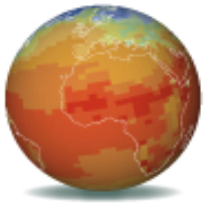

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The weather@home approach to event attribution

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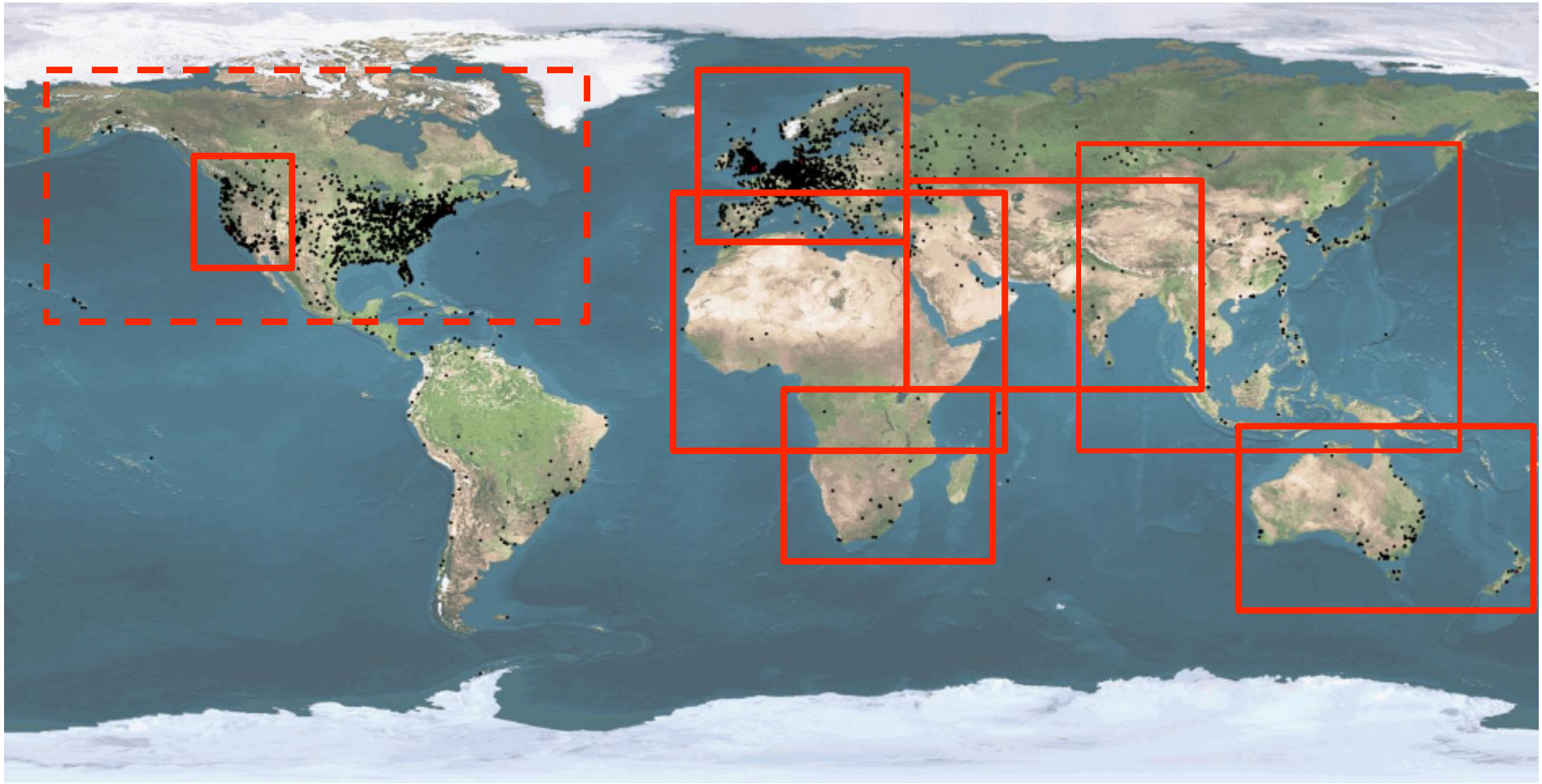
weather@home regional climate models



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Generally impossible to say "this event would not have occurred without human influence"

1809

1884

2001

2000

2003

2014

- **Historic flood levels in Shillingford**
- **Oxford has been flooded before, in 1897, 1947, 2000, 2003, 2007, 2014…**
- **DJF 2013/2014 highest ever recorded seasonal precipitation in Oxford**

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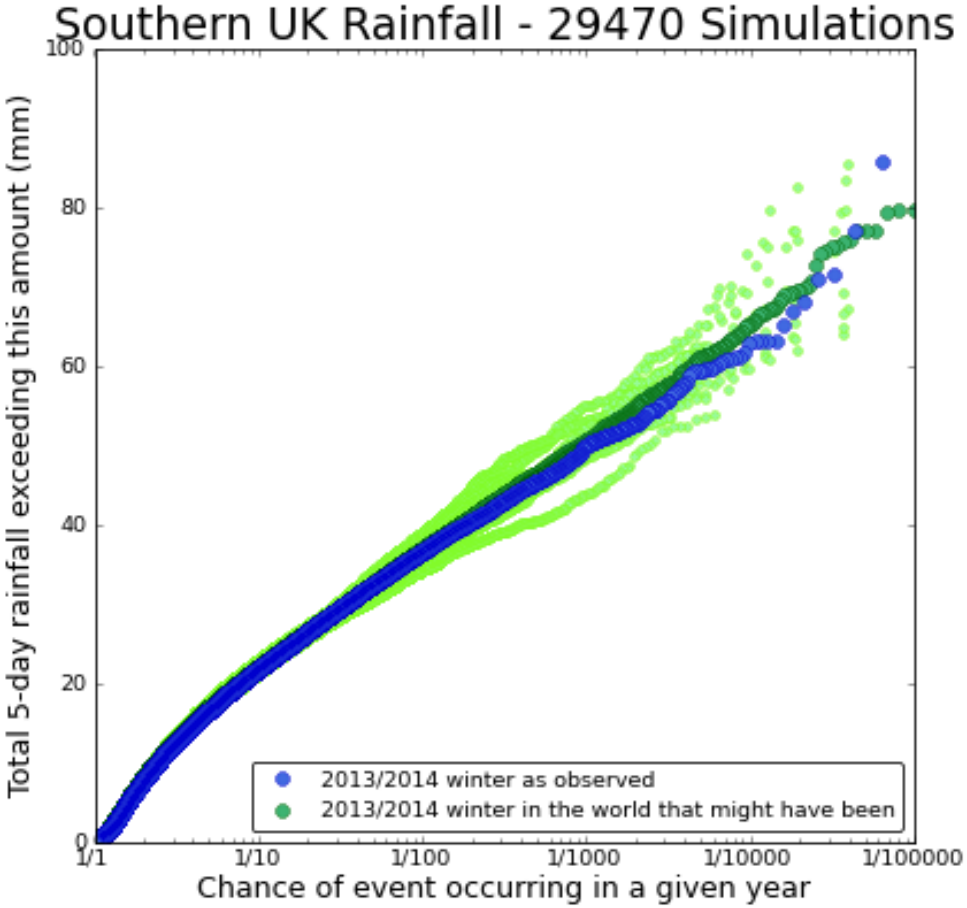
But we can ask how the risk of such an extreme event occurring has changed due to external factors

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

The highest precipitation ever recorded in winter in Oxford



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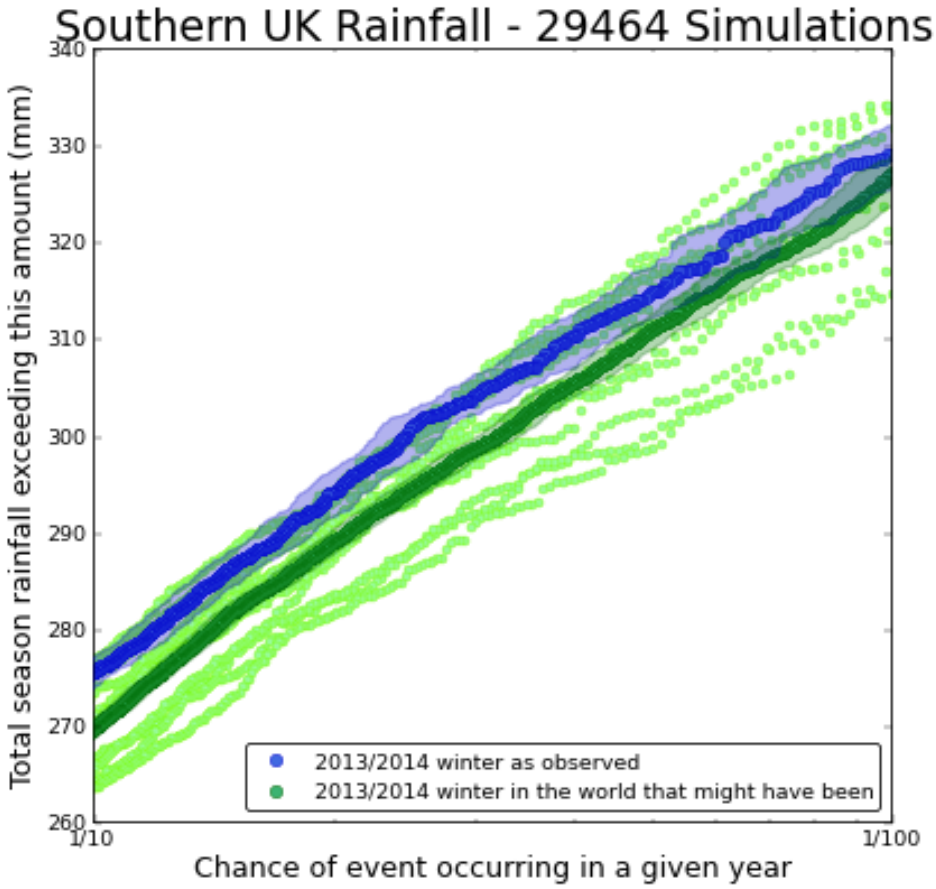
25% increase in the risk of what was a 1 in 100 year event in the world that might have been



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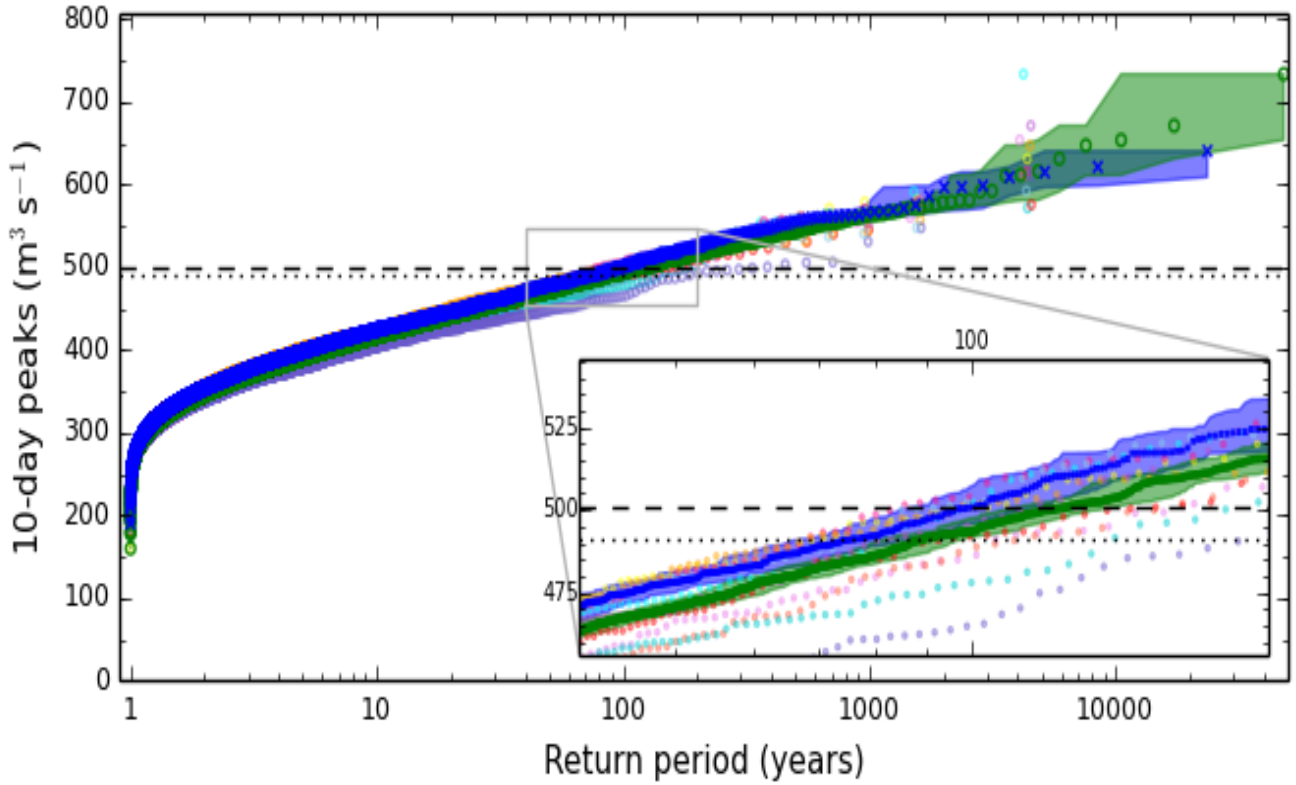
10-day peak river flow in the Thames catchment



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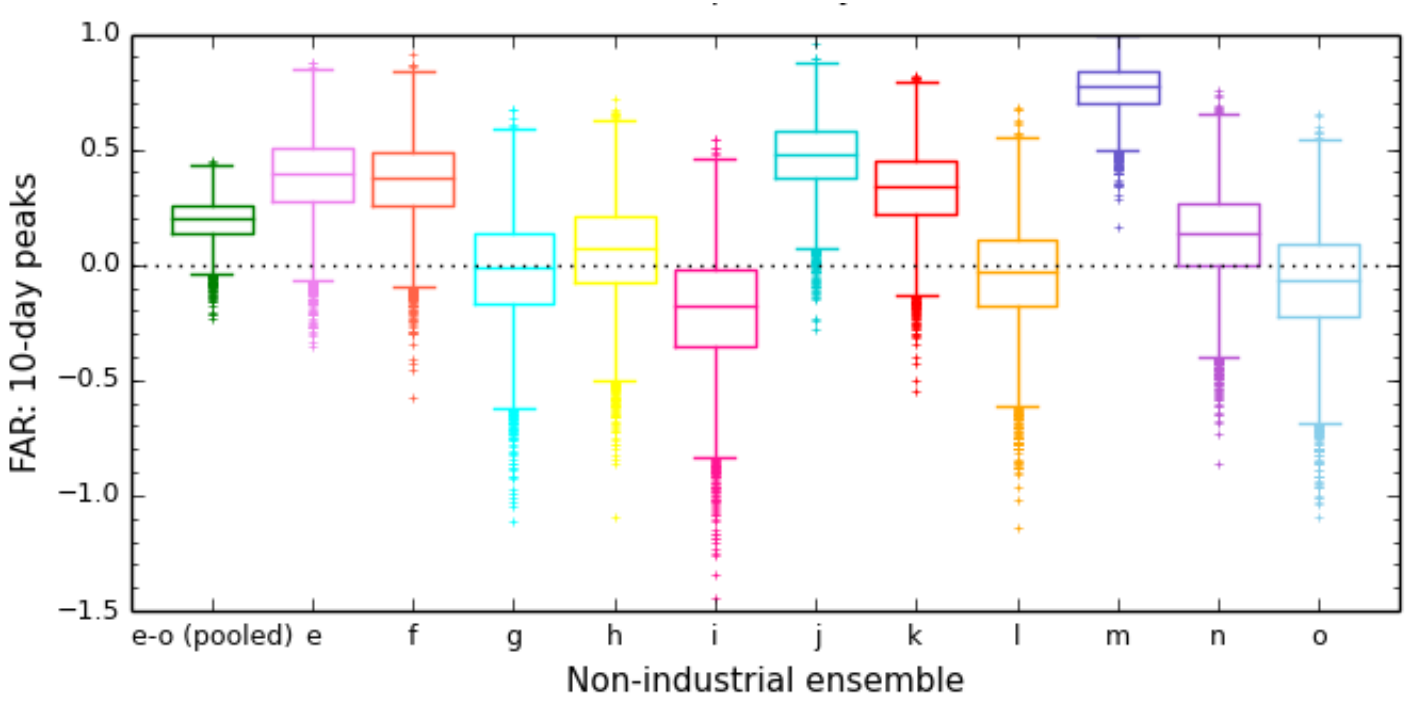
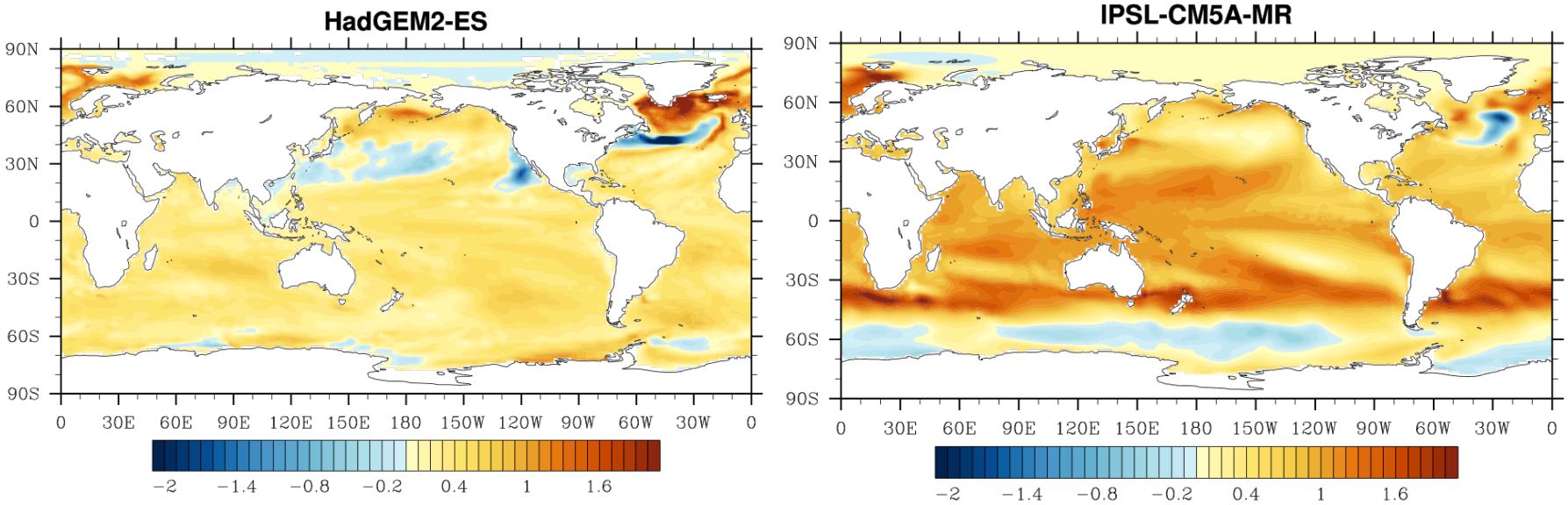
FAR for river flow depending on the SST pattern removed



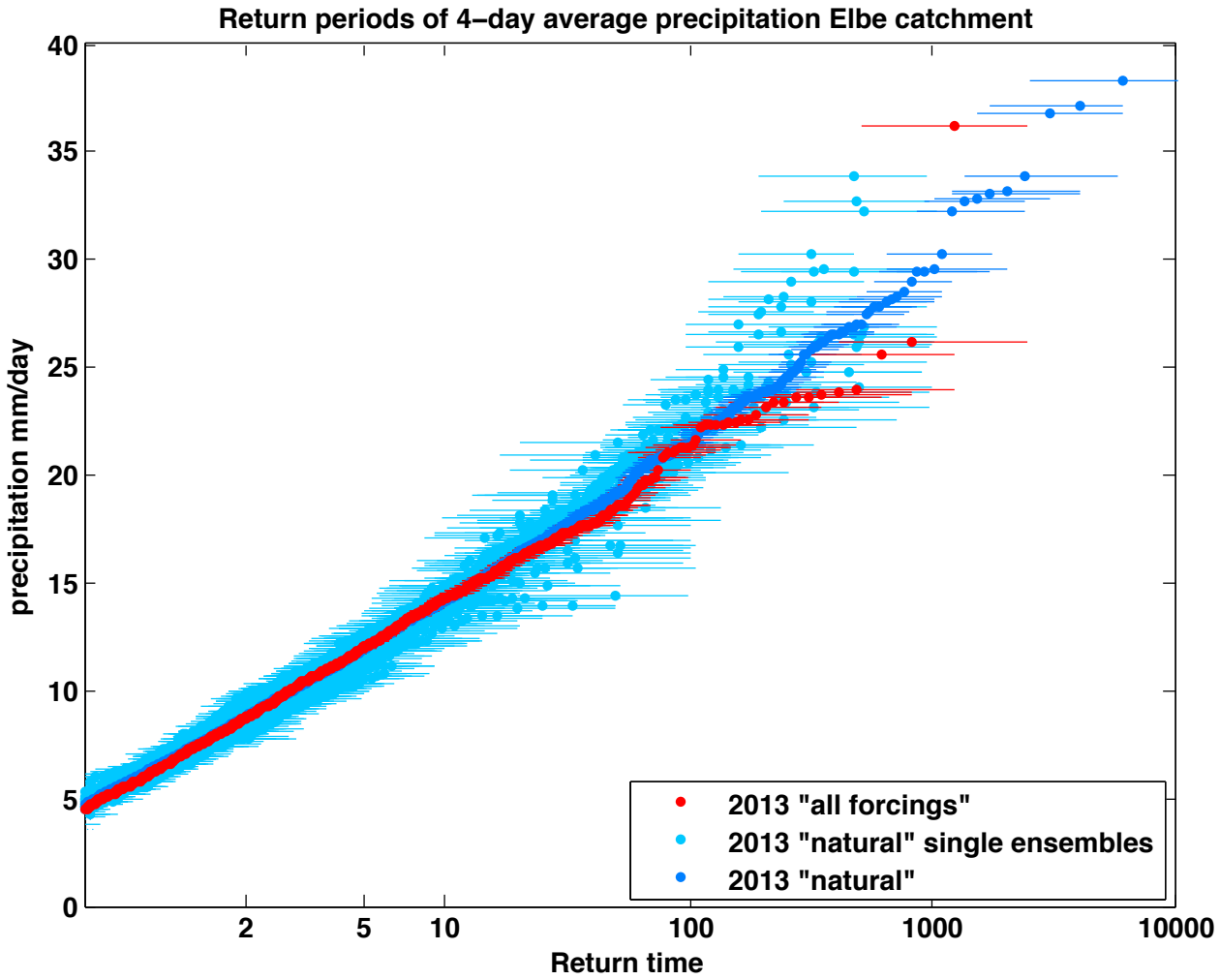
The world that might have been

2 of 11 different SST patterns removed from observation



DJF SST response pattern to anthropogenic forcing for the HadGEM2-ES (left) and IPSL-CM5R-MR (right) models

Interpretation of PEA results is not straight forward



Schaller et al., 2014

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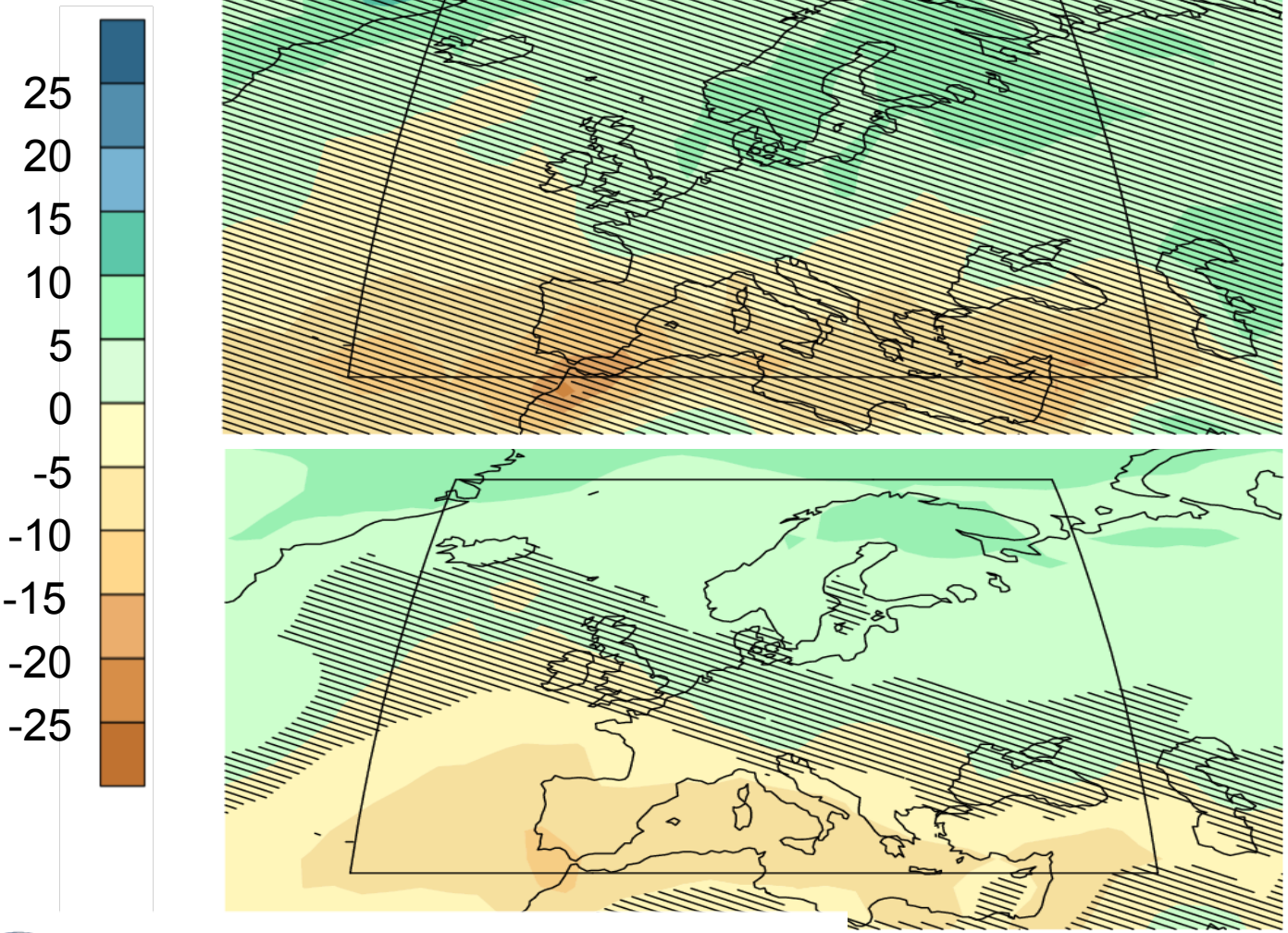
Precipitation changes in % DJF RCP 4.5



1900-2012

1900-2100

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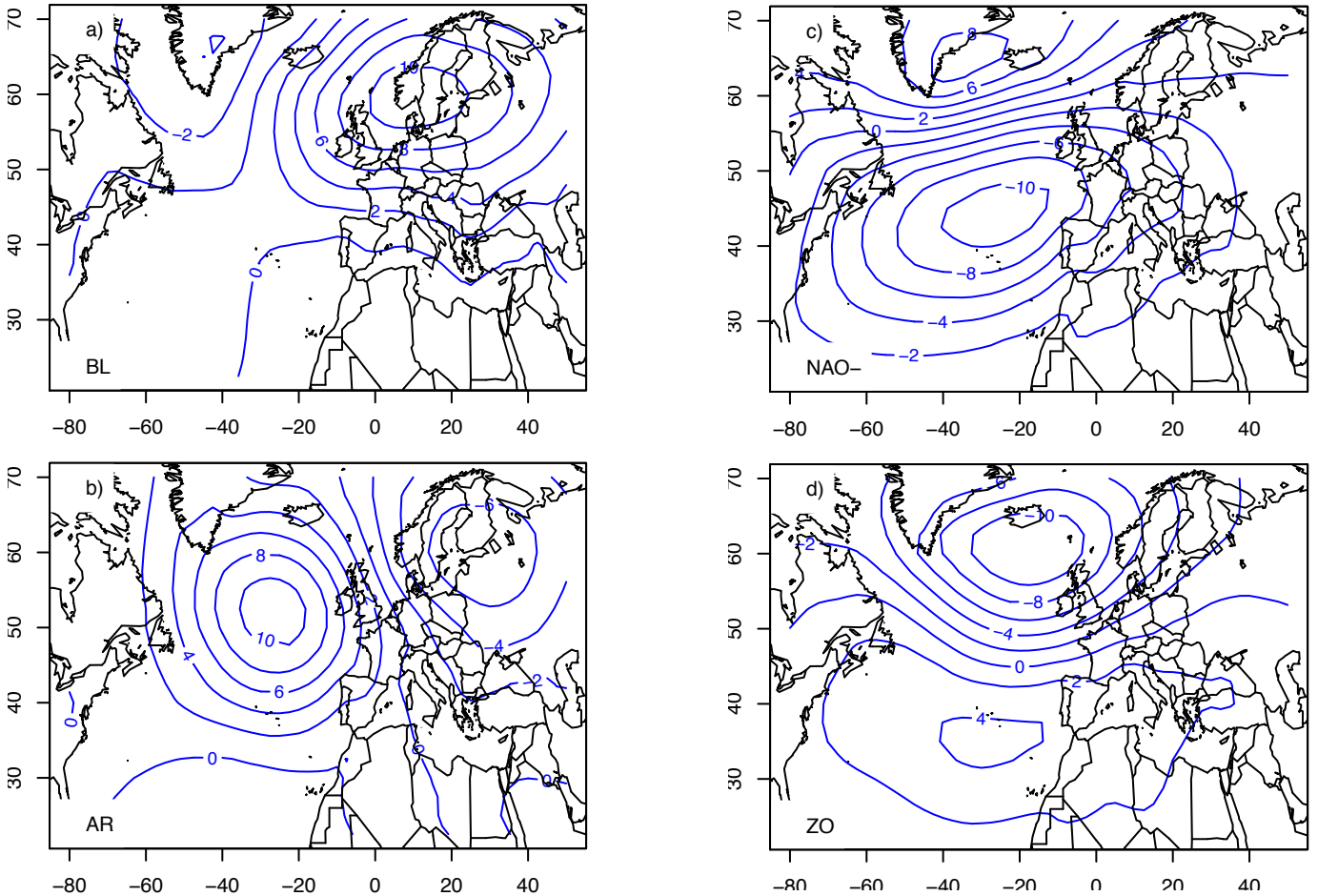
Regime occupancy ?



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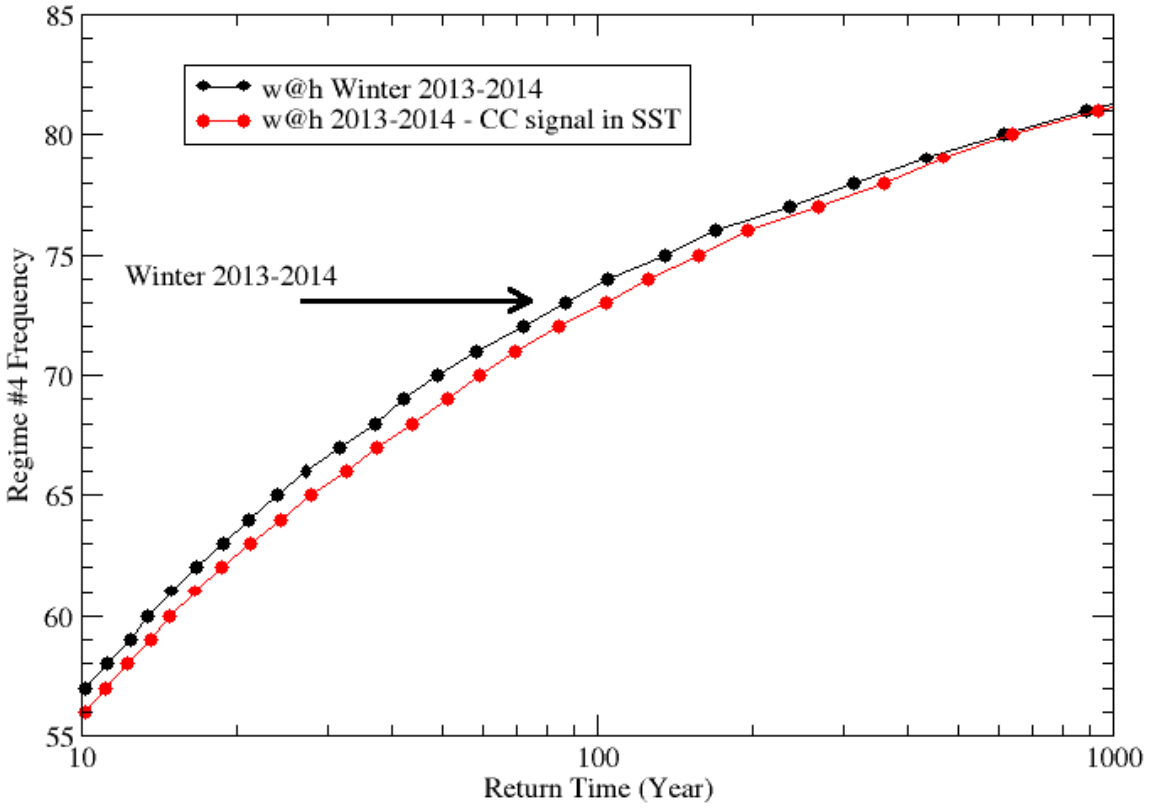
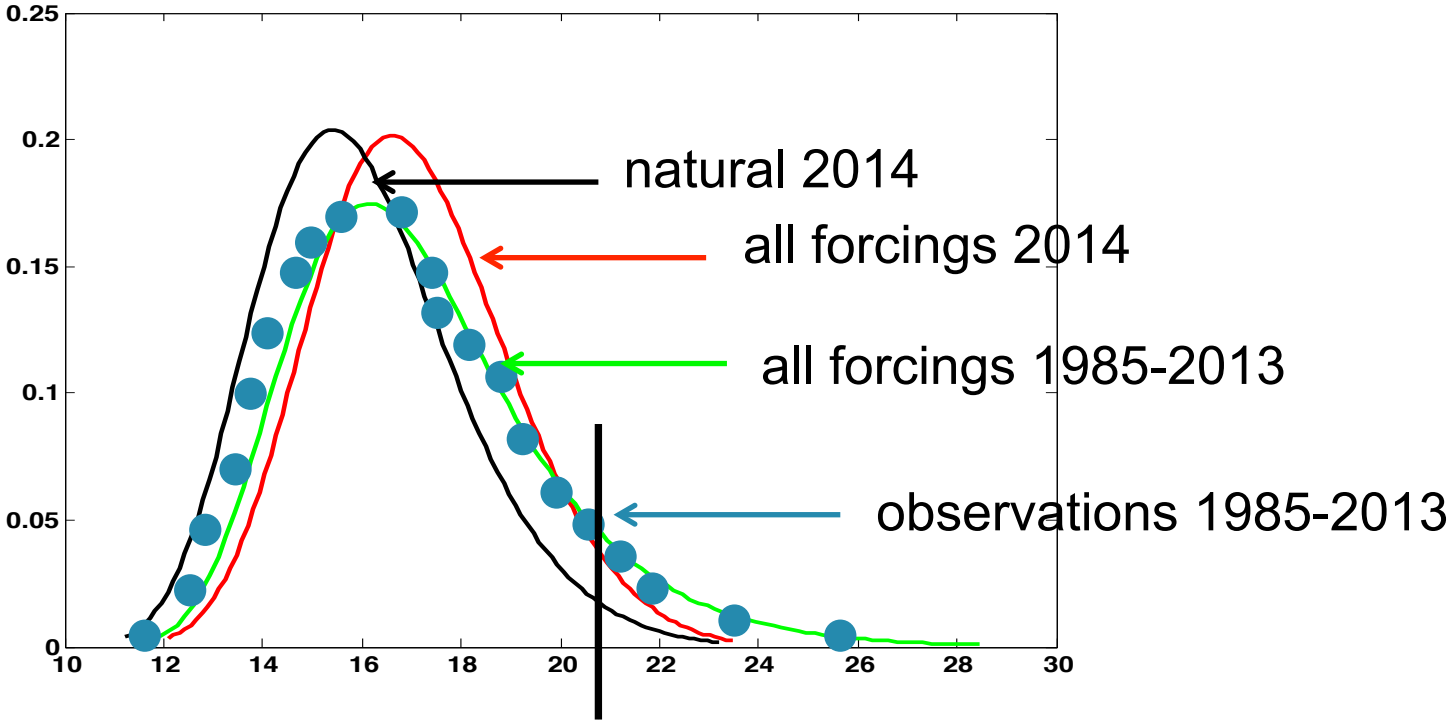
Return times for regime occupancy



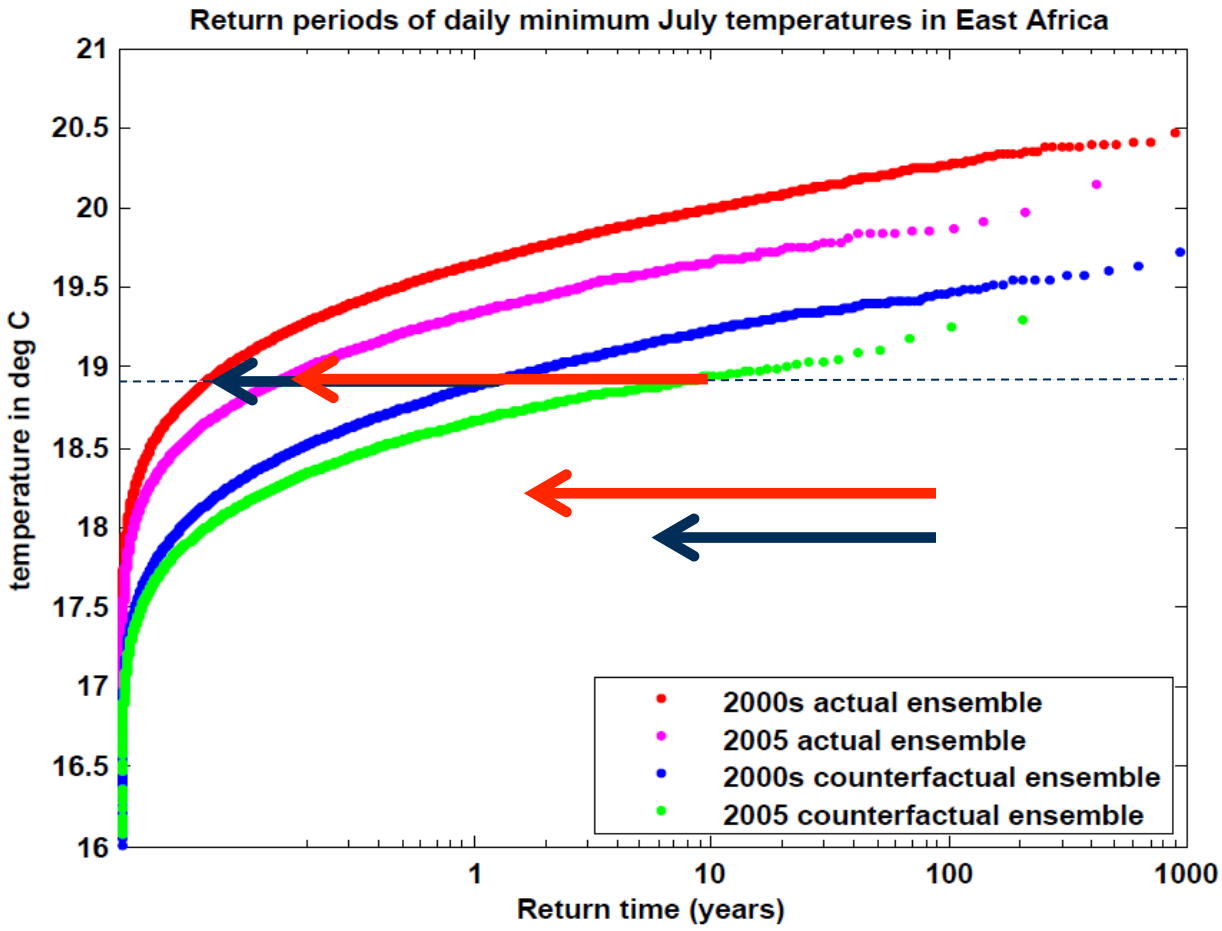
What is an event?
or how to relate the model to the real world



Exceeding a threshold of an index relevant for a damage?

Framing the attribution question

The 2 historic approaches used in weather@home



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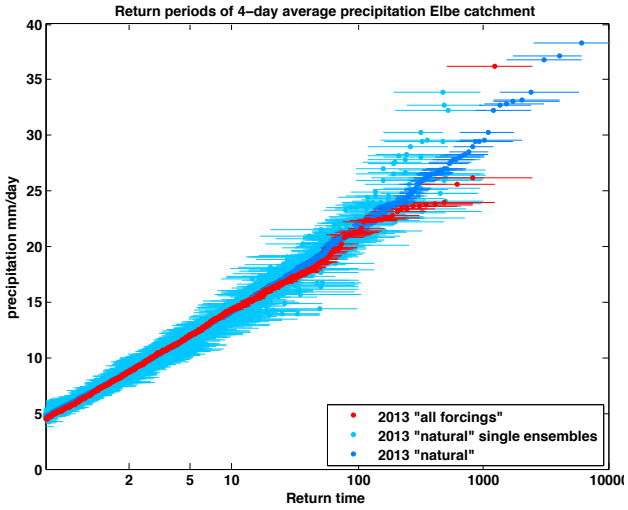
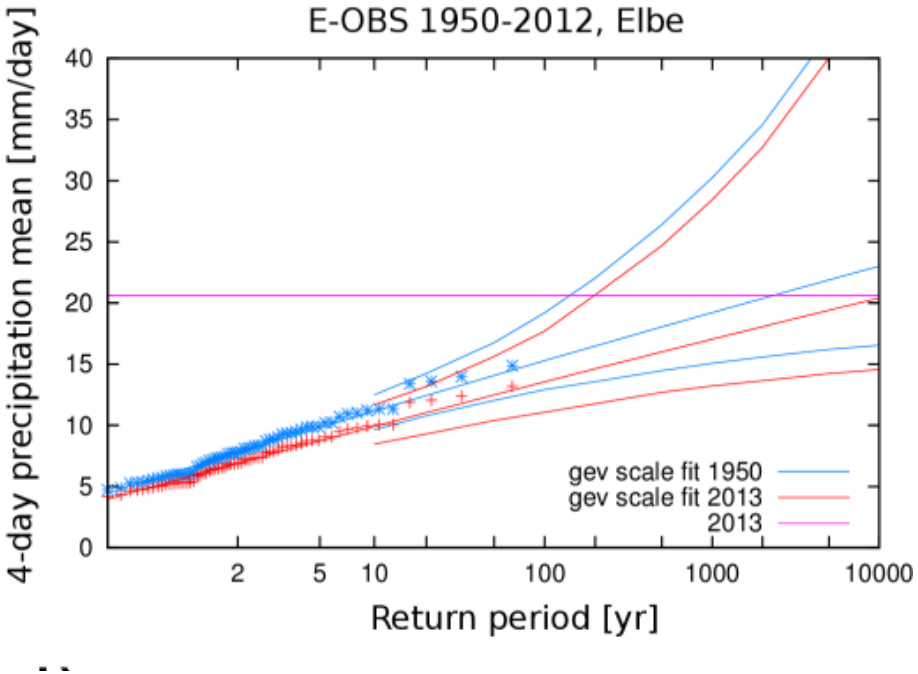
4-day precipitation Elbe catchment 2013

In a climate model



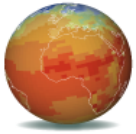
and in an empirical model based on observations



Schaller et al., 2014

The weather@home strategy

- Use very large ensembles of regional models (HadRM3P) embedded in an atmosphere-only global model (HadAM3Pxxxx)
- Remove different patterns of warming from the SST forcing to create counterfactual "worlds that might have been" (and different strategies)
- Use observed SSTs and seasonal forecasts SSTs
- Use multiple lines of evidence when making attribution statements
- Scrutinise our methods and models
- **Invite you to contribute with your methods when we want to make attribution statements**



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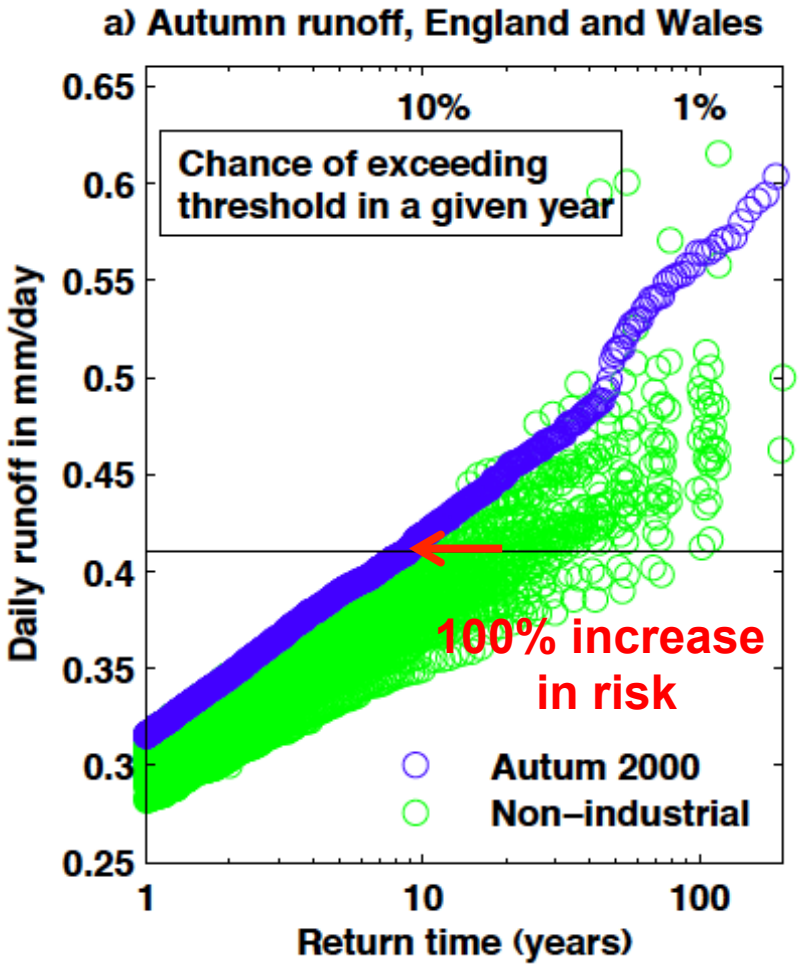
Back up slides

Results from the Autumn 2000 flood analysis

Substantial, but uncertain, increase in risk



Pall et al. 2011

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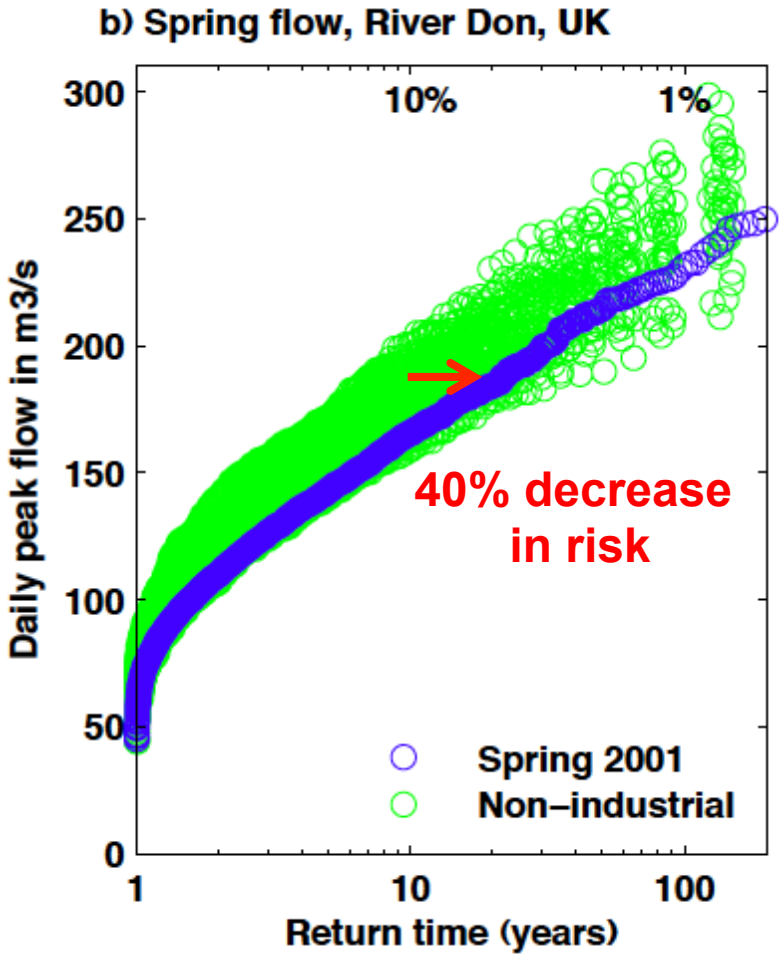
Not all events are being made more likely

A flood that didn't happen – in Spring 2001



Kay et al., 2011

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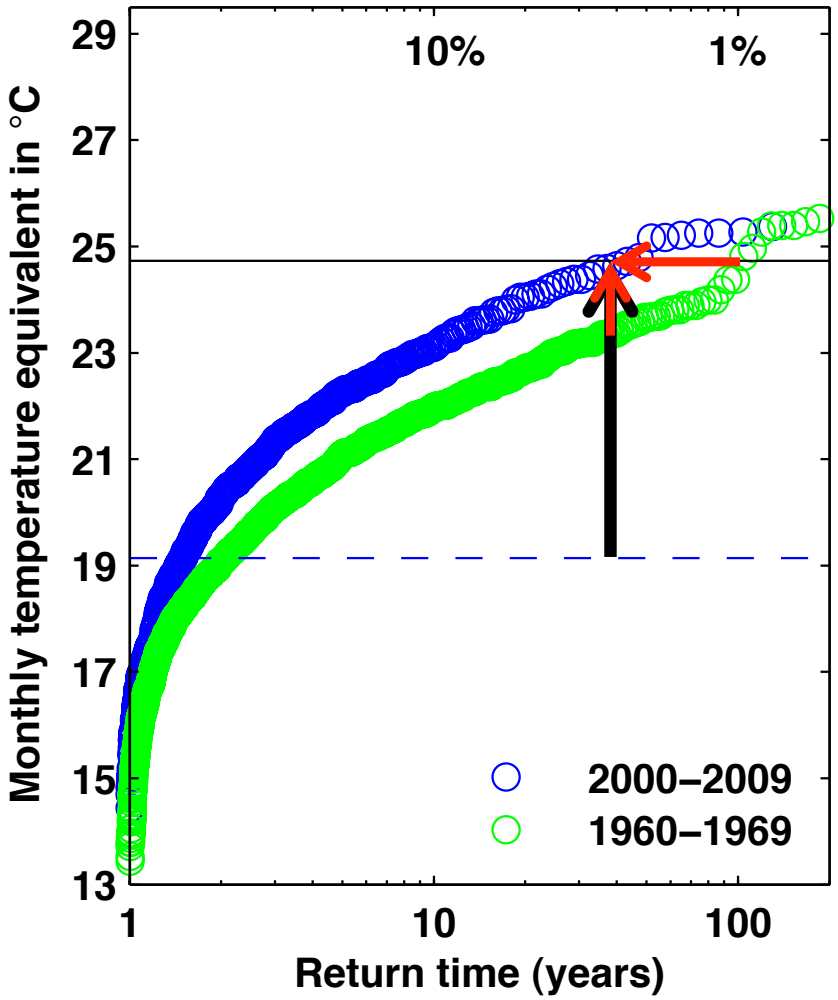
The role of large-scale warming in the 2010 Russian heat wave: 1960s versus 2000s

Not "impossible without warming"



"Mainly externally driven"

"Mainly internally generated"

Otto et al., 2012

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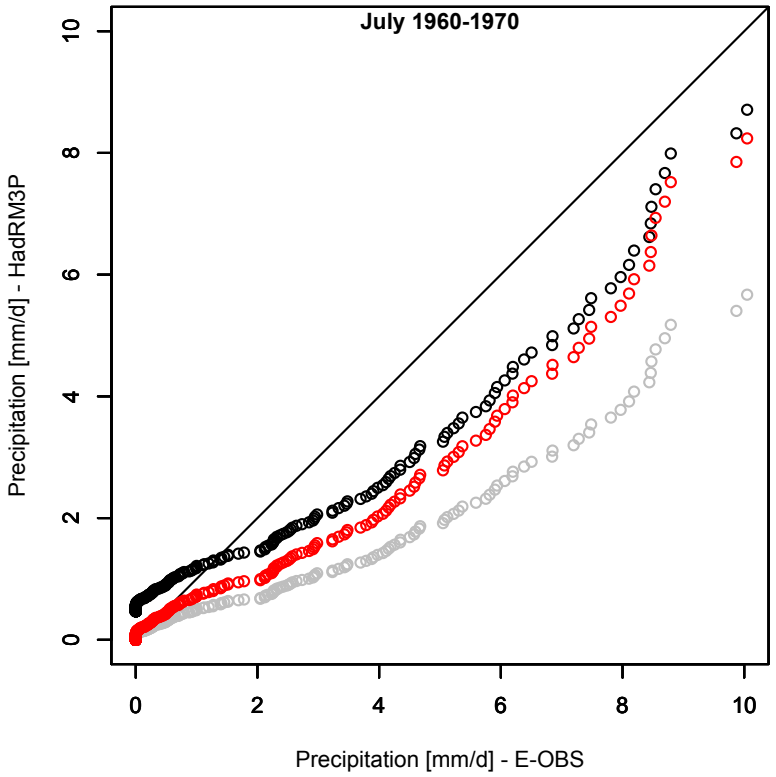
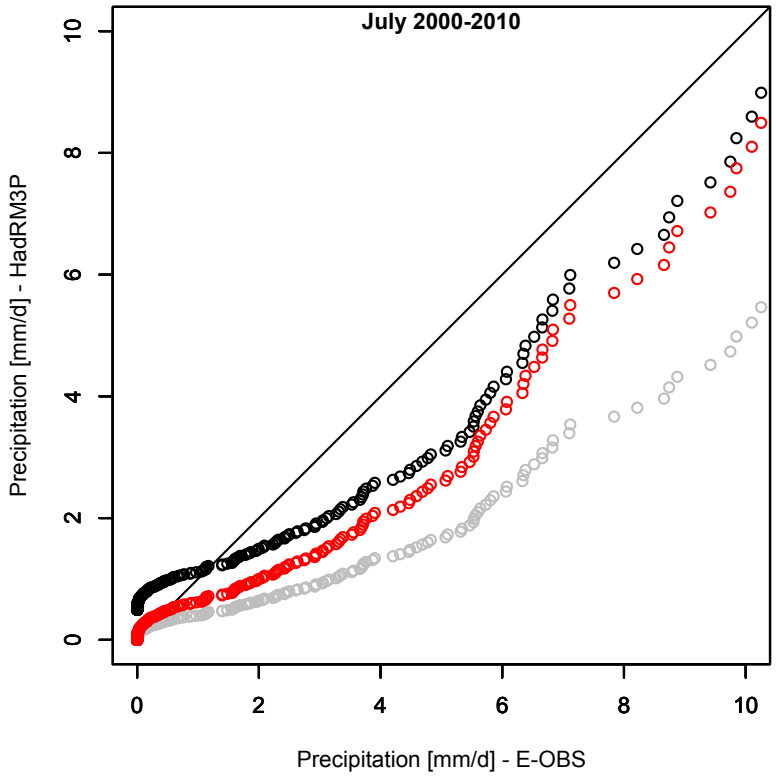
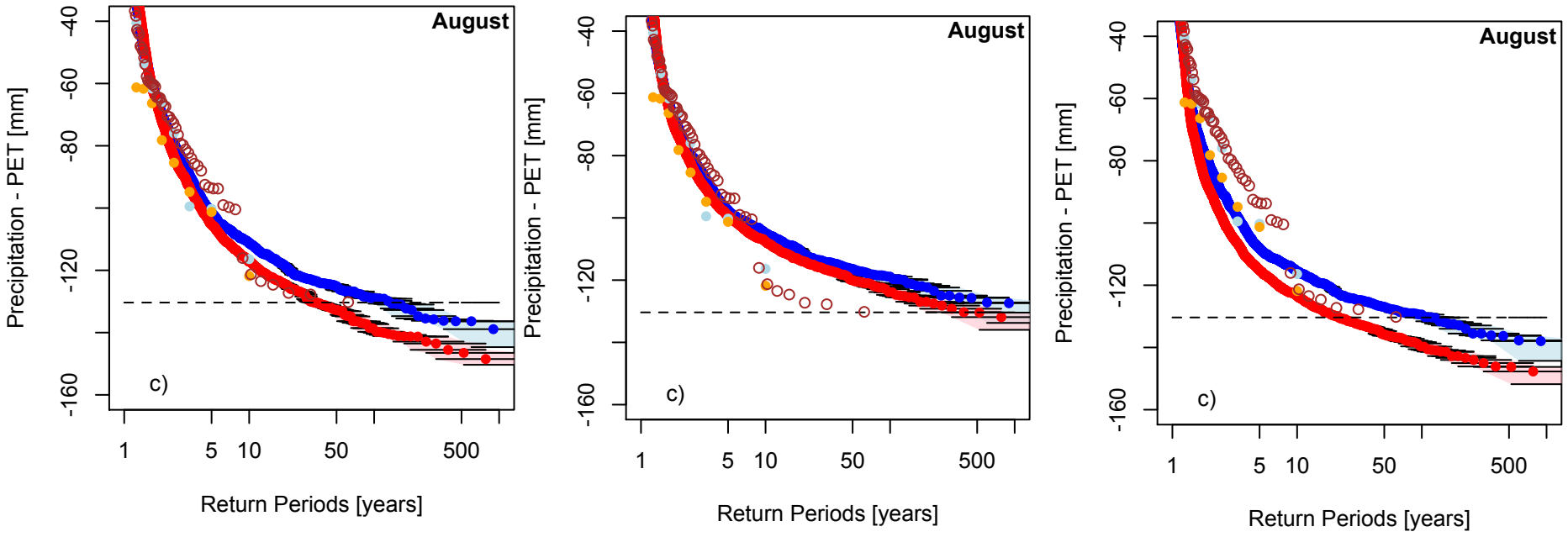
q-q plot





Sippel and Otto, 2014

Different ways to bias correct



Sippel and Otto, 2014

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Image: nasa.gov

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