

Focus | CLIMATE

EARTH'S FUTURE: A WORLD OF EXTREMES?

Extreme weather events, as scientists long expected, appear to be increasing in response to climate change.

Heat waves, heavy rains, melting ice, retreating glaciers: Extreme events appear to be on the rise across the planet, and climate scientists say it's no coincidence.

For years, computer-model projections have suggested that the frequency of some extreme weather events would increase as global warming continues to perturb the climate system.

And while most scientists still say no individual event can be linked directly to climate change – despite all the buzz about Superstorm Sandy – more now say statistical evidence is mounting that the Earth's climate is tipping toward the extremes.

A new NASA-sponsored study adds fuel to the fire. Using satellite measurements to mark changes in tropical humidity, scientists

at the National Center for Atmospheric Research in Boulder, Colo., found that computer models of climate that most accurately capture humidity levels also project global temperature rise on the higher end of the scale.

"We asked a fairly naïve question: Which models reproduce relative humidity better than the others?" said John Fasullo, a project scientist at NCAR and a co-author of the study. "We didn't expect the accurate models to all fall on one side of the range."

Taken together, computer models, given a range of possible greenhouse gas emissions from civilization in the decades ahead, tend to project a three- to eight-degree rise in average global temperature by the end 21st century.

Climate scientists around the world, amounting to a strong consensus, say greenhouse gas emissions, mainly carbon dioxide, are driving global temperatures higher.

But the models that do a good job with humidity project temperatures on "the upper half of that side: six to eight degrees," Fasullo said. "Humidity is what drives variations in clouds, and those are what drive global temperatures."

Scientists must do more work, he said, to learn whether all models that capture humidity levels also produce high temperature projections – or if that just happened to occur in the models they studied.

"It's going to be some time till we know exactly what to make of it," Fasullo said. "What we haven't proven is whether any climate model that does well with relative humidity has to have high climate sensitivity."

If the connection holds, however, it suggests the world could well be in for even more roller-coaster weather.

"All the environmental changes that go along with temperature – humidity available for storms, sea-level rise, Arctic ice melt – all the things that follow temperature pretty well, they also would be on the high side of current estimates," he said.

The findings by Fasullo and co-author Kevin Trenberth could be used to help

check long-term projections in the next climate assessment by the Intergovernmental Panel on Climate Change, due for release in late 2013.

But while their results are a big step forward, they aren't likely to eliminate the wide range of possible future temperatures seen in climate models, said Michael Prather, an author of a chapter of the coming report and a climate modeling specialist at UC Irvine.

"It's a great scientific result," he said. "I don't think it solves the uncertainty problem by itself."

That would require a better understanding of the physical basis for the models' output, he said.

Still, Prather says at least some extreme weather events appear to be showing a statistical increase over decades – although making such a call becomes more difficult with extremely rare events, such as a 100-year storm.

"My belief is, we are seeing a statistical shift in extreme events, and they are happening now," he said. "That doesn't allow you to blame greenhouse-gas warming for a single event."

WHY IT MATTERS

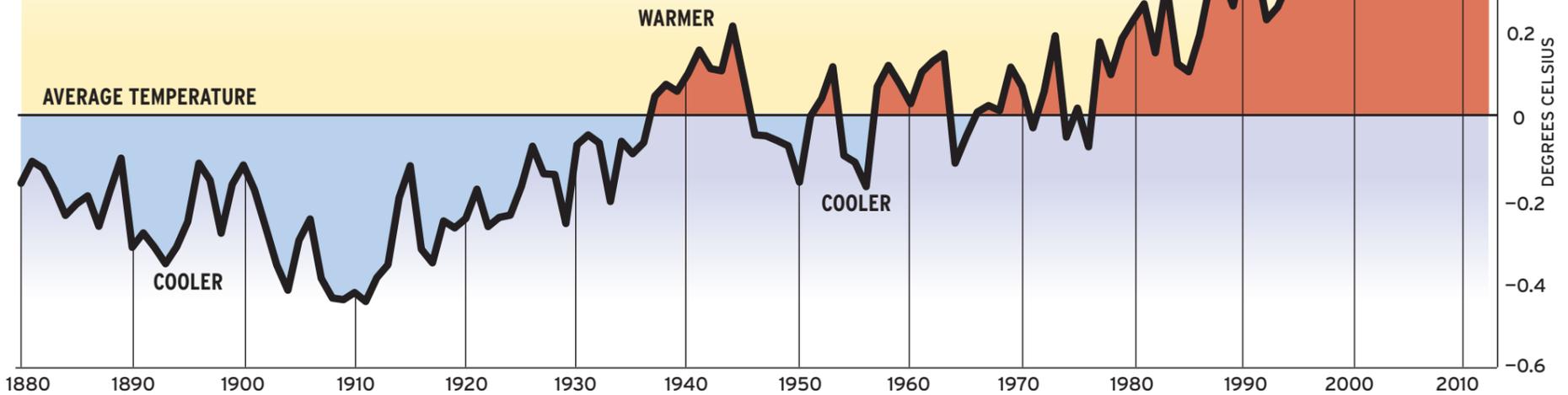
Recent dramatic weather events have kept climate change in the spotlight. Extreme weather events, some expected to increase as the Earth's climate warms, would have a huge impact on how and where people live.



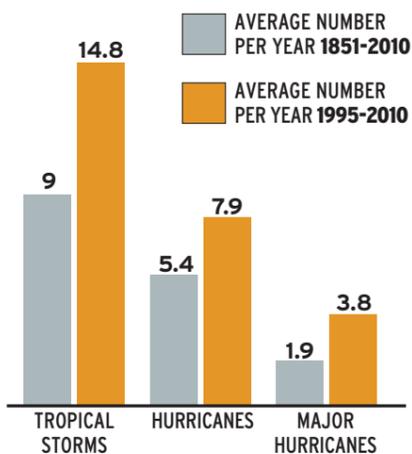
PAT BRENNAN REGISTER WRITER

GLOBAL SURFACE TEMPERATURE

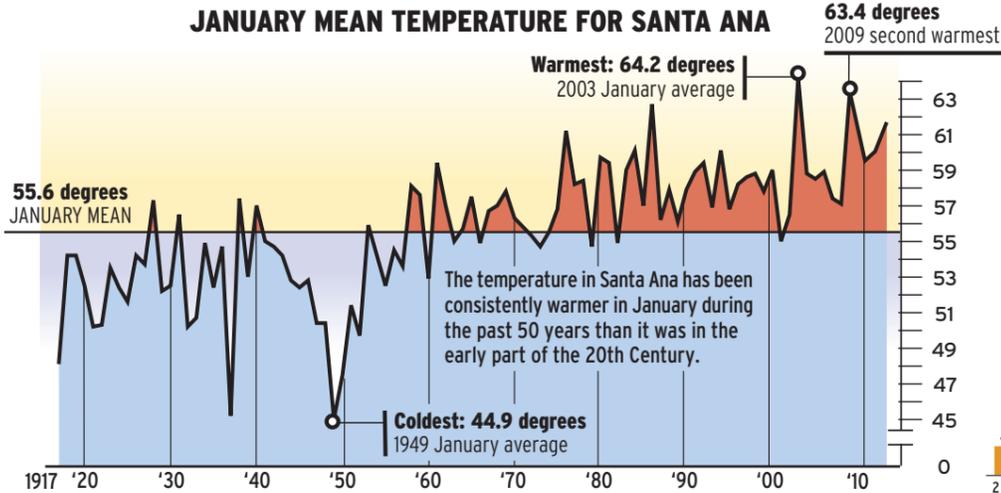
One way scientists express the temperature of the earth is the "temperature anomaly" from the "20th Century average." This is how much hotter or colder each year is than the 100-year average. This includes both the land and water temperature, in degrees Celsius:



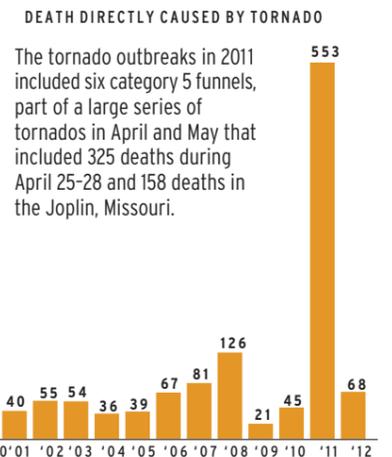
HURRICANES MAKING U.S. LANDFALL



JANUARY MEAN TEMPERATURE FOR SANTA ANA



U.S. DEATHS BY TORNADO



WHERE IT MAY GET WARMER IN THE U.S.

The days exceeding 100 degrees are projected to grow, according to a U.S. government report, depending on the emission levels of heat-trapping gases. Here are the low- and high-emission scenarios for 2080-2099:

