

News

EARTH & ENVIRONMENT

Extreme weather linked to humans

Climate change to blame for some of 2016's severe events

BY CAROLYN GRAMLING

For the first time, scientists have definitively linked human-caused climate change to extreme weather events.

Several extreme events that occurred in 2016—including a deadly heat wave that swept across Asia—simply could not have happened due to natural climate variability alone, three new studies find. The studies were part of a special issue of the *Bulletin of the American Meteorological Society* released December 13.

These findings are a game changer—or should at least be a conversation changer, Jeff Rosenfeld, editor in chief of the bulletin, said at a news conference that coincided with the studies' release. "We can no longer be shy about talking about the connection between human causes of climate change and weather."

For the last six years, the bulletin has published a December issue containing studies of extreme weather events from the previous year that seek to disentangle the role of anthropogenic climate change from natural variability. The goal from the start has been to find ways to improve the science of attributing such events, said Stephanie Herring of the National Oceanic and Atmospheric Administration's National Centers for Environmental Information in Boulder, Colo., lead editor of the latest issue.

To date, the bulletin has published 137 attribution studies. But this is the first time that any study has found that a weather event was so extreme that it was outside the bounds of natural variability—let alone three such events, Herring said.

In addition to the heat wave in Asia,

the other events were the record global heat in 2016 and the growth and persistence of a large swath of high ocean temperatures, nicknamed "the Blob," which extended into the Bering Sea off the coast of Alaska. The unusually warm waters, which lingered for about a year and a half, have been linked to mass die-offs of birds, collapsed codfish populations in the Gulf of Alaska and altered weather patterns that brought drought to California.

Many of the other 24 studies in the new issue found a strong likelihood of human influence on extreme weather events but stopped short of saying they were completely out of the realm of natural variability. One study found that an already strong El Niño in 2016 was probably enhanced by human influence, contributing to drought and famine conditions in southern Africa. And greenhouse gas-driven warming of sea surface temperatures in the Coral Sea was the main factor driving an increase in coral bleaching risk along the Great Barrier Reef, another study found. But not all of the studies linked 2016's extreme events to human activity. Record-breaking rainfall in southeastern Australia between July and September, for instance, was due to natural variability, one study found.

With hurricanes, wildfires and drought, 2017 was chock-full of extreme event candidates for next year's crop of attribution studies. Already, the likelihood of human influence on the extreme rainfall from Hurricane Harvey is the subject of three independent studies. The storm dropped up to 1.3 meters of water in and around Houston in August. The three studies, discussed in a separate news conference December 13, found that human influence probably increased the hurricane's total rainfall, by anywhere from at least 15 to at least 19 percent.

The studies in the *Bulletin of the American Meteorological Society* "speak to the profound nature of the impacts we're now seeing," says Michael Mann, a climate scientist at Penn State who was not involved in any of the studies. But Mann says he's concerned that many researchers are too focused on quantifying how much human influence was responsible for a particular event, rather than how human influence affects various processes on the planet. One example, he notes, is a better understanding of the established link between rising temperatures and increased moisture in the atmosphere that is also implicated in Hurricane Harvey's extreme rainfall.

Another possible issue with attribution science, he says, is that the current generation of simulations may not be capable of capturing some of the subtle changes in the climate and oceans—a particular danger when it comes to studies that find no link to human activities.

It's a point that climate scientist Andrew King of the University of Melbourne in Australia, who authored the paper on Australia's rainfall, noted at the news conference. "When we find no clear signal for climate change, there might not have been a human influence on the event, or [it might be that] the particular factors of the event that were investigated were not influenced by climate change," he said. "It's also possible that the given tools we have today can't find this climate change signal."

Rosenfeld noted that people tend to talk about the long odds of an extreme weather event happening. But with studies now saying that climate change was a necessary condition for some extreme events, discussions about long odds no longer apply, he said. "These are new weather extremes made possible by a new climate." ■

