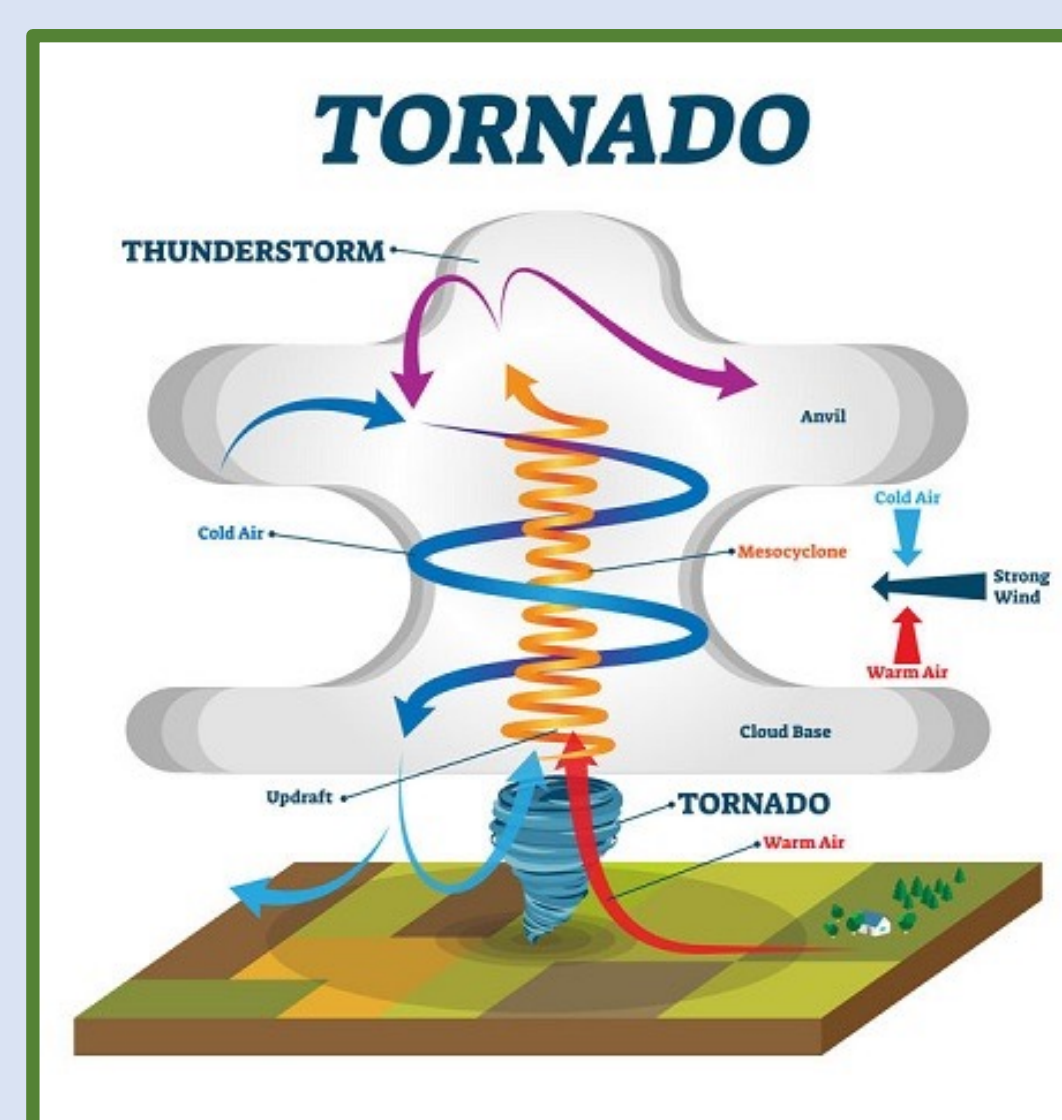
ABSTRACT

Oftentimes, when we think of tornadoes in the United States, our minds picture America's Great Plains—states like Kansas, Nebraska, and Oklahoma. But this isn't exactly an accurate representation of tornadic activity within the U.S. It is likely possible that Tornado Alley as a term has over-simplified tornadic weather as well as led to dangerous misconceptions regarding tornado risk for decades. Additionally, due to Earth's changing climate system, the frequency and location of most tornadoes could be slowly shifting. As the Earth's climate system changes due to warming temperatures, so do weather patterns. A very widely-acknowledged effect of this is changing precipitation patterns. An effect that hasn't gained as much attention, is the implications of climate change for tornadoes and severe convective weather. In order to provide those affected by tornadoes with the maximum number of resources for risk management and mitigation of the effects of tornadoes, more research into the extent to which these weather patterns are changing, and the role of climate change in any change is necessary.

BACKGROUND

TORNADO FORMATION

Figure One: Tornadoes are formed by a combination of both atmospheric instability and wind shear, or the changes in wind speed and direction at different elevations. The combination of instability due to interaction of warm and cold air, and wind shear forms the rotating column of air that is associated with the physical form of a tornado.



MISREPRESENTATION

Tornado Alley isn't the only region to experience tornadoes in the US. The Deep South, namely Alabama and Mississippi, experience similar amounts of tornadoes throughout the year as the Great Plains region. Additionally, areas across the Ohio Valley, the Tennessee Valley, the Midwest, and Florida remain at great risk for tornadoes throughout the year. Many scientists believe that the lapse in representation of reality that is presented by the term Tornado Alley misguides citizens and has affected tornado mitigation and resilience for decades ("Experts say the term 'tornado alley' is misleading, advocate moving away from it," n.d.).

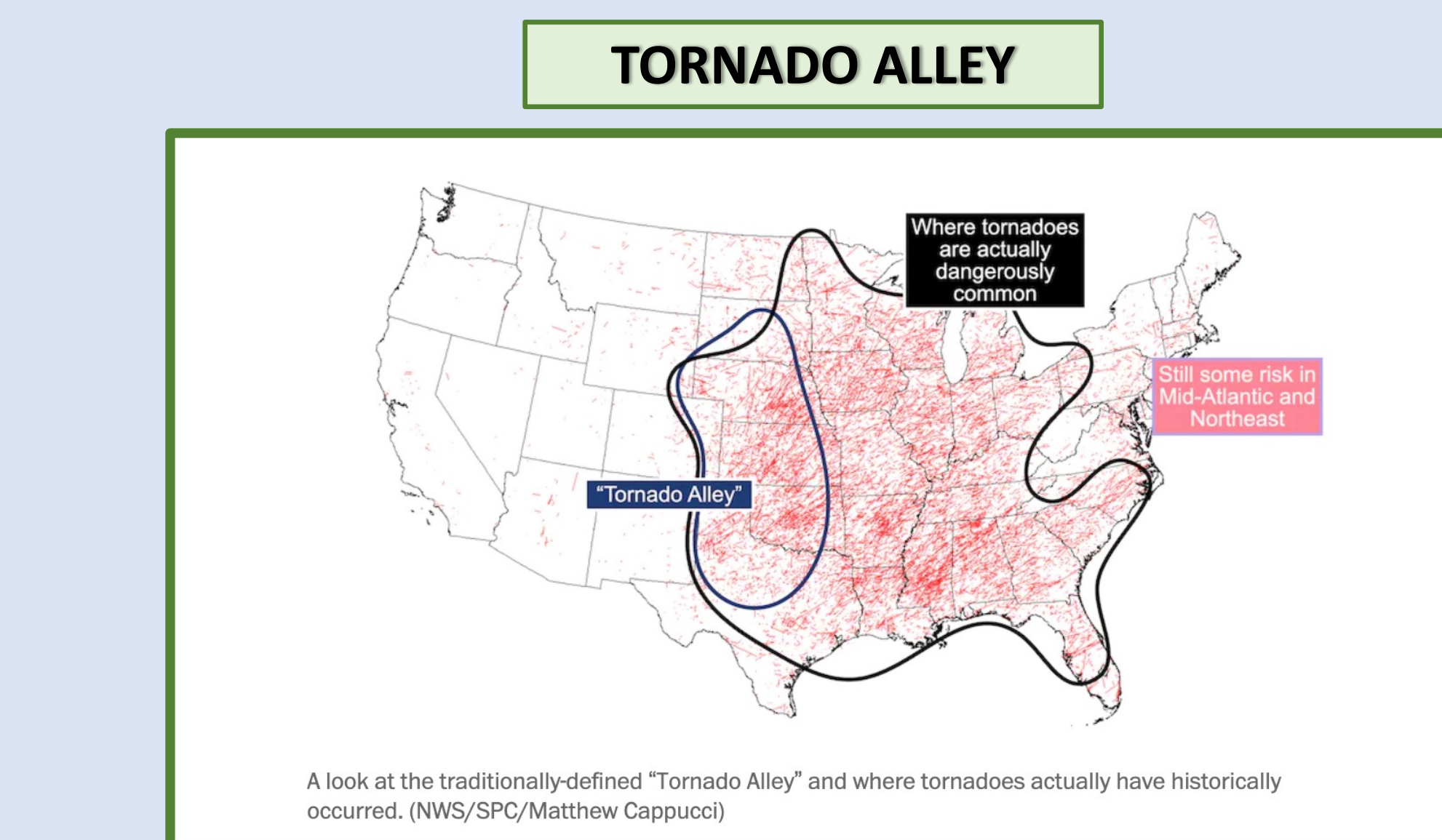


Figure Two: The above map shows spatial tornado occurrence data, indicating that Tornado Alley is not the only area in the contiguous US to experience tornadoes. Data has been provided by the NWS and adapted by Gensini, V. A., and Brooks, H.E. (Gensini & Brooks, 2018).

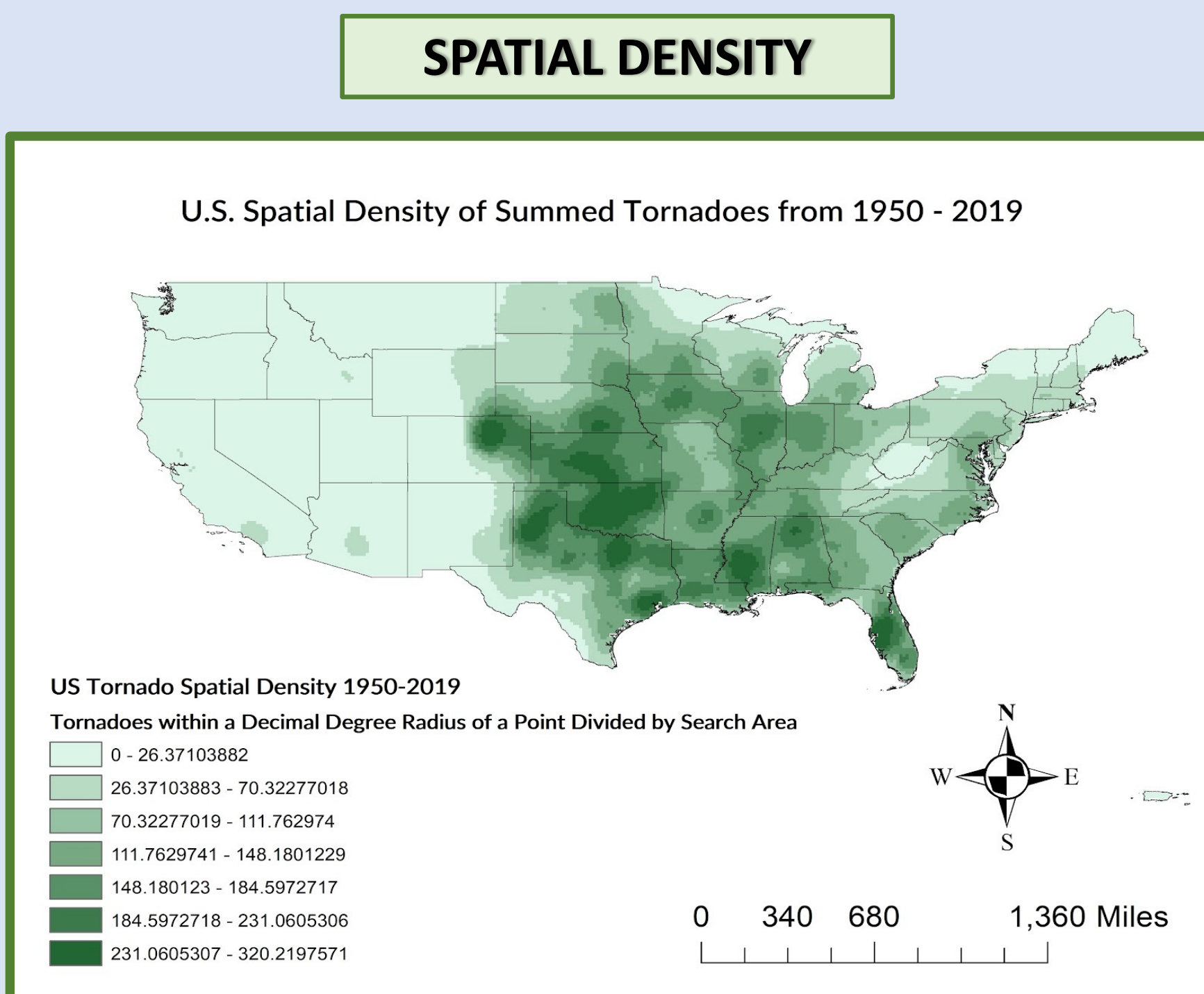


Figure Four: The map above shows the density of touchdown points of tornadoes, summed from 1950 to 2019, within the contiguous United States. The map shows that areas in darkest green, which are spread throughout the Great Plains, Deep South, and the Midwest, have the highest density of tornado starting points. The data in the map has been retrieved from NOAA and analyzed using GIS software (Storm Prediction Center WCM Page, n.d.).

Dating back to 1948, the term, "Tornado Alley," has been used to refer to a stretch of central contiguous United States where tornadoes frequently occur, especially in the late spring and early summer months. However, by nature of the way the term was developed, it has become unrepresentative of the overall picture of tornado frequency and corresponding spatial risk within the US ("Experts say the term 'tornado alley' is misleading, advocate moving away from it," n.d.).

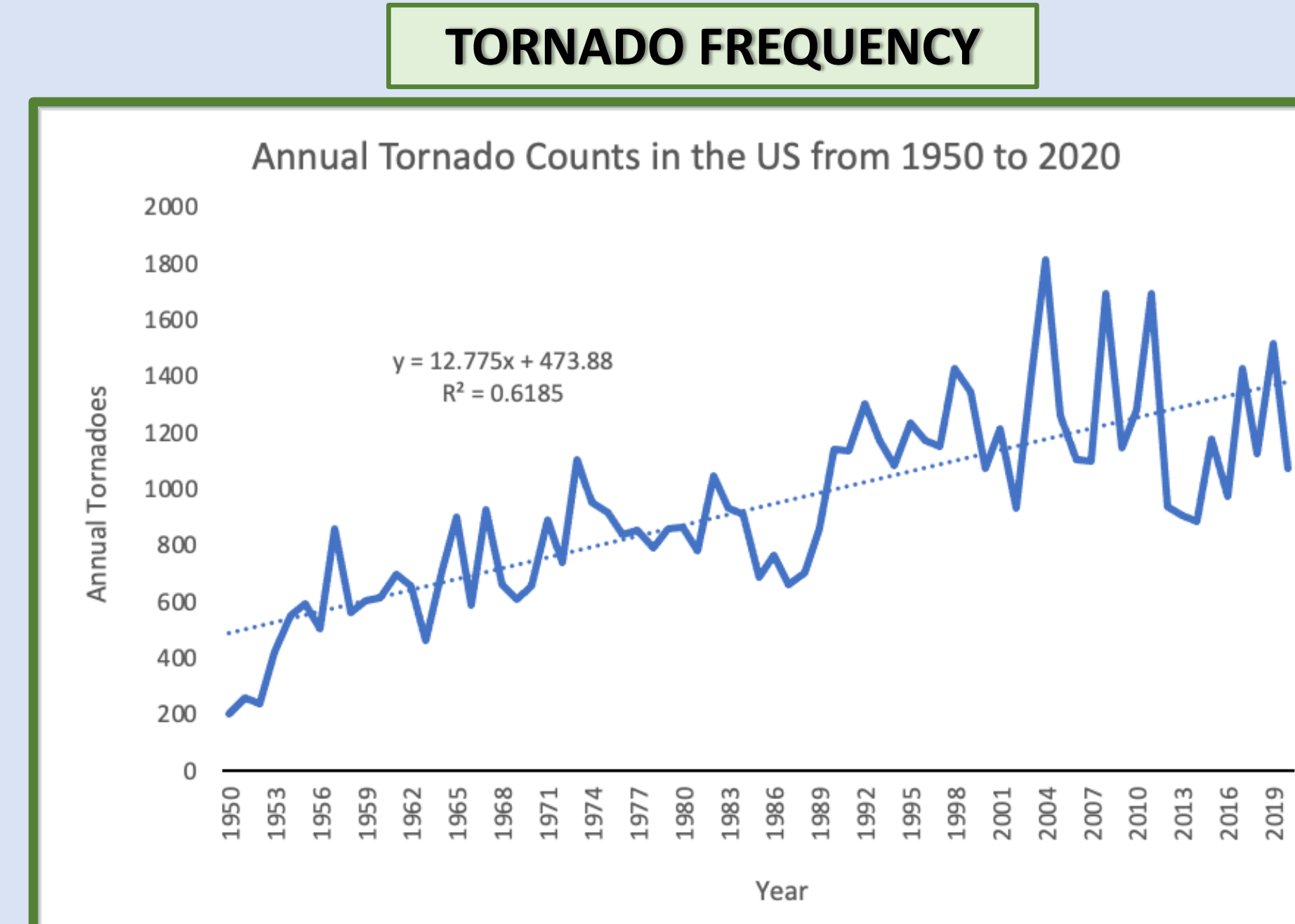


Figure Three: The graph above displays annual tornado counts from 1950 to 2020 for the contiguous U.S. There is a clear upward trend over time in frequency, however, the trendline does not hold a high level of significance as there are may periods of extreme fluctuation. Data was provided from the NOAA Storm Prediction Center (Tornadoes - October 2021 | National Centers for Environmental Information (NCEI), n.d.).

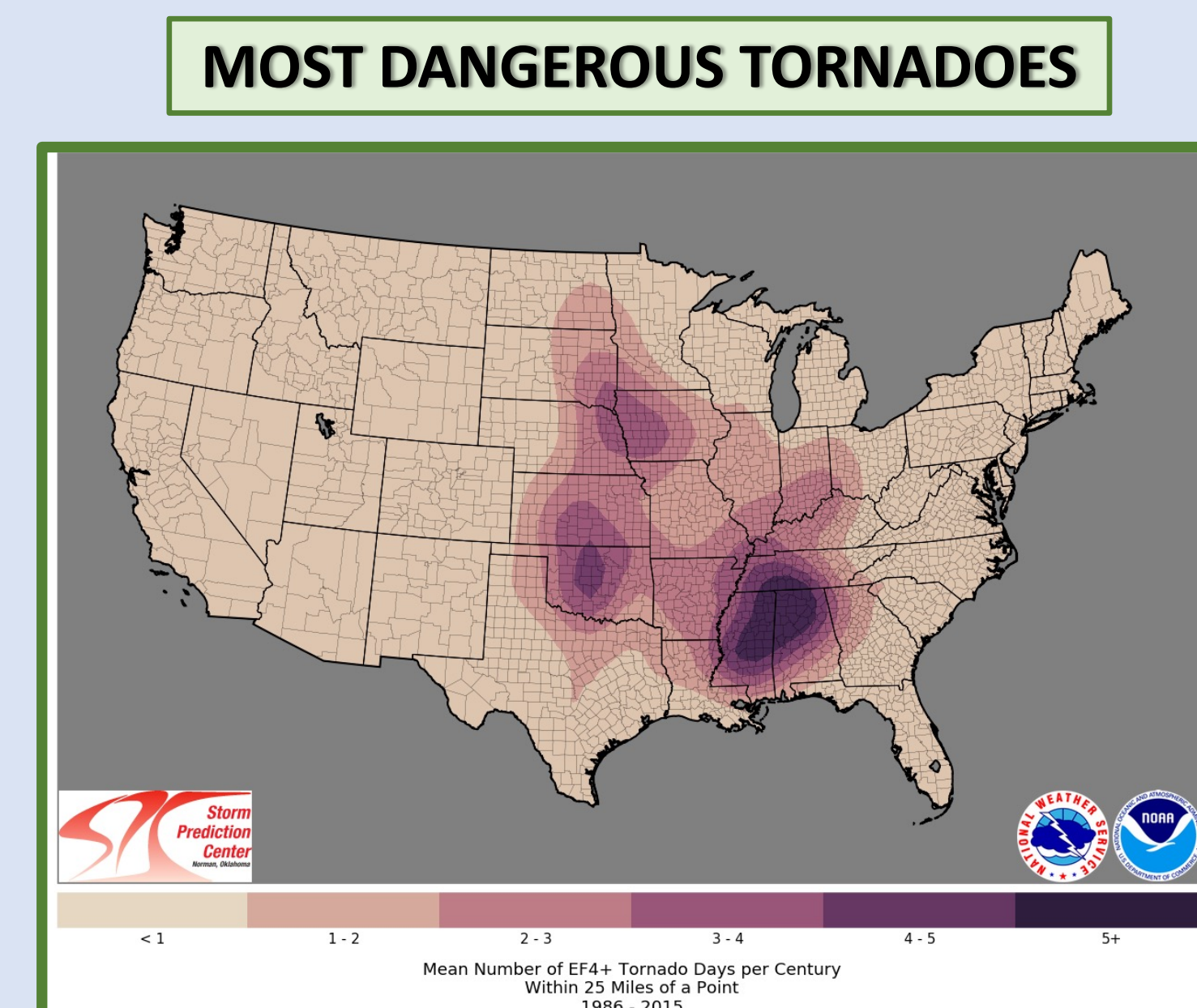


Figure Five: The map above shows the mean number of EF4+ tornado days with 25 miles of a point from 1986 to 2015 in the contiguous U.S. EF4+ tornadoes represent the two strongest classifications of tornadoes on the Enhanced Fujita Scale and indicate extremely dangerous weather events (Storm Prediction Center WCM Page, n.d.).

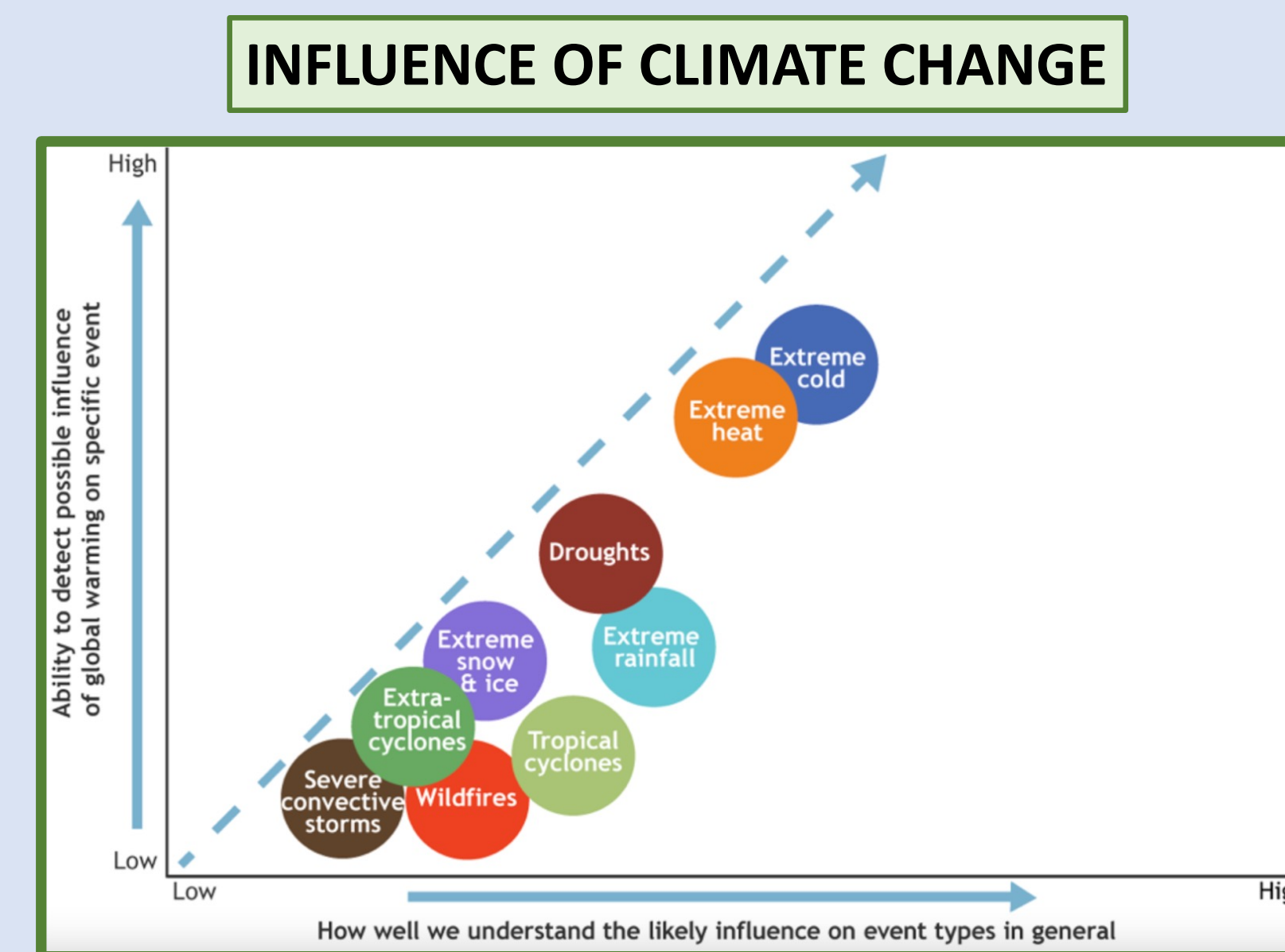
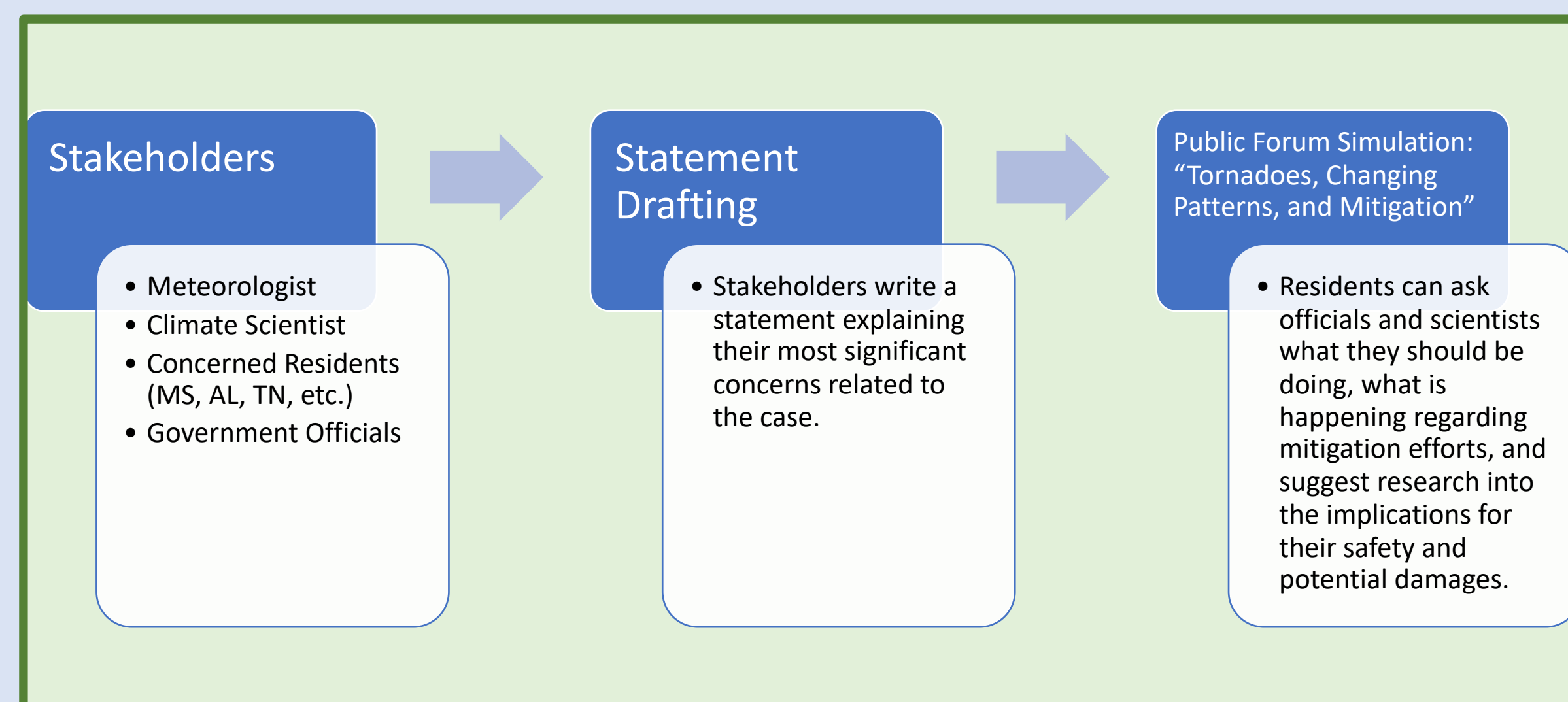


Figure Six: The graph to the left shows environmental events and the confidence with which climate scientists understand climate change's implications for each event. Tornadoes, which fall under severe convective storms, are one of the least understood events in terms of the influence inflicted by climate change (Tornadoes and Climate Change | Center for Climate and Energy Solutions, 2019).

TEACHING THE CASE STUDY

- Primary Learning Objectives**
 - Help students understand how climate change can impact weather systems and complicate weather phenomena
 - Encourage students to think critically about historical precedent and analyze new data and facts to draw new conclusions
- Secondary Learning Objectives**
 - Understand tornadoes, their formation process, and how climate change and different socioeconomic factors can have significant implications for tornadic impacts



DISCUSSION AND CONCLUSIONS

- Data Implications**
 - There are takeaways regarding tornado frequency despite factors that cloud validity of analysis.
 - Areas notoriously prone to tornadoes are not what people think of when they think of tornadoes.
 - Due to media popularization, Tornado Alley's relevance as a name has been horribly exaggerated.
- Misrepresentation**
 - Preparedness of other regions of the US must be on par with that of Tornado Alley.
 - Ultimately, the name Tornado Alley is not getting people's attention in the way it was intended.
 - As the term becomes more scientifically inappropriate, it becomes more misleading.
 - Mitigation efforts must reflect this.
- Climate Research**
 - A better understanding of the impacts of climate on these weather systems is necessary.
 - This research could provide stronger evidence for the trends being displayed.
 - Further understanding of climate change's implications for tornado trends can provide better reasoning for tornado hazard mitigation efforts.

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