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Answering the attribution question while the world is listening – attribution and the media

Friederike Otto, Heidi Cullen, Geert Jan van Oldenburgh et al.

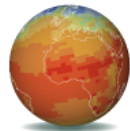
Environmental Change Institute

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Someone will ask the attribution question & someone will answer it



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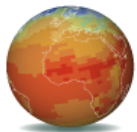
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Step 5 - Scientific communication

A scientific write-up has to be ready at the same time as the popular story.

- ◆ For transparency: people can check what we have done in terms of assumptions, event definition, ...
- ◆ To improve communication within the team: it has proven very hard to go from numbers and graphs to a popular piece without a scientific text as stepping stone.



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The results

Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-448, 2016

Manuscript under review for journal Hydrol. Earth Syst. Sci.

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Hydrology and
Earth System
Sciences
Discussions



Rapid attribution of the August 2016 flood-inducing extreme precipitation in south Louisiana to climate change

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Abstract.

A stationary low pressure system and elevated levels of precipitable water provided a nearly continuous source of precipitation over Louisiana, United States (U.S.) starting around 10 August, 2016. Precipitation was heaviest in the region

The key-message summary

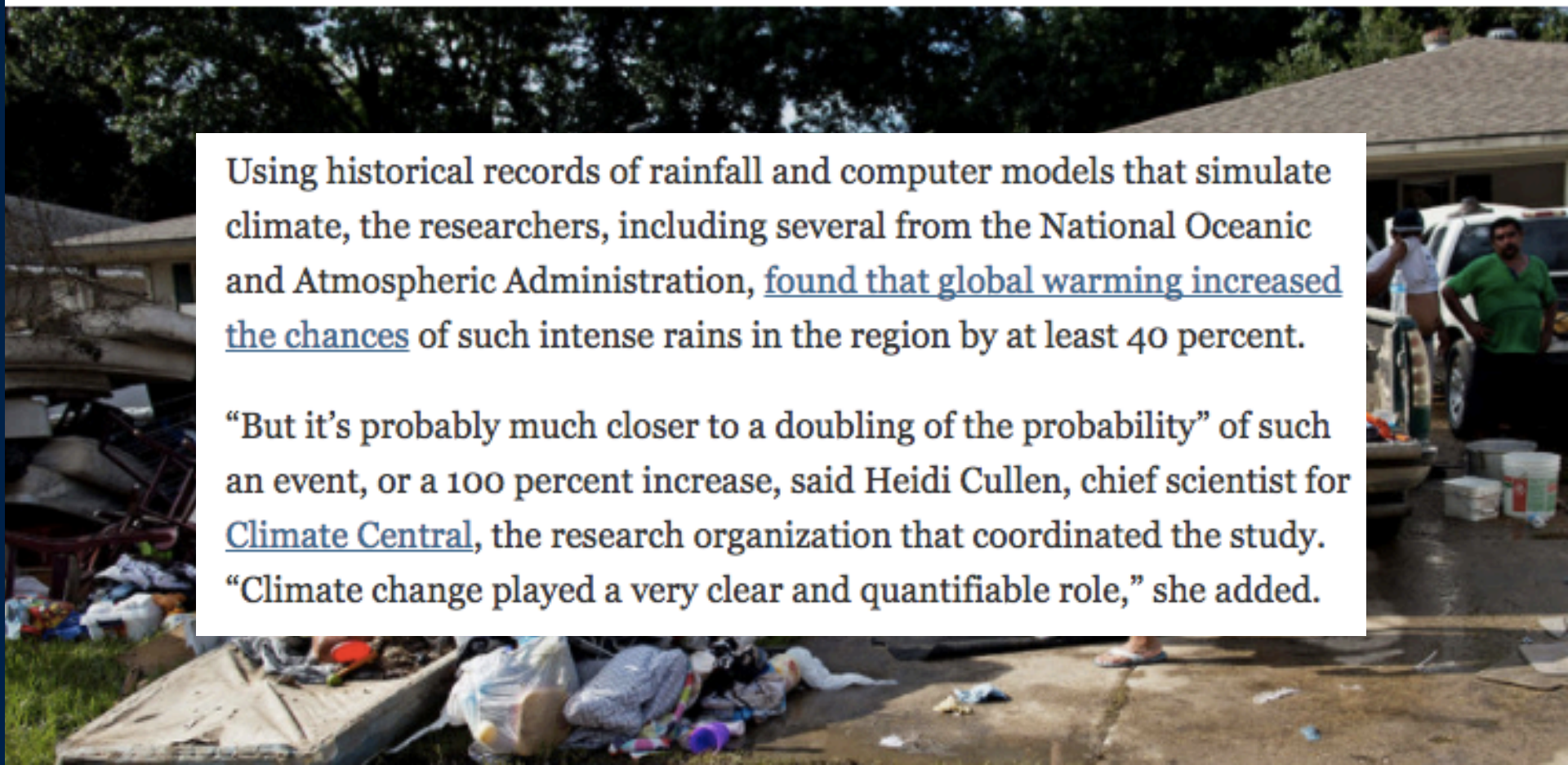
Scientists See Push From Climate Change in Louisiana Flooding

By HENRY FOUNTAIN SEPT. 7, 2016



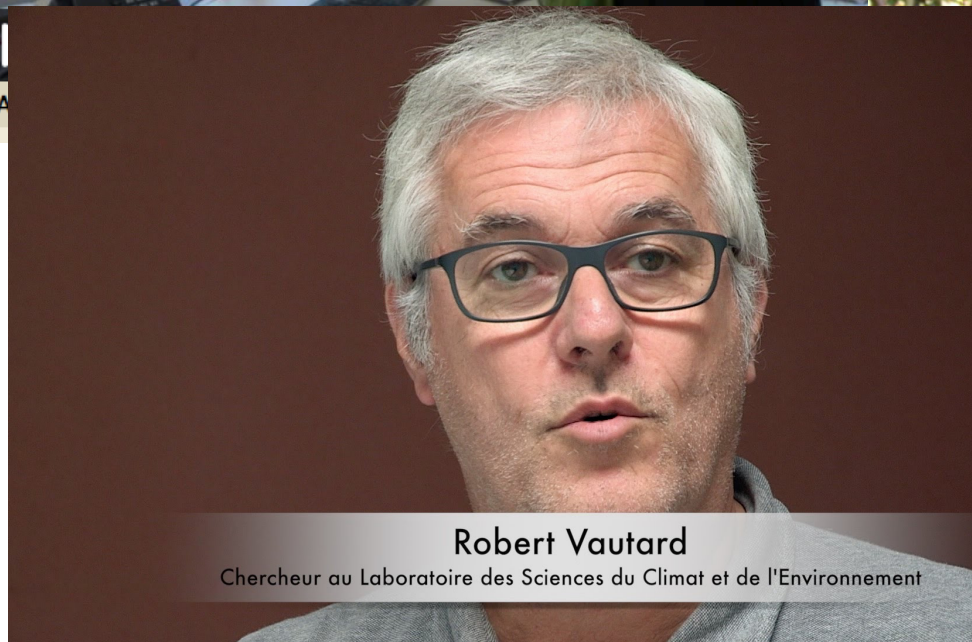
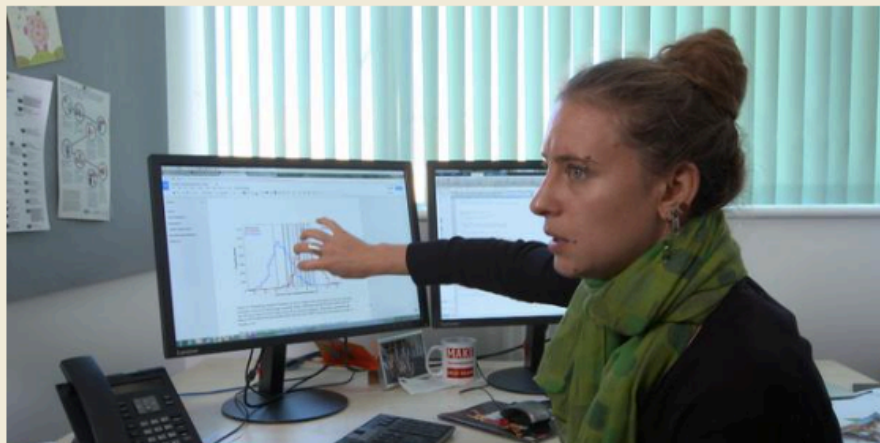
Using historical records of rainfall and computer models that simulate climate, the researchers, including several from the National Oceanic and Atmospheric Administration, found that global warming increased the chances of such intense rains in the region by at least 40 percent.

“But it’s probably much closer to a doubling of the probability” of such an event, or a 100 percent increase, said Heidi Cullen, chief scientist for Climate Central, the research organization that coordinated the study. “Climate change played a very clear and quantifiable role,” she added.



Three or more *scientists* happy to answer the phone

Attribution Science

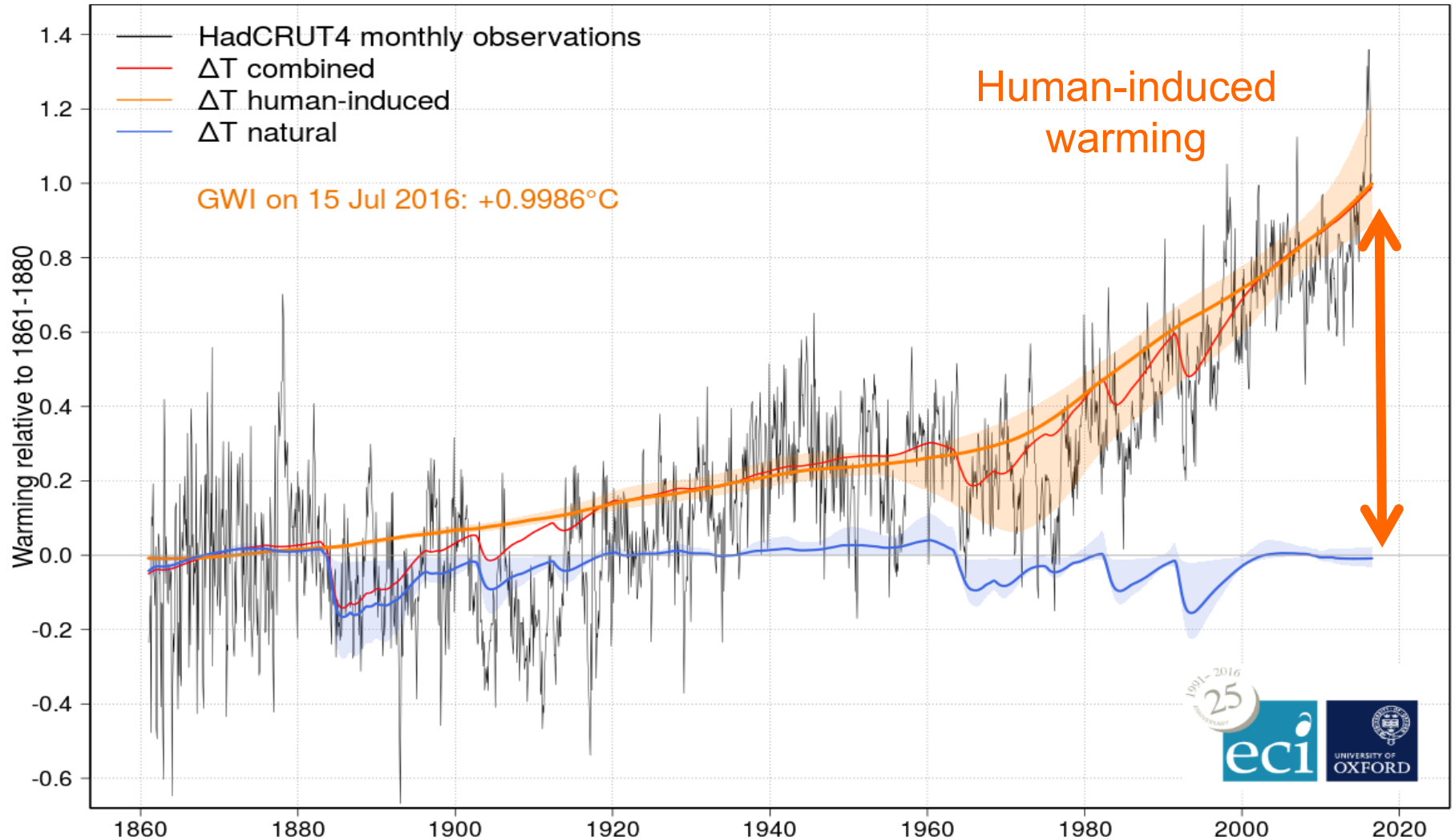


Robert Vautard

Chercheur au Laboratoire des Sciences du Climat et de l'Environnement

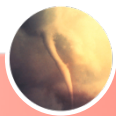
The background

Global Warming Index based on HadCRUT4 - updated until Jul 2016



The background

Strongest scientific evidence shows human-caused climate change is increasing heat waves and coastal flooding



Tornadoes



Hurricanes



Severe Droughts



Winter Storms



Extreme Precipitation Events



Coastal Flooding



Heat Waves

← Limit Moderate Strong → Strongest

d

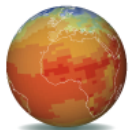
Adapted from SBEV



The background

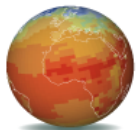
Possible outcomes of an attribution study:

1. The event was made more likely due to anthropogenic climate change
2. The event was made less likely due to anthropogenic climate change
3. Anthropogenic climate change did not alter the frequency of occurrence of the event
4. With our current understanding and tools we cannot assess whether and how the event was influenced by anthropogenic climate change



Questions to be prepared for - Selection criteria

1. The event had major impacts on people
1. There is enough usable data available to allow us to understand what happened in terms of the meteorology so we know how to define the event. & enough historical observations to put the event in context.
1. We have output of a model in principle capable of describing the event.
1. The people in the team who are crucial for the analysis have time



Acts of God, human influence and litigation

Sophie Marjanac, Lindene Patton and James Thornton

Developments in attribution science are improving our ability to detect human influence on extreme weather events. By implication, the legal duties of government, business and others to manage foreseeable harms are broadening, and may lead to more climate change litigation.

Advances in the science of extreme weather event attribution have the potential to change the legal landscape in novel ways. Identifying the human influence in events once known as 'acts of God' is likely to inform litigation relating to claims and liability for damages. Attribution science is also leading to better predictions of the expected severity of certain types of weather-related natural disasters. Such a shift in our understanding of extreme events could have legal implications for decision-makers with a duty to manage foreseeable harm and plan for the future.

Litigation may play an important role in reducing greenhouse gas emissions in the absence of enforceable commitments from government¹. Despite the shifting sands of climate politics — or perhaps because of them — the courts are being asked to play an increasing role in apportioning responsibility for loss and damage resulting from climate change².

Improvements in attribution science are affirming the foreseeability of certain climatic events and patterns in specific locations, and in identifying increasing risks of consequential impacts on property, physical assets and people. Such improvements are key from a legal point of view, because foreseeability of damage is an important requirement to establish a duty of care in many legal systems.

Determining the foreseeability of an action, event or loss may therefore inform common-law-based litigation related to directors' and officers' liability, professional, sovereign, premises and product liability and more. The question is not whether there will be another wave of climate-related litigation — the wave is already in motion. The question instead is whether it will be more successful than previous efforts³.

We expect that evidence from attribution science will catalyse future climate change litigation. Such cases are likely to involve

actors such as local government agencies, built-environment professionals, and companies and their directors alleged to have had duties of care or special knowledge about specific climate-related risk (Box 1).

Claims are likely to arise when those actors fail to share or disclose relevant knowledge, or fail to take adaptation actions that would have protected those to whom they owed a duty of care. Such litigation may become an important driver of both mitigation of greenhouse gas emissions and adaptive action by both public and private sectors.

Attribution science

Probabilistic event attribution is the science of seeking to determine the extent to which anthropogenic climate change has altered the probability or intensity of a particular weather event or class of weather events, with an assignment of statistical confidence⁴. Existing methodologies have been deemed robust by the National Academy of Sciences, though uncertainties remain and confidence is far higher in studies of extreme heat and cold events⁵.

Event attribution is a relatively new discipline that developed in response to interest from outside the scientific community in the extent to which damaging extreme events can be attributed to human-induced climate change or natural climatic variability, or both.

The primary approach used is to compare the changes in the observed record over time with climate model simulations. The 'real world', defined through observations and models, is compared to a 'counterfactual world' modelled without human forcings (greenhouse gases and aerosols), an approach that allows isolation and analysis of the influence of anthropogenic factors.

In 2004, an attribution study analysed the link between anthropogenic climate change and the 2003 European heat wave (Fig. 1)⁶. Since then, the conclusions of

event attribution studies have become more confident — qualitatively and quantitatively — in their expression of the (probabilistic, not deterministic) causal relationship between anthropogenic greenhouse gas emissions and certain extreme weather events. In addition, the ability of scientists to differentiate between natural and human-caused drivers of temperate extremes, droughts and heavy rain events has improved markedly⁷.

The soundness of the scientific conclusions are evaluated based on the three pillars of attribution science: the quality of the observational record; the ability of models to simulate the event being studied; and scientific understanding of the physical processes that drive the event and how they are being impacted by climate change.

It should be noted that all attribution studies express their findings in probabilistic terms, as scientists reject the notion that deterministic attribution of weather events is ever possible — because it is impossible to say that the event would 'never' have occurred in the 'counterfactual world'. We wish to emphasize, however, that this does not diminish the utility of attribution science for the law and liability.

In the UK, courts considering occupational exposure to toxic substances have accepted probabilistic evidence as proving causation when such evidence demonstrates that the risk of the event occurring was increased by a factor of 2d, known as the doubling-of-the-risk test^{8,9}. In the US, toxic tort litigation has adopted similar tests for situations where deterministic causation is impossible, known as proximate cause^{10,11}.

In addition, the law in civil cases accepts as proven any evidence that is shown to be 'correct' on the balance of probabilities' or 'more likely than not' (that is, with certainty of >50%). Indeed, a British judge has stated: "...in the event that the epidemiological

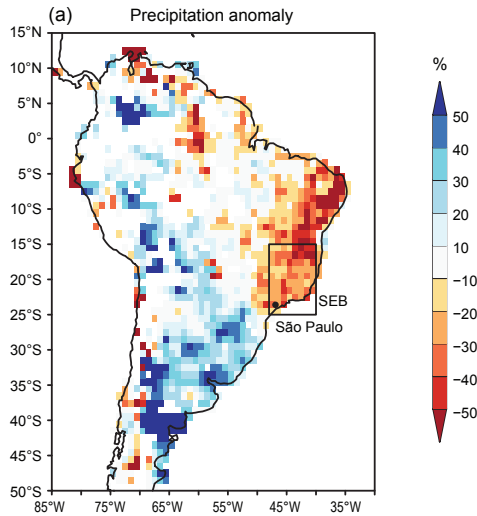
Questions to be prepared for

Liability

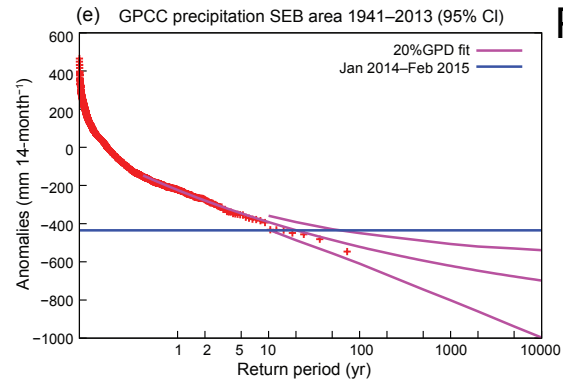
Nature Geoscience

- September 2017
- Mentions WWA analysis
- Risk management frame

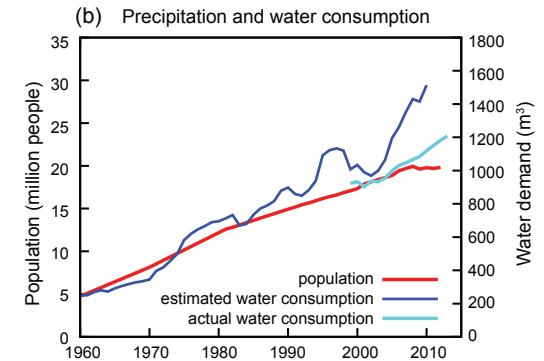
Questions to be prepared for – What else happened? drought Sao Paulo



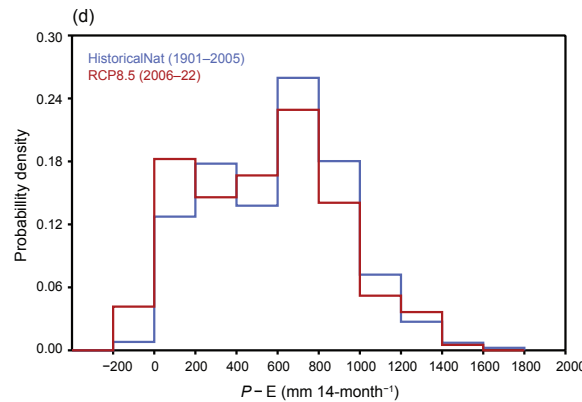
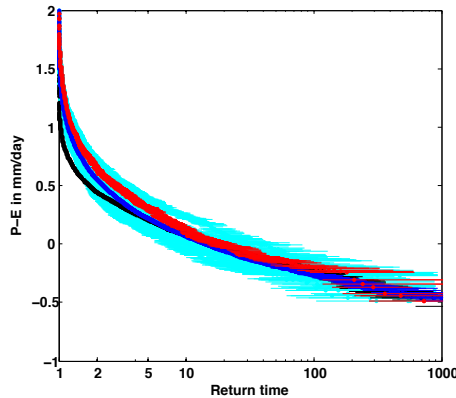
Precipitation



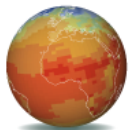
Population increase+ water demand



P-E



Otto et al., 2015



Extreme Heat - Europe (June 7-11, 2017)

Date of Release: *June 29, 2017*

Hits Total - 199 (U.S. - 24 & Int. - 175)

Countries (≥ 5 times):

- *Brazil - 17*
- *United Kingdom - 15*
 - *Spain - 10*
 - *Croatia - 9*
 - *Italy - 11*
- *Portugal - 8*
- *România - 7*
- *Vietnam - 6*
- *Australia - 5*
 - *Mexico - 5*
- *Indonesia - 5*

Examples

Reuters US

StarTribune (Minnesota)

Homeland Security News Wire (N.Y.)

International Coverage

Reuters (Brazil, U.K.)

BBC (U.K.)

The Guardian (U.K.)

TAZ (Germany)

...

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Louisiana Downpours (Aug. 12 - 14, 2016)

Date of Release: *August 15, 2016*
Hits Total - 534 (U.S. - 473 & Int. - 61)
Countries (≥ 2 times)

- *India - 11*
- *Canada - 10*
- *United Kingdom - 8*
 - *Korea - 4*
- *United Arab Emirates - 3*
 - *Australia - 2*
 - *Singapore - 2*
- *Cayman Islands - 2*
 - *Italy - 2*
 - *Vietnam - 2*

U.S. Coverage

The New York Times

Las Vegas Sun (Nevada)

The Christian Science Monitor (National)

International Coverage

La Vanguardia (Spain)

Daily Mail Online (U.K.)

South China Morning Post (H.K.)

Kenya Drought (Oct. - Dec. 2016)

Date of Release: *March 23, 2017*
Hits Total - 9 (U.S. - 5 & Int. - 4)
Countries

- *Canada - 1*
- *South Africa - 1*
- *Kenya - 1*
- *United Kingdom - 1*

U.S. Coverage

*Relief Web - digital service of
the UN Office for the
Coordination of Humanitarian
Affairs (OCHA)*

International Coverage

*Standard Digital News (Kenya) -
Ranked as number one of the
most visited websites in kenya.*