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OPINION

The Decline of Tornado Devastation

Despite what you might have heard about 'extreme weather events,' damage and loss of life from twisters is in retreat.

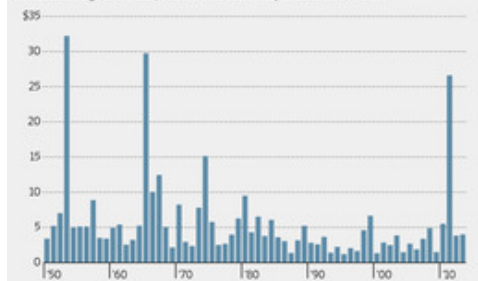
By ROGER A. PIELKE JR.

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So far in 2014, the United States has experienced fewer tornadoes than in any year since record-keeping began in 1953, or even before. Greg Carbin, a meteorologist with the Storm Prediction Center of the National Oceanic and Atmospheric Administration, has called this "likely the slowest start to tornado activity in any year in modern record, and possibly nearly a century." But just because tornado activity has declined doesn't mean that we can let down our guard, as potentially large impacts are always a threat.

Losing Their Punch

Tornado damage in the U.S., in billions of dollars adjusted to 2014 values



Source: Kevin Simmons, Austin College; Roger Pielke Jr., University of Colorado; based on the NOAA's Storm Prediction Center and Simmons, et al., 2013

Overall, however, the good news for residents of the Midwest's "Tornado Alley" and elsewhere is that over the past six decades America has witnessed a long-term decrease in both property damage and loss of life. That's the finding that I and Kevin Simmons and Daniel Sutter, two of the nation's leading tornado experts, have gleaned from studying the data on almost 58,000 tornadoes observed since 1950.

Using estimates collected by the NOAA's Storm Prediction Center, we used several approaches, including taking inflation into account, to "normalize" historical losses to 2014 dollar values in order to estimate how much damage would occur if tornadoes of the past occurred with today's

levels of population and development.

The nearby chart shows our central estimates. How do we know if they are any good? We performed several independent checks. For instance, we already know which years had exceptionally large property losses: 1953, 1965, 1974 and 2011—and these four years show up clearly in our data set. A more sophisticated check is to compare trends in the incidence of tornadoes with trends in damage. Counts of tornadoes at different strengths can serve as an independent basis for evaluating our methods. Logically, these trends would match up. And once we break the overall data set into a series of shorter periods to take into account changes in the way meteorologists have tracked tornadoes over time, the trends do match, supporting our approach.

Certainly the potential for tornado damage in the U.S. remains strong. Just three years ago, the country was wracked by a series of particularly destructive storms, including a tornado outbreak in late April 2011 that killed more than 300 people across seven states, and one in May that devastated Joplin, Mo. That year was one of just three since 1950 with more than \$25 billion in damage, and the 560 deaths in 2011 were the most fatalities since 1925, when 794 people died.

The average annual U.S. property losses caused by tornadoes, from 1950 to 2013, is \$5.9 billion in today's dollars. However, for the first half of the data set (1950-81), the annual average loss was \$7.6 billion, and in the second half (1982-2013), it was \$4.1 billion—a drop of almost 50%.

Does the substantial decline in average annual damage mean that there have actually been fewer tornadoes? Not necessarily. The U.N.'s Intergovernmental Panel on Climate Change concluded recently that the quality of the available data on tornado frequency and intensity makes drawing conclusions about long-term trends problematic: "There is low confidence in observed trends in small spatial-scale phenomena such as tornadoes and hail."



Huge lightning strikes cross the skies as thunderstorms supercells pass through areas in Archer City, Texas late April 23, 2014. *Reuters*

In our analysis we concluded that the data is "suggestive" of an actual decline in tornado incidence but do not say anything stronger, and we recommend further research.

What we can say with some certainty is that the number of years with very large tornado losses has actually decreased. Consider that from 1950 to 1970 the U.S. saw 15 years with tornado damage in excess of \$5 billion a year. From 1993 to 2013 there were only four such years, with three since 2008.

We can also tell that even though the U.S. is crisscrossed by hundreds of tornadoes annually, they are not nearly so damaging as the much less frequent occurrences of hurricanes and earthquakes. Cumulatively since 1950, 153 landfalling hurricanes in the U.S. have caused about twice as much total damage (in normalized dollars) as the almost 58,000 documented tornadoes. We also estimate that a recurrence of the 1906 San Francisco earthquake today could cause more damage than all of the tornadoes since 1950 combined.

Our study also provided a state-by-state portrait of the country's vulnerability to tornadoes—but there's more than one answer to the common question about which state has the most tornado damage. It depends on how the measuring is done. In total damage suffered since 1950, Texas has the melancholy distinction of leading the way, followed by Indiana, Missouri and Oklahoma. If we look at damage per square mile, the leaders are Massachusetts, Connecticut and Indiana, and Texas drops to 29th. There are relatively fewer tornadoes in New England, but high populations and development mean a risk of more damage. The only state with no tornado losses during this period: Alaska.

While tornadoes occur throughout the year, their destructiveness is concentrated in April, May and June, with 66% of total damage and 55% of total tornadoes in those three months. Only 20% of annual damage occurs after July 1.

Deaths from tornadoes dropped precipitously after the deployment of weather radars and warning systems in the middle of the 20th century. But even if tornado incidence is in a period of decline, we can be certain that there is always the possibility of a monster storm coming over the horizon. Because of

that, we need to shore up the technologies of the nation's weather infrastructure, centered on the National Weather Service, to ensure that the U.S. has the best possible warning system. For those in Tornado Alley enjoying a quiet start to the year, constant vigilance, as always, is vital.

Mr. Pielke is a professor of environmental studies and a fellow of the Cooperative Institute for Research in Environmental Sciences at the University of Colorado-Boulder.

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