

Explaining Extreme Events of 2014 from a Climate Perspective

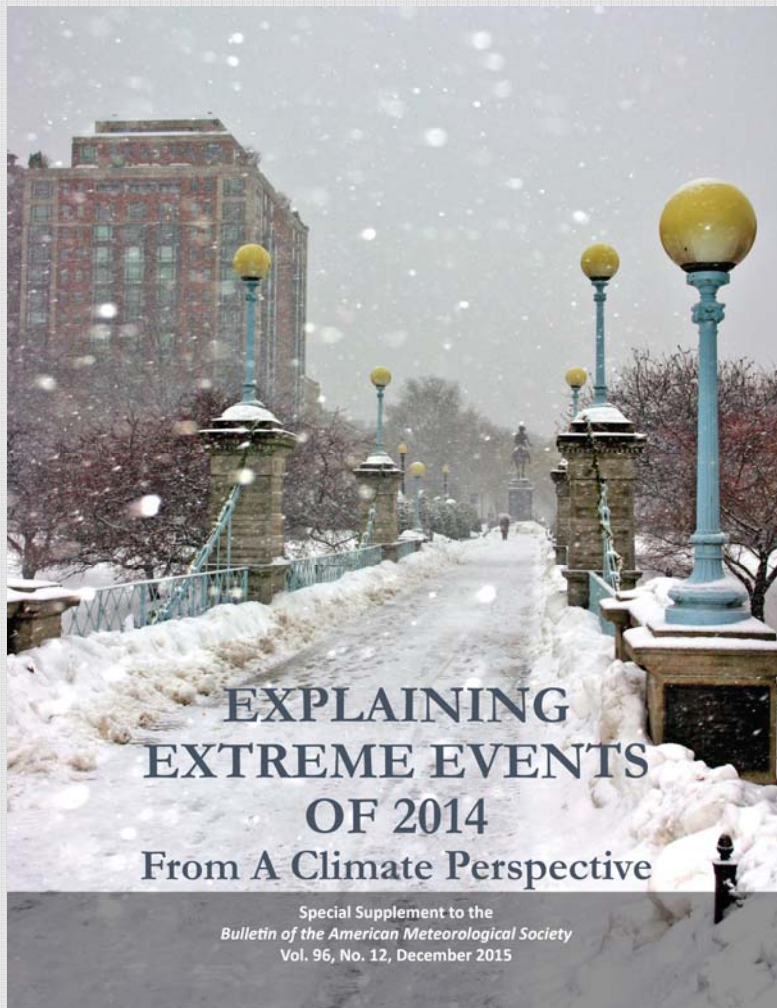
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NOAA Satellite and Information Service | National Centers for Environmental Information



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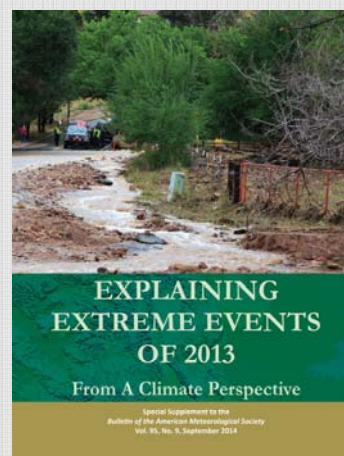
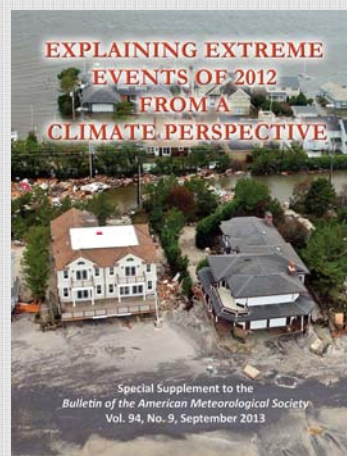
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Report Background

- Fourth year of publishing research on “Explaining Extreme Weather and Climate Events” of the past year in the *Bulletin of the American Meteorological Society* (BAMS)
- Each event is assessed and written by independent author teams who select the events they will examine
- Each paper is independently peer reviewed by BAMS editors and scientific reviewers





Why this report?

Using science to help communities prepare for the future

- Annual report was started four years ago to:
 - Advance attribution science and improve the ability to determine how individual extreme events are influenced by natural and human activities
 - Promote application of existing methodologies in closer to ‘real-time’ attribution assessments by focusing on events from the previous calendar year
 - Encourage scientifically based communication about the presence and absence of climate change influences on extremes



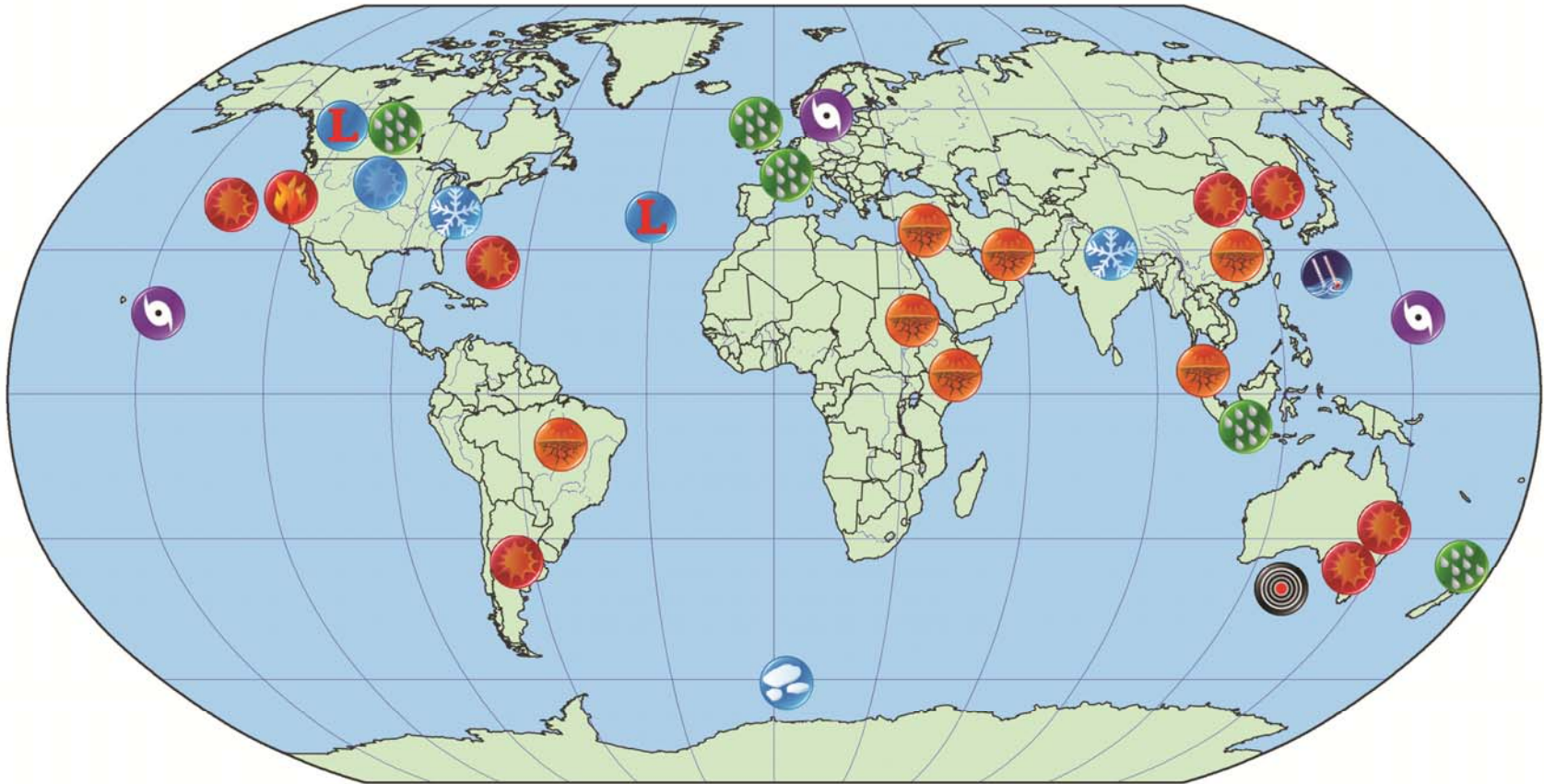


What is in the Report?

- 32 papers looking at 28 different extreme events from around the world in 2014. Largest of the four reports.
- Most global coverage of any of the past reports. All seven continents are represented.
- Papers cover event types ranging from the more common heat, precipitation and drought, to new event types including fires, Antarctic sea ice extent, and sea level pressure anomalies.



What is in the Report?



-  Drought
-  Heat
-  Fire
-  Heavy Rain
-  Cold
-  Snow
-  ETS Activity
-  Tropical Cyclones
-  Sea Ice Extent
-  SST
-  MSLP Anomalies





When a climate change signal is not found

- Natural variability is always part of any weather and climate extreme. A human influence on an event is not always found in these studies.
- How should this be interpreted? Any of the following could explain the absence of a signal:
 - There was no human influence on the event
 - The particular factors investigated were not influenced by human-caused climate change
 - The human influence could not be identified with the scientific tools available today
- In all cases, as models, data, and analysis methods improve, future studies could yield new information.





Temperature and Precipitation

Heat events

- Results overwhelmingly show climate change influenced event likelihood and/or intensity
- Globally extreme heat is becoming more common.
 - “Using a $5^{\circ} \times 5^{\circ}$ grid with at least 100 years of coverage, 12% of this area globally set a new warm record during 2014, and **none set a cold record.**”
 - “Globally since 1990, there have been almost no cold annual mean records observed at this spatial scale.” – Kam et al., Ch 13

Precipitation events

- The role of human influences on the extreme precipitation events analyzed is decidedly mixed





Drought

7 papers looked at drought; most did not find a role for climate change

- East Africa: Two independent papers found climate change played a role
- Brazil: Increased water usage, not climate change, was the main driver

The complexity of drought makes it an ongoing research challenge:

- A combination of factors that interact in a complex way lead to a drought.
 - Lack of precipitation, temperature, evaporation rates, soil moisture, etc.
 - Human activity such as land and water usage
- Many papers looked at only one of these variables. To enhance usefulness of drought attribution assessments it will be important to increasingly include multiple factors.





U.S. Event Highlights

- Long term CA fire risk has increased due to climate change. Links to 2014 event not certain.
 - *“The fire season in northern California during 2014 was the second largest in terms of burned areas since 1996. An increase in fire risk in California is attributable to human-induced climate change.”* - Yoon et al.
- Eastern U.S. cold winter not linked to climate change
 - *“The near-record number of extremely cold days during winter 2014 in the eastern United States cannot be attributed to trends or variability changes. Daily temperature variability is actually decreasing, in contrast to CMIP5 simulations and projections.”* – Trenary et al.
- Greater Upper Midwest cold winter shown to be less likely
 - *“The frigid 2013/14 Midwestern winter was 20–100 times less likely than in the 1880s due to long-term warming, while winter temperature variability has shown little long-term change.”* – Wolter et al.



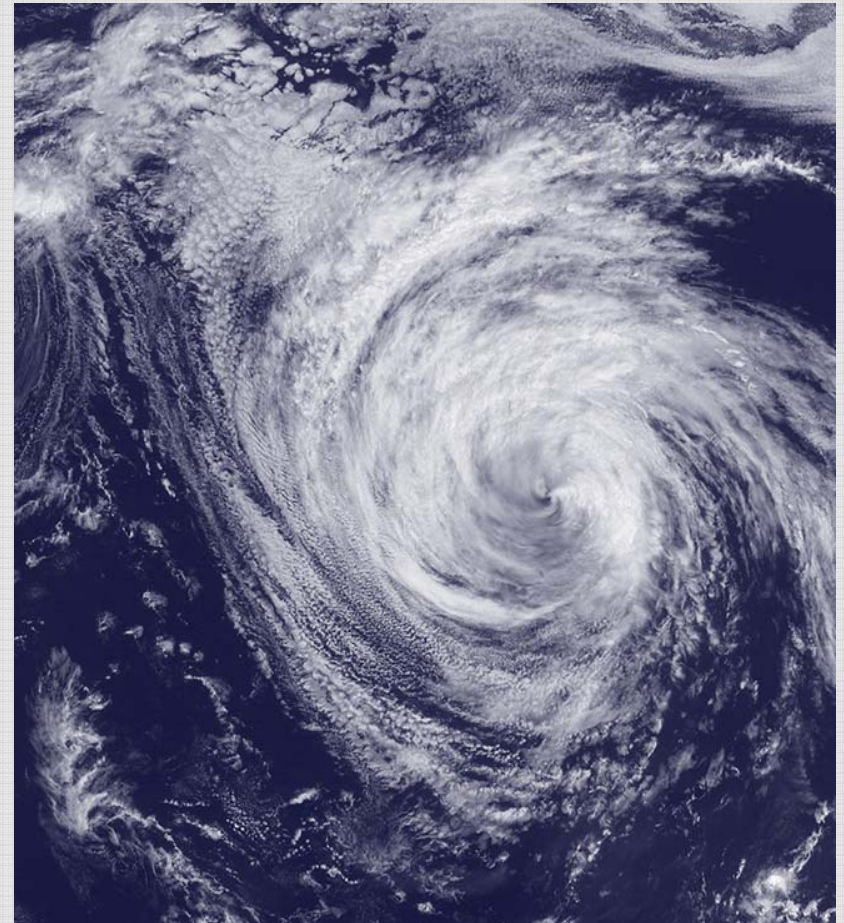


Tropical Cyclones

Tropical Cyclone events in this report:

- **Hawaii:** Climate change made the Hawaiian hurricane season ‘*substantially more likely... but natural variability of El Niño was also partially involved.*’ – Murakami et al.
- **Hurricane Gonzalo:** No role for climate change found for Europe’s hurricane Gonzalo, which “*was within the historical range of such transforming storms.*” – Feser et al.
- **No TC activity in western North Pacific:** An analysis of an extreme *absence* of TCs showed no role for climate change (Yang et al.)

Events such as tropical cyclones present unique scientific challenges because of severe limitations of the past observational data as well as the ability of models to accurately reproduce them





Other types of 'human influence'

Two papers looked at other human influences besides the usual radiative climate change forcing

- Southeastern Canadian Prairies: An increase in spring rainfall as well as extensive artificial pond drainage increased the risk of more frequent severe floods from the enhanced rainfall
- Jakarta Floods: May have been compounded by land use change via urban development and associated land subsidence

These types of mechanical factors reemphasize the various pathways beyond climate change by which human activity can increase regional risk of extreme events.

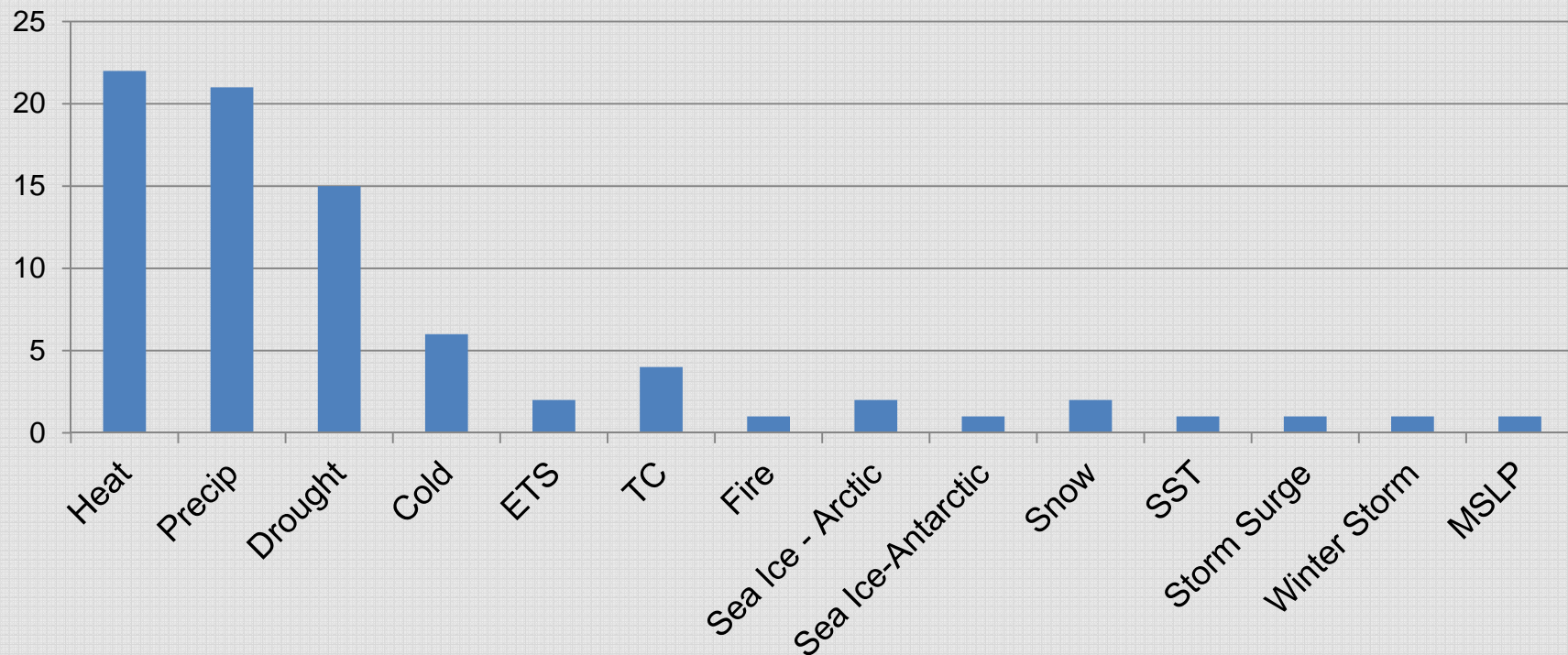


After Four Years

Includes 2011-2014 Reports

*These are not a random sampling of extreme events from around the world

Total





After Four Years

- Heat and precipitation events lend themselves more readily to timely attribution assessments
 - Heat and precipitation events, including in the context of drought, comprise ~75% of all submissions
- Signal to noise for heat events is clear:
 - For heat events the vast majority find a climate change signal: ~95% found a human influence
 - For precipitation events it is more mixed: ~40% found a human influence





Summary

- Attribution science has made major steps forward over the past four years. The range of event types being examined continues to grow.
- Some event types are more ready for near real-time attribution analysis than others
- Opportunities are emerging to integrate attribution science with other non-climate change related drivers to support decision making
- The science remains challenging, but the environmental information it yields for decision makers is invaluable and the demand is ever-growing





For More Information

- Full Report - BAMS “Explaining Extreme Events of 2014 from a Climate Perspective”
 - <http://bit.ly/1Nfyq7i>
- NCEI Web Story and Slides from today’s call
 - <http://www.ncdc.noaa.gov/news/explaining-extreme-events-2014>
- Recording of today’s media call
 - <http://1.usa.gov/1HtxeeM>
- Media Contacts:
 - Katy Matthews (katy.matthews@noaa.gov, 828-257-3136)

