Tornado Alley is moving ESE but appears to be diminishing as a lethal risk

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Tornado Alley is a region in the United States that sees more tornadoes per year than any other part of the world.

The unique geography of the United States - from its proximity the jet stream, multiple sources of ocean temperature air, and vast valley in the middle of the country - create the ideal breeding ground for tornadoes and other extreme weather events. Tornado Alley refers to the Great Plains region of the US (Iowa, Nebraska, Kansas, Oklahoma, north Texas, etc) but the greatest clustering of tornadoes has seasonality as well, moving southeast in the colder seasons and northwest as the weather warms.[1]

That said, the general trend of tornadoes is moving. The etiology of this behavior is still debated,[2] but the impacts could be considerably. If extreme weather events are generally moving more southeastward, then they are also traveling towards more densely populated areas of the country. Not just more densely populated, but towards areas with a higher proportion of mobile homes and buildings not designed for this kind of weather. This may lead to more property damage and possibly to more weather-related fatalities.

Our research has concluded that this migration is happening and more tornadoes are forming

The center of Tornado Alley is generally moving East-Southeast at roughly 4.2 miles per year. It is currently on track to enter Western Tennessee in the next decade with more powerful storms entering northern Mississippi at around the same time. This migration has been correlated with a noted increase not just in tornadoes overall but in *clustered* tornadoes - tornadoes that form with 40km (~25 miles) and 24 hours of each other. This means that more tornadoes are forming and forming in close time and space to another.

This initially raised concerns, but we noted a decrease in casualties (deaths and injuries directly and indirectly caused by tornadoes) over the last 40 years. The increase in tornadoes has not been even across the Enhanced Fujita (EF) scale, the scale used to classify tornadoes, but has favored EF1 (the second weakest classification) almost exclusively. These counterintuitive events suggested a fascination hypothesis:

The ESE migration of tornado alley is paired with a "Shatter and Clustering" of potential, creating clusters of weaker, less lethal tornadoes

Our study indicates that EF1 tornadoes are forming far more frequently than other tornadoes and that EF1 tornadoes are forming in clusters far more frequently. We've also found that more powerful tornadoes are forming much less frequently. This implies a "shattering" of the available energy to form tornadoes into "clusters" of lower-magnitude tornadoes.

This is excellent news for the Southeastern United States. The EF scale is exponential - an EF2 tornado is roughly 67% stronger than an EF1 tornado - so this drop in magnitude means a far lower risk profile. For example, if the energy to form an EF5 tornado was present but has been "shattered and clustered" into a cluster of 5 EF1 tornadoes, the lethal potential of that system has been reduced by over 300x. This is an

extreme illustration, but the basic concept is playing out in the skies over Tennessee, Missouri, and Arkansas every spring.

Tornadoes remain a profound risk

Even though there has been a decline in risk and lethality, tornadoes are still extraordinarily dangerous events. The 2011 Super Outbreak proved that massive, deadly tornado clusters are still possible in the 21st century. [3] Although storms in general appear to be losing their lethality, we should still consider techniques like a Gutenburg-Richter analysis to evaluate the likelihood of future super outbreak events in the new tornado mean coordinates.

[1] https://www.nature.com/articles/s41612-018-0048-2.pdf

[2] https://www.nytimes.com/article/tornado-climate-change.html

[3] https://www.weather.gov/gsp/EpicOutbreak