

EXTREME WEATHER AND CLIMATE CHANGE

Devastating deluges, record floods and deadly heat waves have raised the question of whether there's a connection between these events and global warming. **The bottom line answer is yes:** Heat waves are longer and hotter than they used to be and some regions are suffering from catastrophic drought. Heavy rains are more frequent and can be more intense and rainfall records have been smashed. These events fit a pattern that climate scientists have long expected to appear as the result of increased greenhouse gases in our atmosphere. That doesn't mean global warming is the only culprit: extreme weather was happening before global warming began. But there's general scientific agreement that global warming has contributed to a trend toward more intense extremes of heat and precipitation around the world, is partly to blame for specific extreme weather events over the last decade and will continue to influence both in the future.



WHAT WE KNOW

- On average, the US is 2 degrees F warmer than it was 40 years ago.
- This warmer world is increasing the odds of extreme precipitation, ^(20,21) in part because a warmer atmosphere can hold more moisture and release more of it during rainstorms and snowstorms.
- Heavy precipitation, both rain and snow, is happening more often than it used to.^(10,4)
- Heat-related extreme events are on the rise around the globe. Manmade climate change significantly increased the odds of some specific events, including the killer European heat wave of 2003⁽⁶⁾ and the Russian heat wave of 2010.⁽¹²⁾
- Even small increases in average temperatures raise the risk of heat waves ^(6a, 6b), droughts⁽⁷⁾ and wildfires.⁽⁸⁾
- Twice as many record highs have been set in the past decade as record lows, in the US. ⁽⁹⁾
- By 2050, record highs could outpace record lows by 20 to 1 in the U.S. By the end of the century, the ratio could jump to 100 to 1 if greenhouse gas emissions continue unabated.⁽⁹⁾

THE SOUTHEAST

Spring 2011 Tornadoes

People who live in the southeastern U.S. are no strangers to tornadoes, which tend to strike during the hot, humid days of spring and summer. But the outbreaks that struck in April and May of 2011 were especially numerous and deadly. April had the most twisters of any month since modern records began in 1950, and in May, the deadliest tornado since 1947 killed 161 people in Joplin, Missouri.

You need three things for a tornado to form:

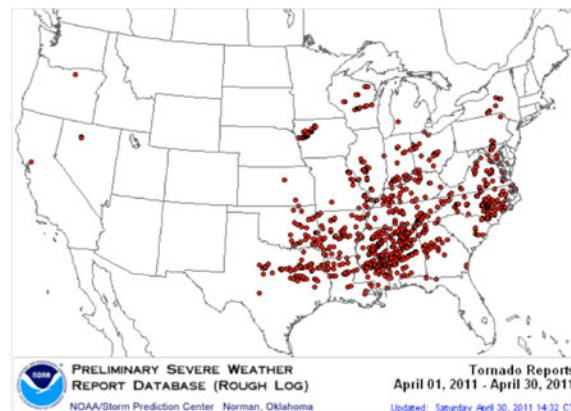
1. A warm, unstable atmosphere
2. Wind shear (winds that change speed and/or direction the higher you go)
3. Something—a cold front, for example—that triggers thunderstorms

We know that climate change is influencing two of these factors, fueling more atmospheric instability because it's warming the air temperature^(1,3) and adding water vapor to the air⁽²⁾ which can mean more powerful thunderstorms.

A warming climate, however, might cause wind shear to decrease,⁽³⁾ but it's too early to tell. Scientists have not observed clear trends in tornado frequency, strength or geographical distribution, so they can't say yet whether or not tornado behavior is changing due to global warming.

What happened in 2011:

- Spring storms were energized by an unusually warm Gulf of Mexico, which provided an ample supply of warm, humid air for storms to draw from.
- Spring 2011 brought several deadly tornado outbreaks to the Southeastern U.S., including the largest in the nation's history. The 748 twisters that touched down in April were the most ever recorded in a single month and the EF-5 tornado that leveled much of Joplin, Missouri on May 22 killing over 150 people was the country's deadliest single tornado since modern record-keeping began in 1950. Damage from the storms has been estimated at nearly \$12 billion overall, according to the National Climatic Data Center.
- The April 14th–April 16th tornado outbreak, which spawned 30 confirmed tornadoes in North Carolina alone, broke records for the single-storm and single-day tornado outbreaks for that state. Another major tornado outbreak, which took place between April 25 and 30, affected several states in the Southeast and the Midwest, killing 321 people. This outbreak caused more than \$6.6 billion in insured losses with total losses exceeding \$9.0 billion. Damages were especially high because many of the tornadoes struck densely populated areas such as Birmingham, Huntsville and Tuscaloosa Alabama.



Tornado reports in the U.S. during the month of April, 2011: <http://www.ncdc.noaa.gov/special-reports/2011-spring-extremes/index.php - drought and wildfire>

Extreme Heat of 2011

In mid July, much of the nation sweltered under a “heat dome” that brought roasting heat and sweltering humidity to much of the eastern two thirds of the country. At its worst, more than 140 million Americans were under a heat advisory or excessive heat warning, with the heat index—a measure of discomfort that combines both heat and humidity and describes how hot it actually feels—reaching levels typical of the area surrounding the Red Sea in Saudi Arabia.

In the Southeast, the August heat was especially brutal:

- Gainesville, Tallahassee and Tampa, FL; and Columbus and Savannah, GA experienced their hottest August on record.
- Tallahassee, FL; Augusta, Athens, Columbus and Savannah, GA; Charleston and Columbia, SC; and Cape Hatteras, NC suffered through their hottest summers on record.
- In July, Cape Hatteras, NC tied its record for the warmest month and Raleigh-Durham, NC had its hottest July ever.
- During July, Washington, DC had its warmest single calendar month in history, including an all-time record high of 105 degrees F at Dulles Airport on July 22. The heat index at Washington’s Reagan National Airport hit 121 degrees F, the second-highest known level since 1980.
- On August 4, Charleston, SC set an all-time record high overnight temperature on August 4 of 83 degrees F and Columbia, SC tied its all-time record high overnight temperature of 82 degrees F, first set in 1936.

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