

Connecting the Dots Between Extreme Weather and Climate Change: What Do We Really Know?

By Steven Hamburg, Steve Cochran, and Eric Pooley

Ever since the 1980s, climate scientists have predicted that a warming world, caused in large part by human activities such as the burning of coal and oil, would bring more floods, more droughts, and more frequent and ferocious storms.

This year, Americans are finding out what that feels like. 2011 has been a year of the weirdest weather imaginable—and hurricane season has only just begun.

Record rain and snowfall caused the worst spring flooding on the Mississippi River since the legendary high waters of 1927.¹ New flood level records were set in Vicksburg and Natchez, Miss.;² in Tunica, six feet of water took up residence inside Harrah's Casino.³ New Orleans and Baton Rouge were spared heavy flooding only because giant spillways were opened to the north, diverting billions of gallons of river water into Cajun country.⁴ This has been described as the second "500 year flood" on the Mississippi in just 20 years—and just a year before, Nashville suffered the equivalent of a 1000-year flood,⁵ causing almost \$2 billion in damage.⁶ Scientists warn that we need to re-calculate the odds of extreme events like these as climate change loads the dice on heavy weather. What we call a 1000-year flood, for example, might become a 20-year event.

While some parts of the country were getting acquainted with a new normal of unusually heavy rainfall, others were simply drying up, as early and intense heat triggered serious drought conditions. Wildfires have burned nearly 1,300 square miles in Arizona alone⁷. More than half of the American South is under extreme or exceptional drought.⁸ Texas and New Mexico had the driest spring on record.⁹ Texas Gov. Rick Perry issued a proclamation marking three days in April as "Days of Prayer for Rain in the State of Texas." He urged Texans to pray for "the restoration of our normal and robust way of life."

The U.S. isn't the only country going through record droughts. Australia recently emerged from a horrific 10-year drought,¹⁰ and when it finally broke, the long dry spell gave way to freak rainfall—with some areas of Queensland receiving up to two feet of rain in just six weeks—followed by record flooding¹¹ as some rivers pushed some thirty feet beyond their banks, displacing more than 200,000 people.¹²

Simply put, rising global temperatures are loading the dice for more extreme weather in many places. 2010 was the 34th year running that global temperatures have been above the average for the 20th-century. 1976 was the last below-average year.¹³ Over the past decade, record highs in the U.S. have occurred twice as often as record lows.¹⁴ (Remember New Hampshire's Primary Day in January 2008, when the normally frigid weather was so balmy that voters went to the polls in shirtsleeves?). According to NASA, the 1980s were the hottest decade on record globally ... until the 1990s came along. The '90s held the crown only briefly ... and then the 2000s became the hottest decade on record. 2010 is the hottest year ever recorded, tied with 2005.¹⁵ No one expects that record to stand for very long, either.

What's the connection between heat and heavy weather? Rising temperatures mean more evaporation of water into the atmosphere, mainly from the oceans. That means more clouds holding more moisture—and that, in turn, means more precipitation, some of it coming in more violent bursts. (That's true for all seasons, meaning that huge snowstorms like last winter's "snowmageddon" in the Northeast are not inconsistent with climate change.)

More precipitation and changing air circulation patterns also mean more flooding—and, in some places, more drought. Even as the world gets generally wetter, scientists say, some areas will get drier. One of those areas is the American Southwest. According to the U.S. Geological Survey, "In the Southwest ... models project a permanent drying by the mid-21st century that reaches the level of aridity seen in historical droughts."¹⁶ In other words, the models predict permanent drought by 2050.

Among climatologists, the link between climate change and weird weather is not controversial. The "controversy" comes mainly from political activists who for various reasons don't believe what scientists are telling us.

That's not to say that climate scientists have everything figured out. For example, although there's understandable speculation about a link between global warming and tornadoes, many years of study are needed before scientists will be able to say whether climate change is affecting these terrible storms. A handful of studies have explored possible links between global warming and the convective thunderstorms that can spawn tornadoes. These studies suggest that, in parts of the U.S., rising temperatures could increase the number of days with conditions favorable to thunderstorm formation.

Hurricane season has now arrived. Although scientists are still working out the details, research consistently indicates that manmade climate change will increase the number of the most intense storms, even as the overall frequency of tropical cyclones goes down.

Here's what we can say for certain: The weird weather of the future will bring devastating, life-threatening heat. The U.S. Global Change Research Program warns that by 2100, what we currently consider to be an extreme heat wave will be a normal summer, and "extremely hot" days will be 10°F warmer. Temperatures in parts of California, Arizona, Texas, and Florida are likely to be above 90°F for at least five months every year.¹⁷ And all of this terrible heat could make violent storms more likely.

This new normal, alas, is no longer in the realm of prediction. Last September, analysts at the reinsurance giant Munich Re—people whose business it is to calculate risk—put it this way: "It would seem that the only plausible explanation for the rise in weather-related catastrophes is climate change."¹⁸

"Extreme events are a manifestation of climate change," adds Thomas Karl, Director of U.S. Climatic Data Center, the lead author of a 2008 report that showed that extreme weather events linked to climate change are happening right now in the United States. "We may be fine for many years, and all of a sudden, one particular season, one particular year, the extremes are far worse than we've ever seen before."¹⁹

Now we know precisely what that feels like.

¹ Flooding: Spring 2011 U.S. Climate Extremes (2011). National Oceanic and Atmospheric Administration, National Climatic Data Center. Accessed July 6, 2011. Available at <http://www.ncdc.noaa.gov/special-reports/2011-spring-extremes/>

² Mississippi Floods near Vicksburg (2011). National Aeronautics and Space Administration, Earth Observatory. Accessed July 6, 2011. Available at <http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=50663>

³ Mississippi River at Tunica Riverpark (2011). National Oceanic and Atmospheric Administration, National Weather Service, Advanced Hydrologic Prediction Service. Accessed July 6, 2011. Available at <http://water.weather.gov/ahps2/hydrograph.php?wfo=meg&gage=trpm6&view=1,1,1,1,1,1,1,0>

⁴ IBID 1.

⁵ May 1 & 2 2010 Epic Flood Event for Western and Middle Tennessee (2010). National Oceanic and Atmospheric Administration, National Weather Service Weather Forecast Office. Accessed July 6, 2011. Available at <http://www.srh.noaa.gov/ohx/?n=may2010epicfloodevent>

⁶ Billion Dollar Weather Disasters 1980-2010 (2010). National Oceanic and Atmospheric Administration, National Climatic Data Center. Accessed July 6, 2011. Available at <http://www.ncdc.noaa.gov/img/reports/billion/billion2010.pdf>

⁷ http://www.azgfd.gov/w_c/fire_impacts_on_wildlife.shtml Accessed July 12, 2011.

⁸ <http://www.ncdc.noaa.gov/sotc/drought/2011/5> Accessed 12 July 2011.

⁹ Drought and Wildfire: Spring 2011 U.S. Climate Extremes (2011). National Oceanic and Atmospheric Administration, National Climatic Data Center. Accessed July 6, 2011. Available at <http://www.ncdc.noaa.gov/special-reports/2011-spring-extremes/>

¹⁰ NYT, 7/29/2007

¹¹ Special Climate Statement 24, frequent heavy rain events in later 2010/early 2011 lead to widespread flooding across eastern Australia. Australian Government, Bureau of Meteorology. Accessed July 6, 2011. Available at

<http://www.bom.gov.au/climate/current/statements/scs24b.pdf>

¹² Flooding in Queensland. (2011). National Aeronautic and Space Administration, Earth Observatory. Accessed July 6, 2011. Available at

<http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=48420>

¹³ http://www.noaanews.noaa.gov/stories2011/20110112_globalstats.html

¹⁴

<http://europa.agu.org/?view=article&uri=/journals/gl/gl0923/2009GL040736/2009GL040736.xml&t=2009GL040736>

¹⁵ http://www.noaanews.noaa.gov/stories2011/20110112_globalstats.html

¹⁶ <http://downloads.climate-science.gov/sap/sap3-4/sap3-4-final-report-ch3.pdf> (Cook, E.R., P.J. Bartlein, N. Diffenbaugh, R. Seager, B.N. Shuman, R.S. Webb, J.W. Williams, and C. Woodhouse, 2008:

Hydrological variability and change. In: *Abrupt Climate Change*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. U.S. Geological Survey, Reston, VA, pp. 67–115.)

¹⁷ Global Climate Change Impacts in the United States, Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson, (eds.). Cambridge University Press, 2009.

¹⁸

http://www.munichre.com/en/media_relations/press_releases/2010/2010_09_27_press_release.aspx

¹⁹ March 2010 broadcast for [EarthSky](#).