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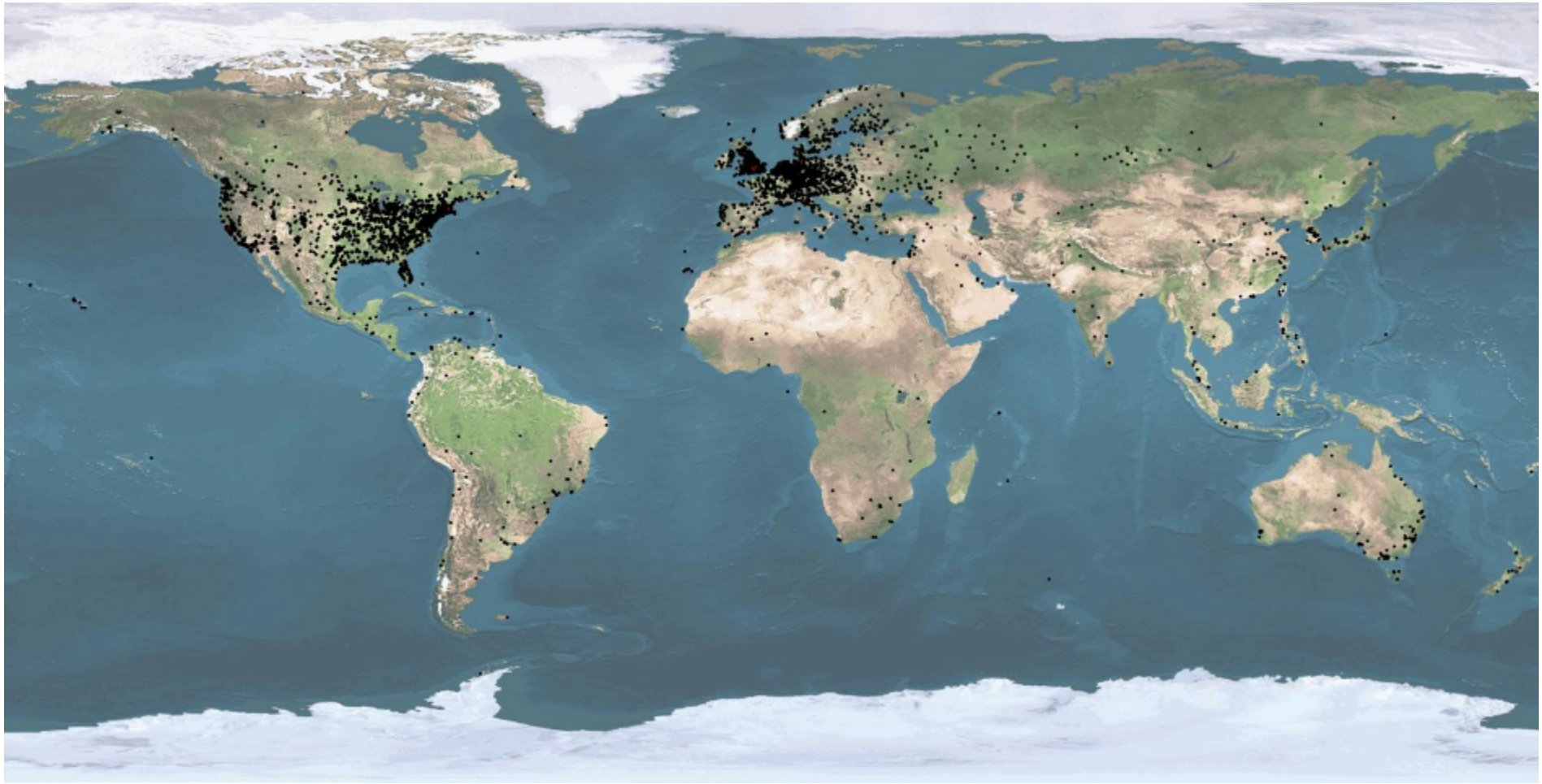
Validation and interpretation of high resolution climate model simulations

F.E.L. Otto · N. Massey · C.J. Rye · M.R. Allen · R.G. Jones · A. Bowery · J. Miller · J. Imbers

friederike.otto@ouce.ox.ac.

Our laboratory: the world's largest climate modelling facility



> 300,000 volunteers, 40,000 active, 130M model-years

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Quantifying the impacts of climate change

- Attribution is understanding how the climate would have been if we had not interfered with it.
- Straightforward (in principle) for global temperature – but most impacts arise from weather events
- Generally impossible to say “this event would not have occurred without human influence on climate”
- But we can ask how the risk of such an event occurring has changed due to external factors
- Attribution depends on modelling to:

  - Quantify the probability of occurrence of weather events
  - Simulate the world that might have been

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Essentially all models are wrong, but some are useful.

George E.P. Box

Biases: systematic model bias

spatial sampling issues

observational errors

Validation: consistency between driving model and regional model

comparison to observations

physical consistency

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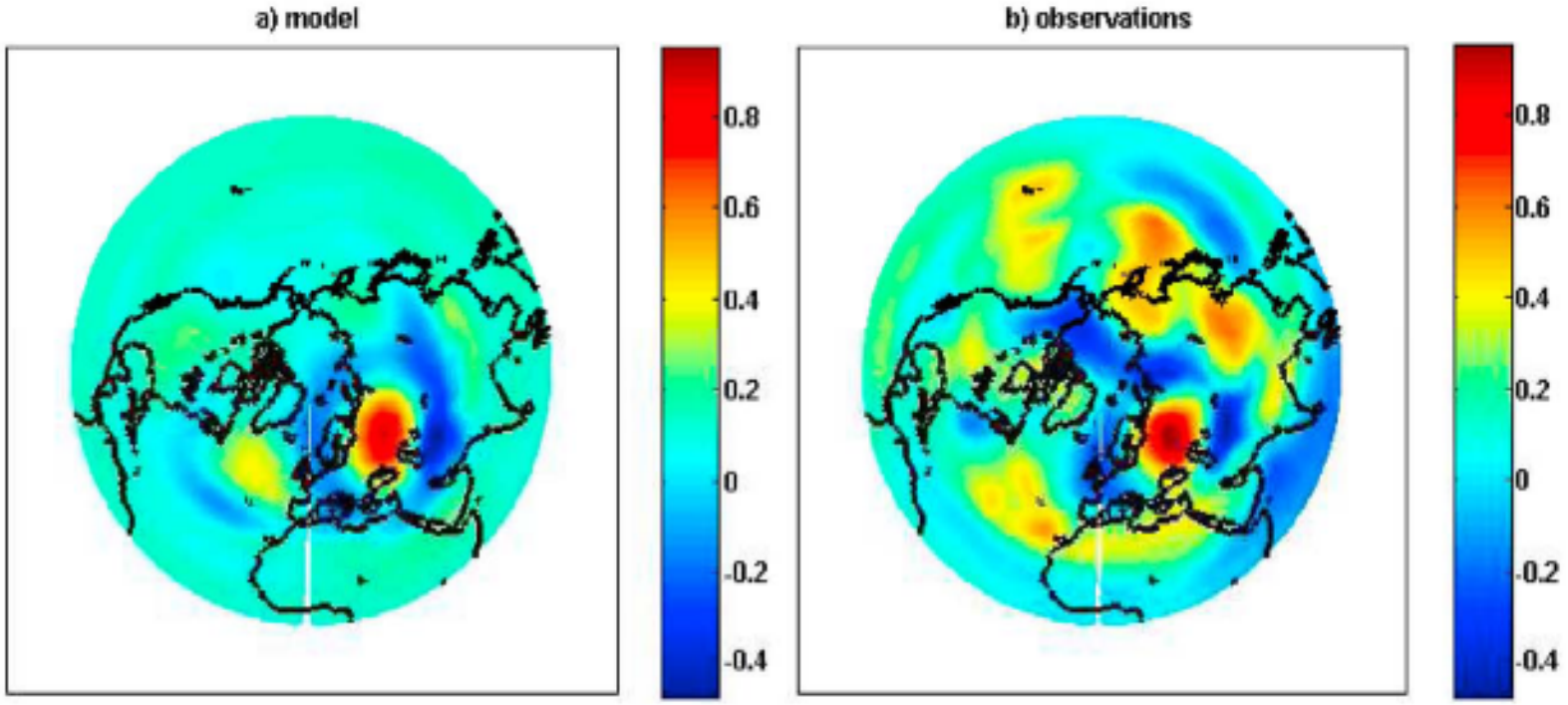
The Russian heat wave 2010



Otto et al. 2012

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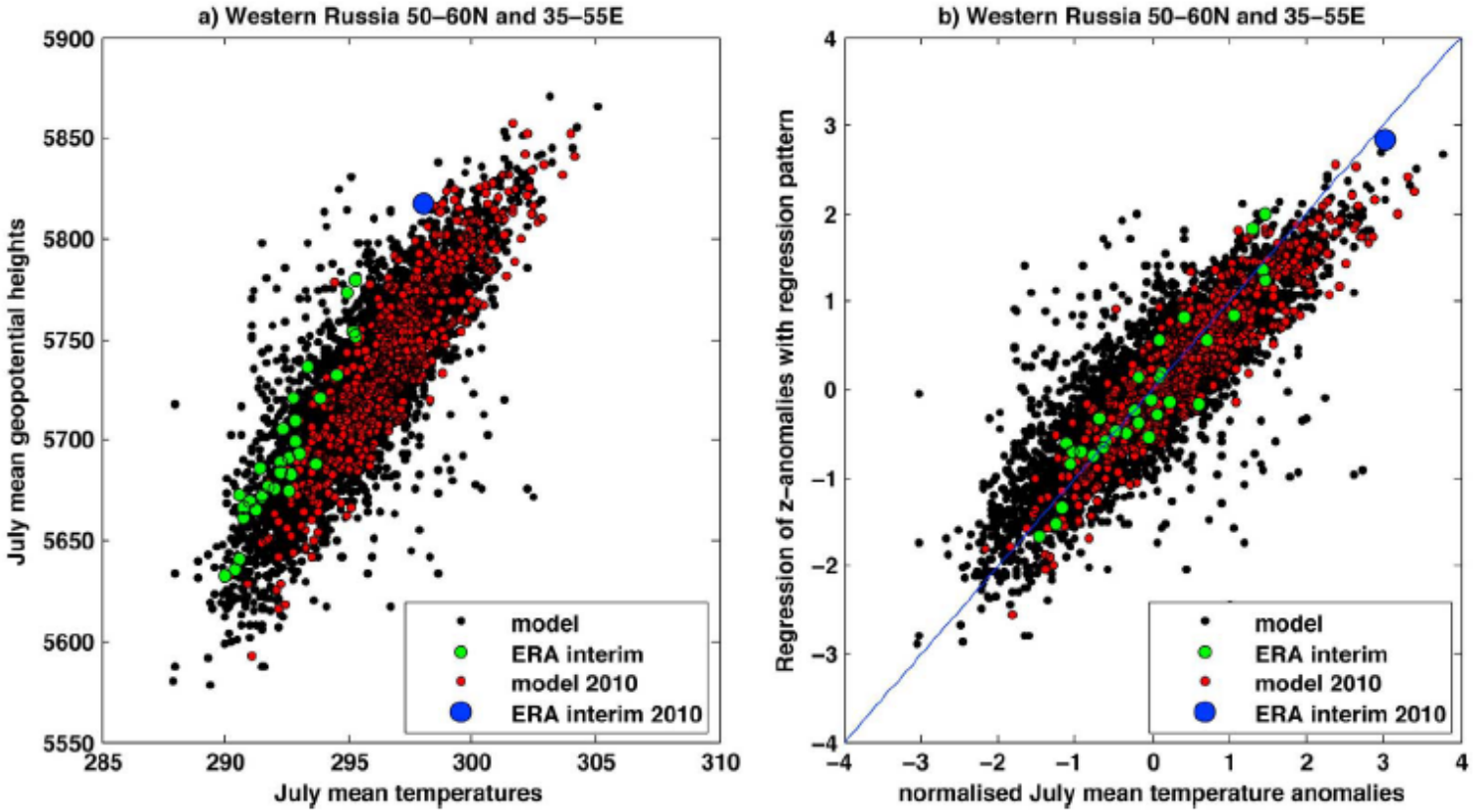
Regression



Otto et al. 2012

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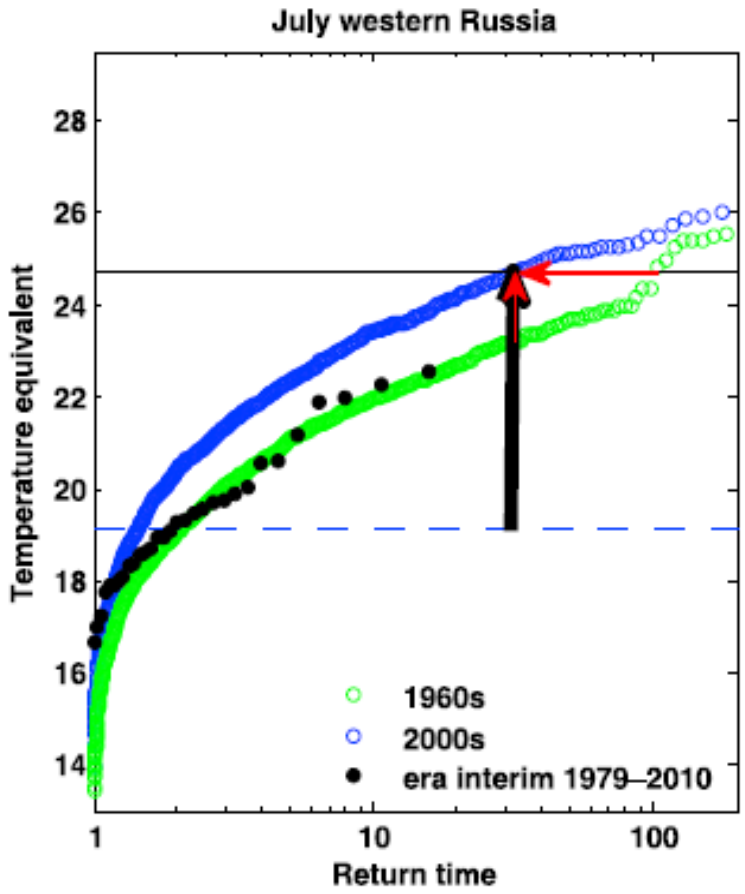
Quantifying the role of large-scale warming in the 2010 Russian heat wave



„mainly externally driven“

„mainly internally generated“

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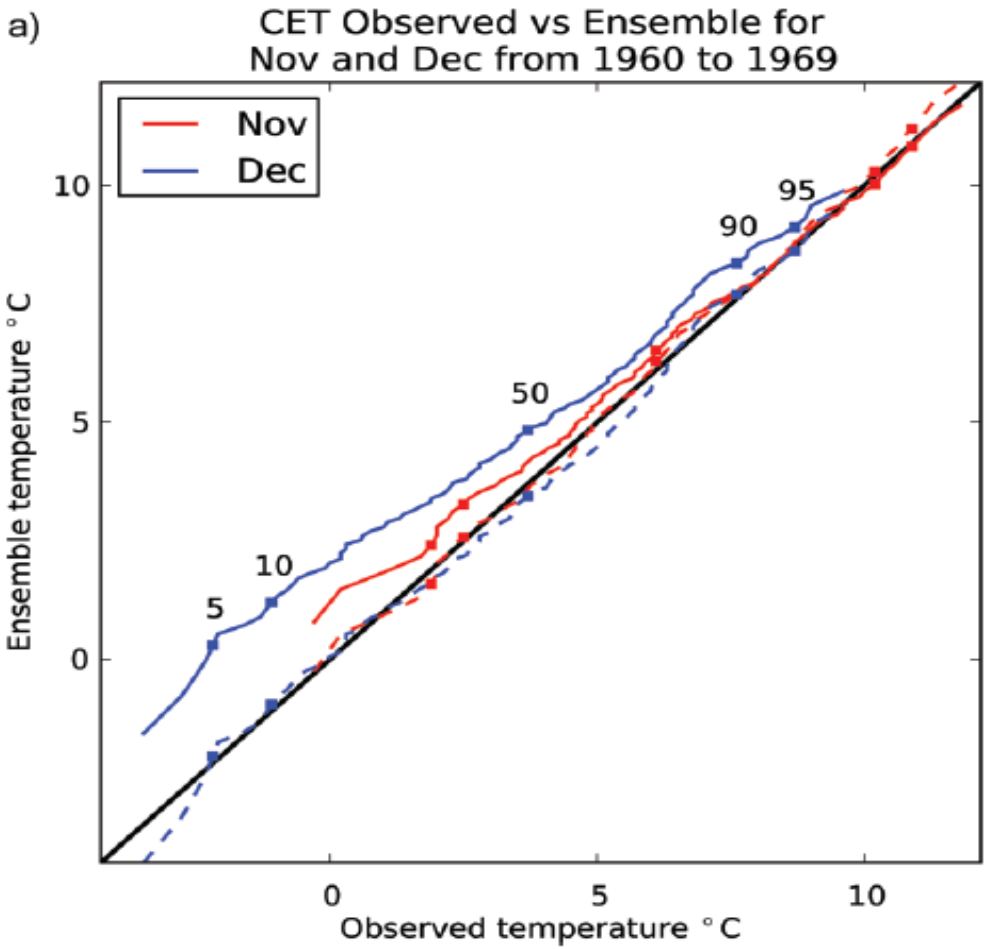
Temperature



Massey et al. 2012

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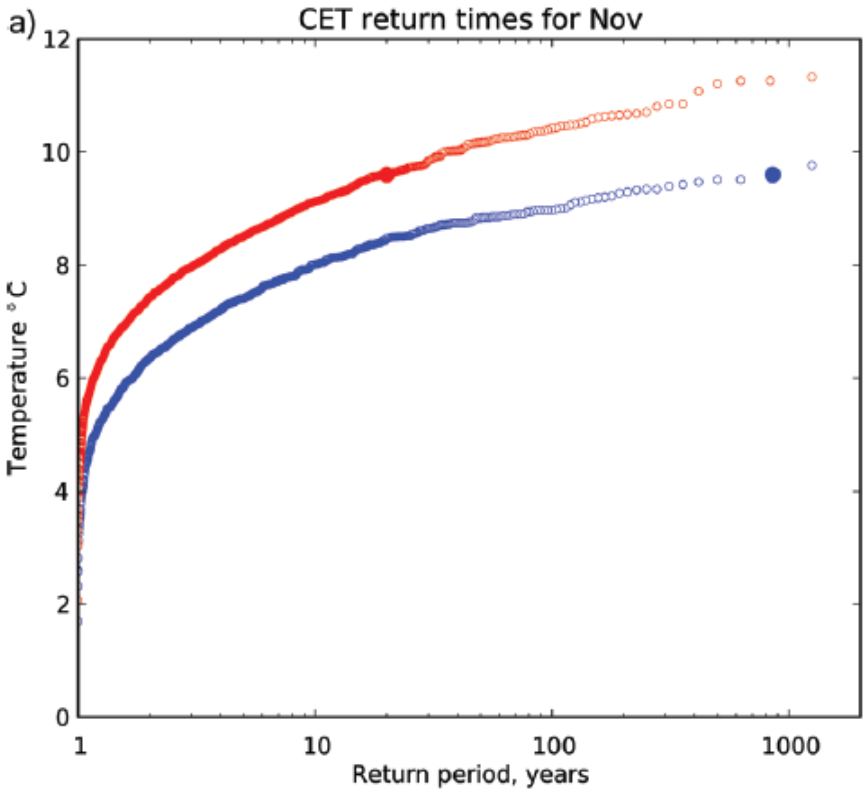
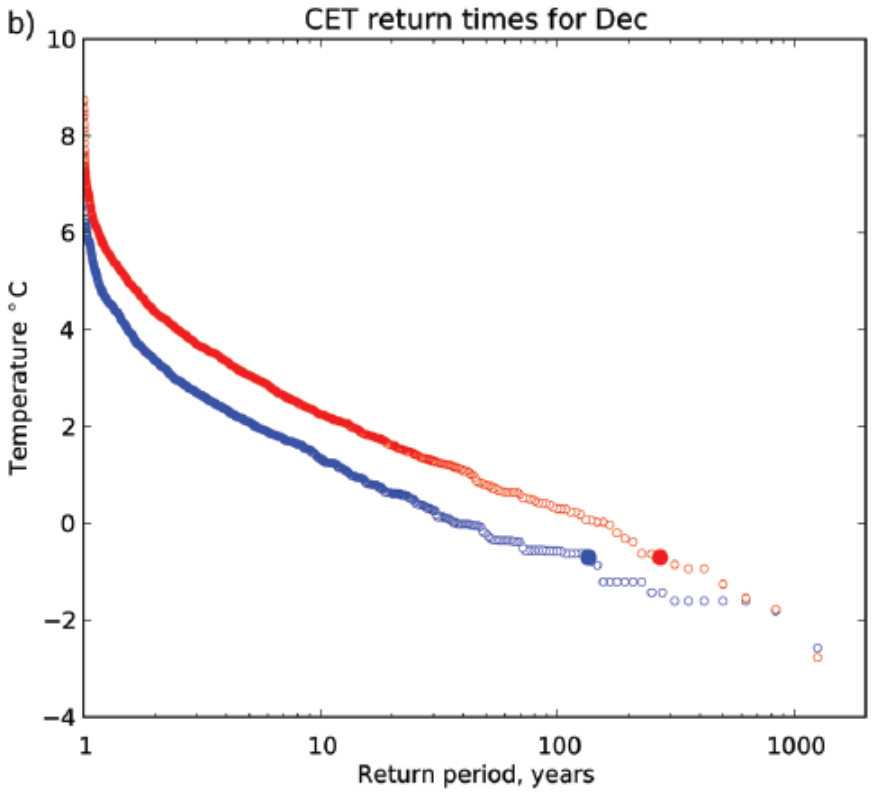
HAVE THE ODDS OF WARM NOVEMBER TEMPERATURES AND OF COLD DECEMBER TEMPERATURES IN CENTRAL ENGLAND CHANGED?





Massey et al. 2012

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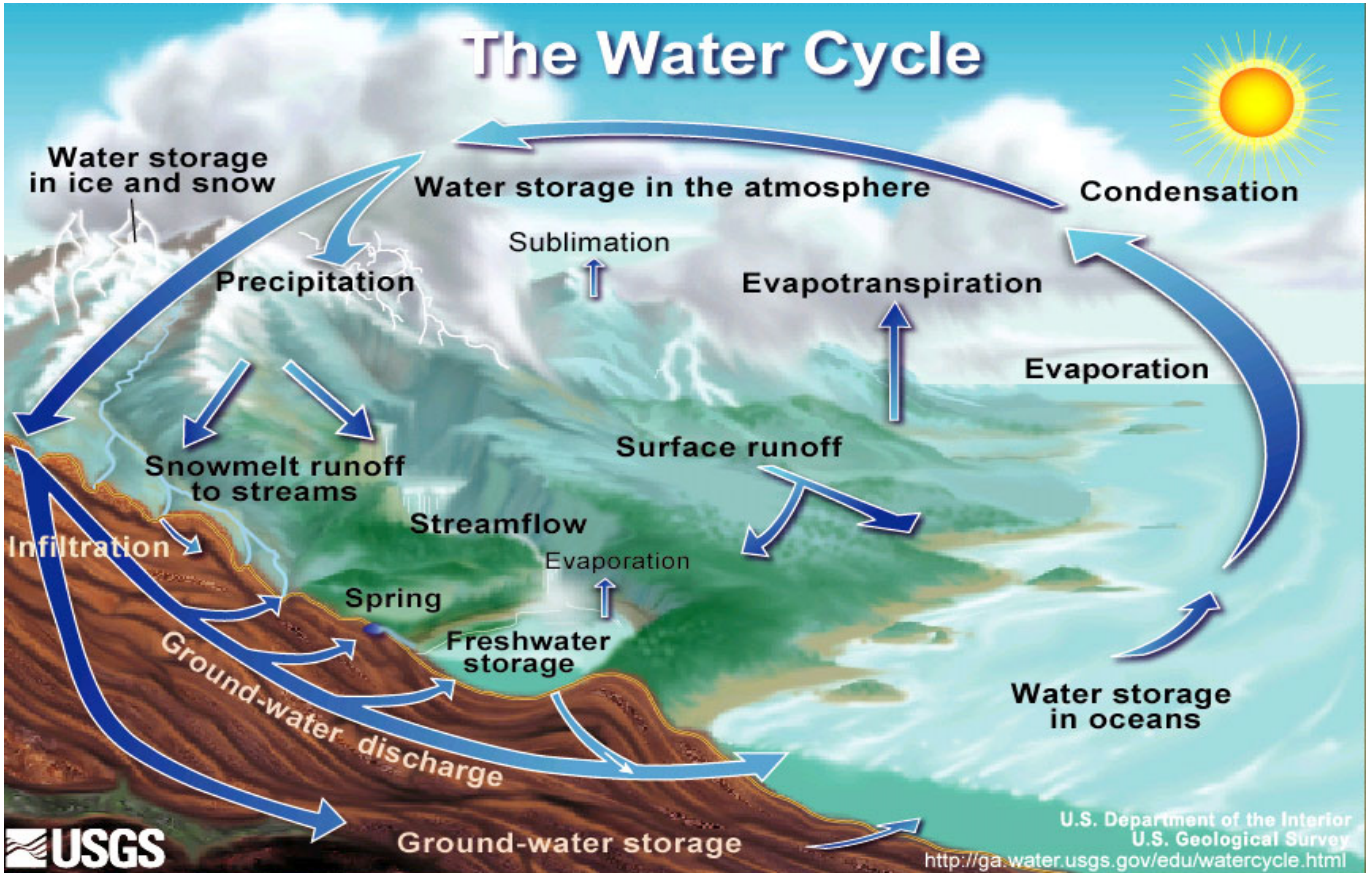
Hydrological cycle



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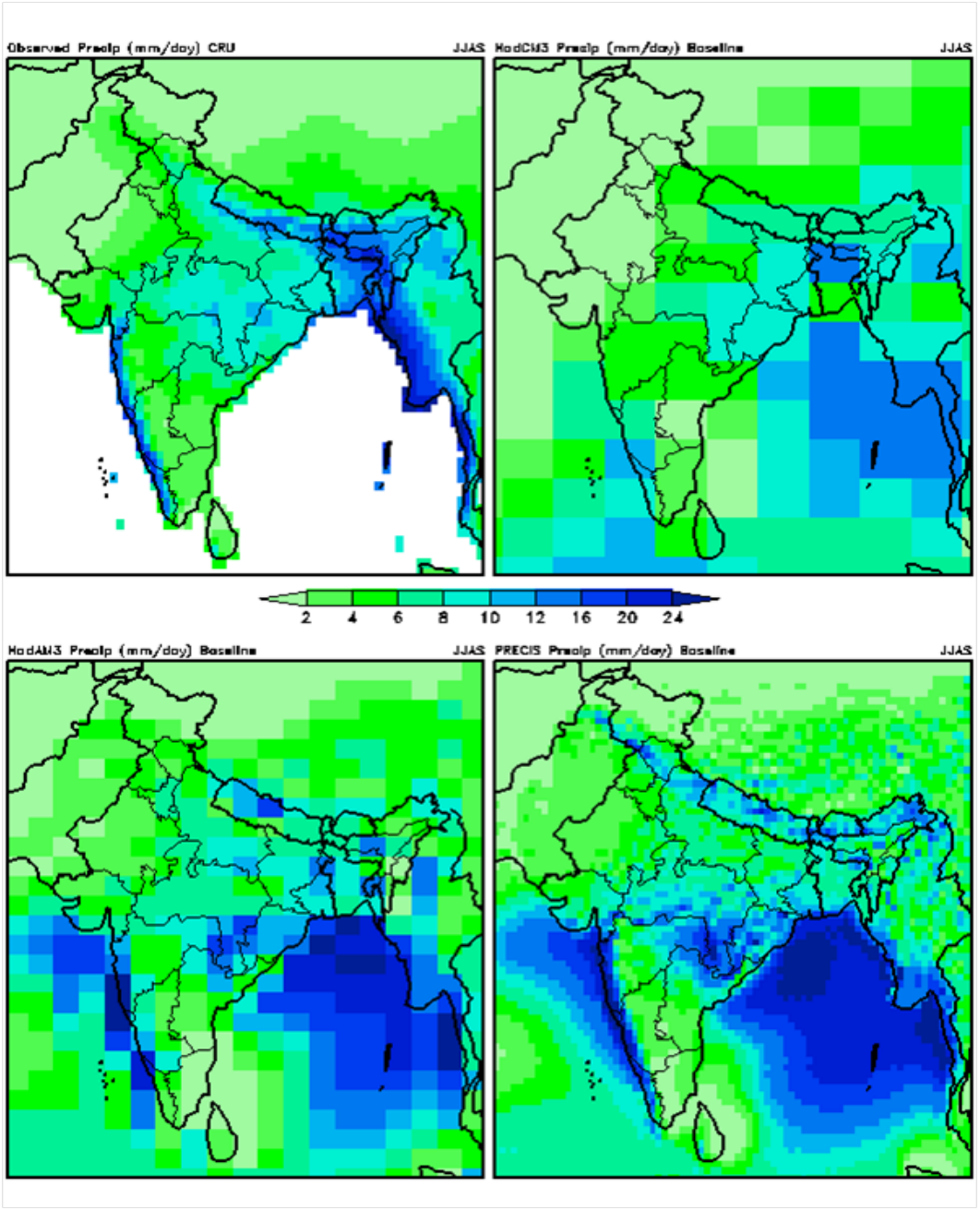

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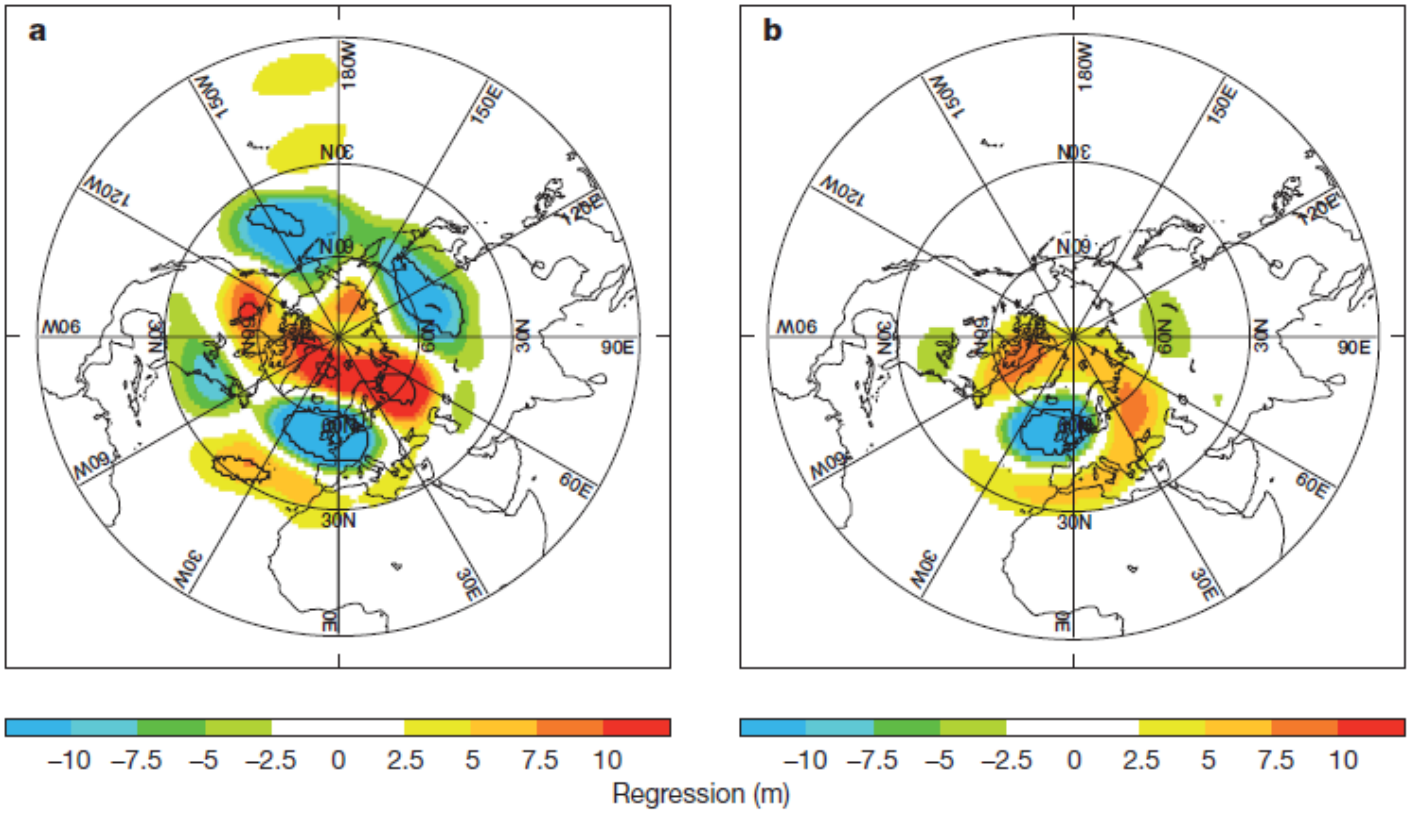
Autumn precipitation in England and Wales



Pall et al. 2011

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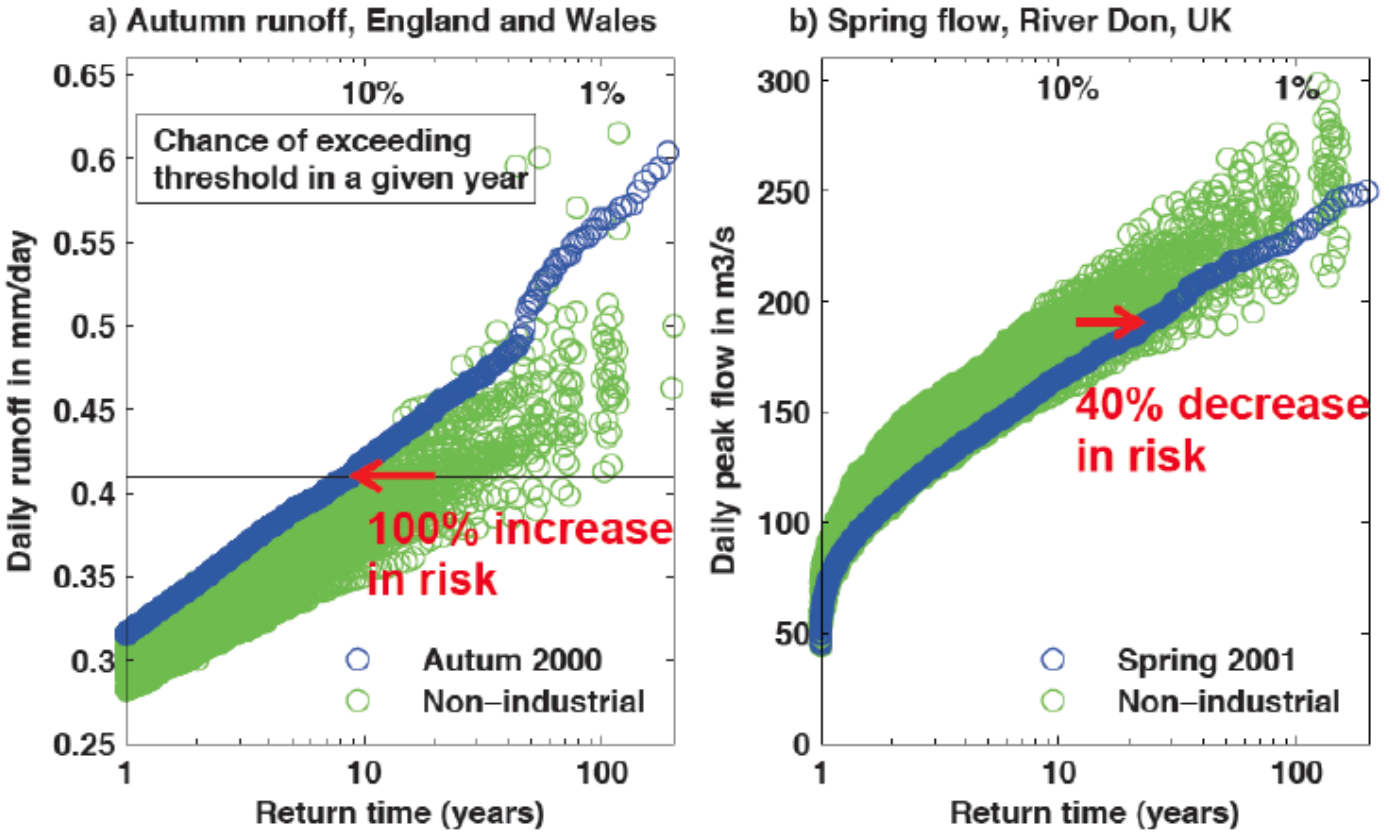
Floods in different seasons in England and Wales



Pall et al. 2011, Kay et al. 2011

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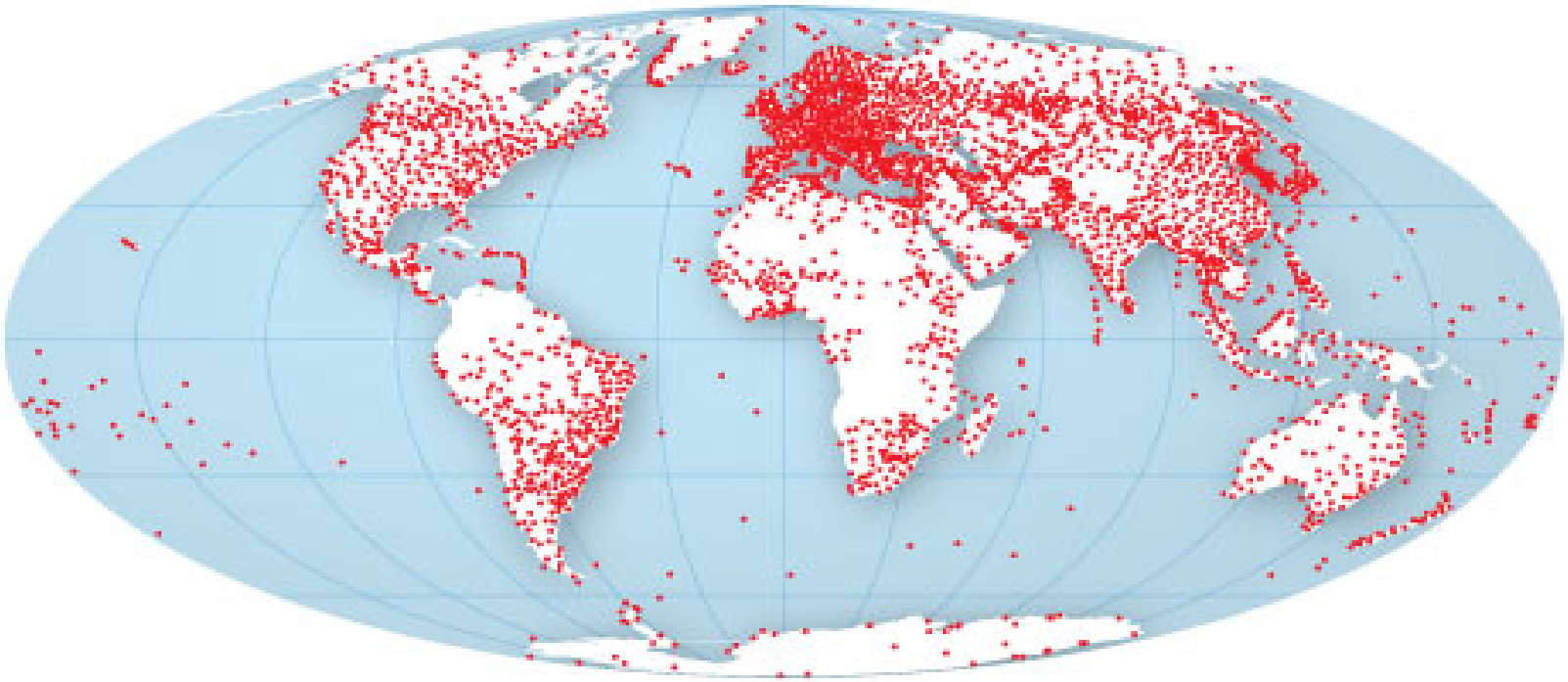
Gaps in the weather map



Source: World Meteorological Organisation

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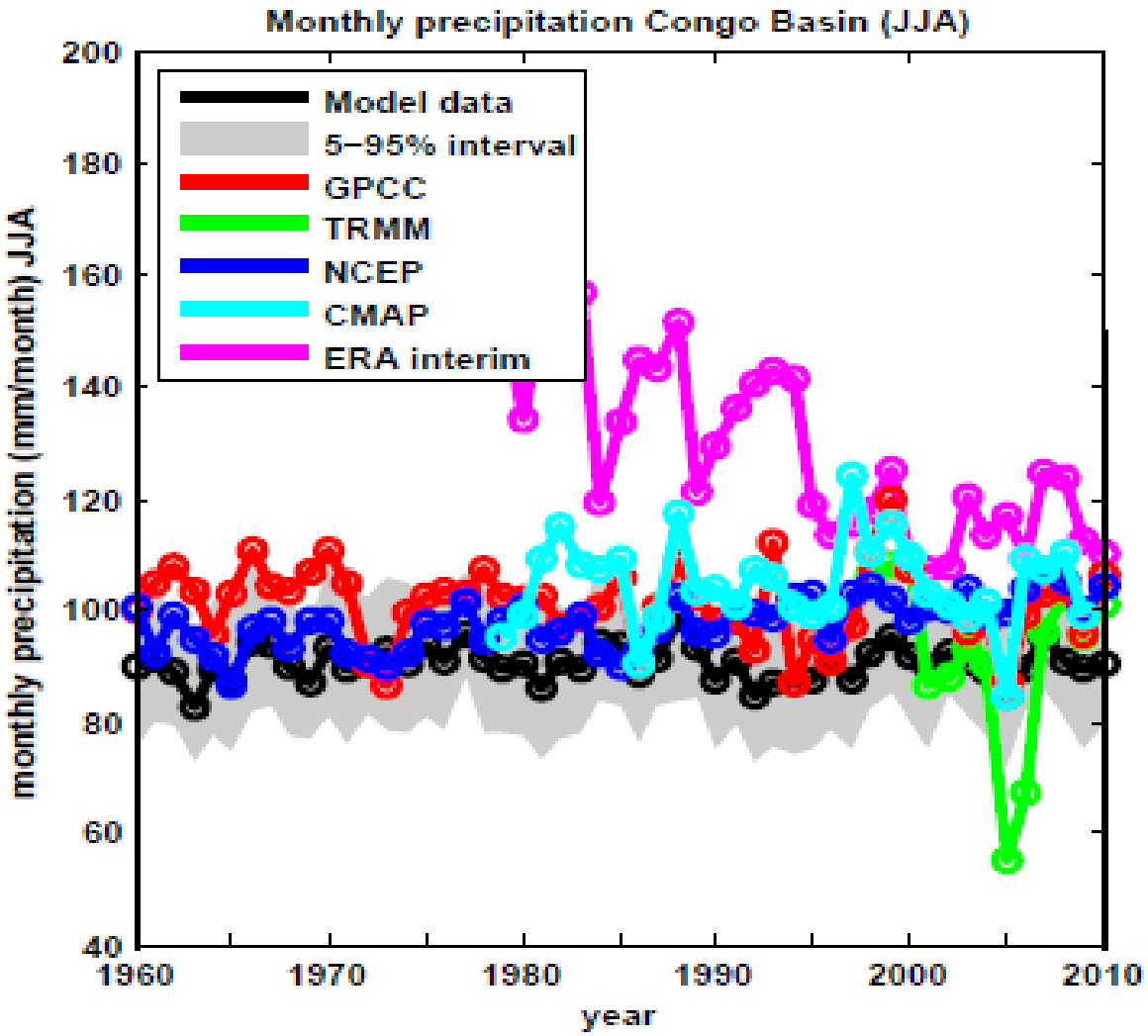
Timeseries



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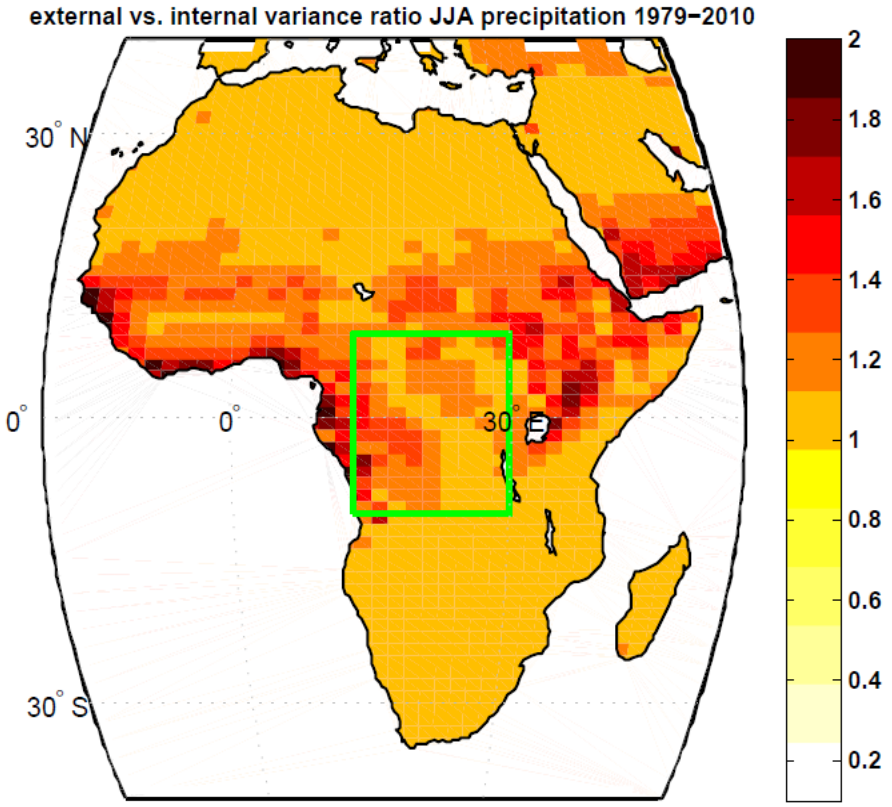
What to validate for – prediction or attribution



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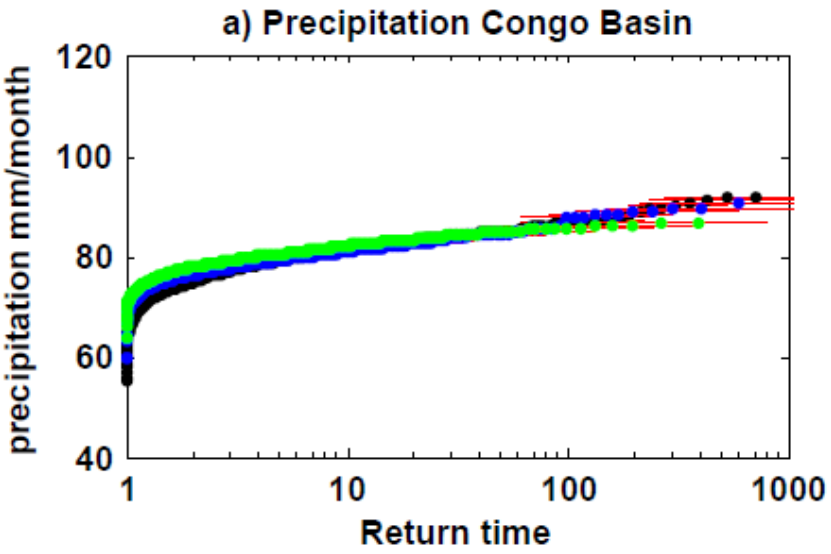
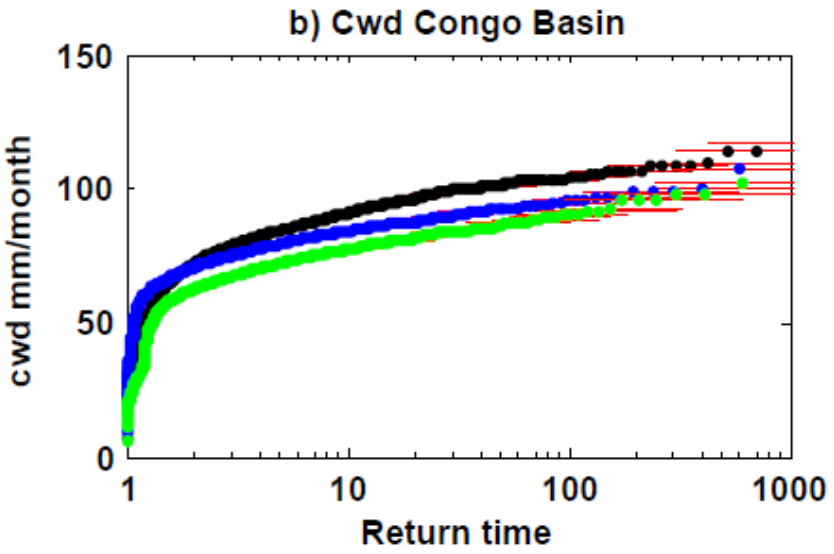
Return periods of precipitation and water stress in the African tropical forest





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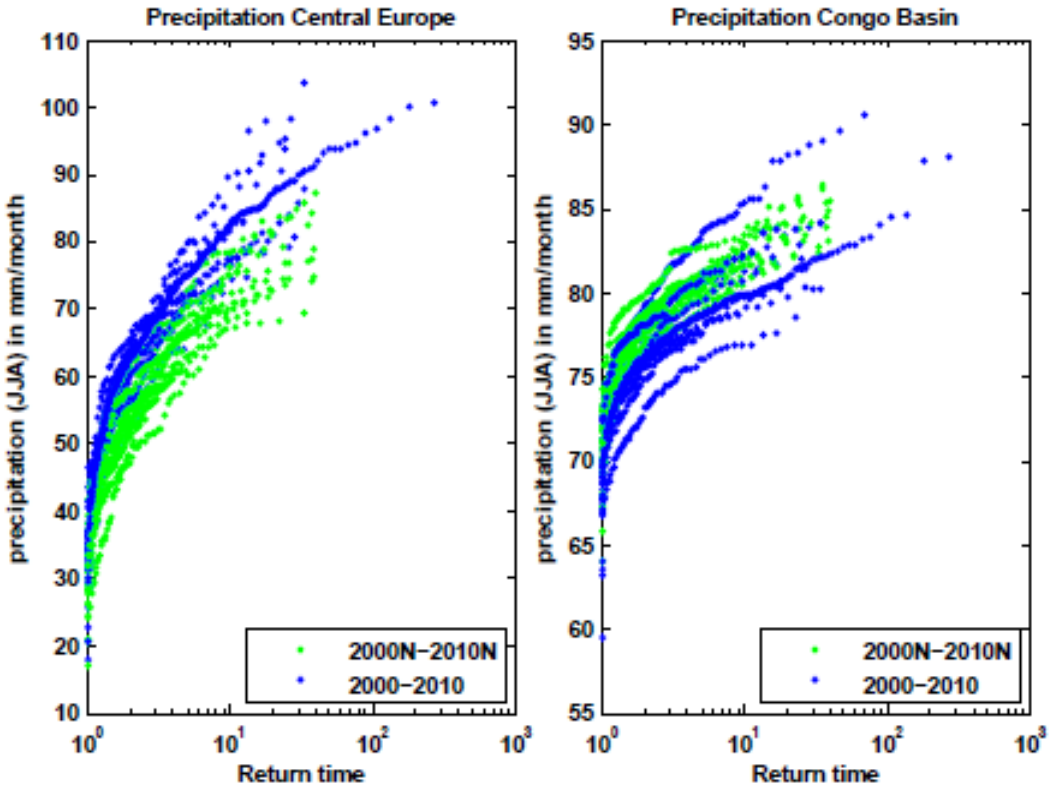
Differences in attribution studies in the Tropics and Mid-latitudes



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Understanding climate modelling and interpreting regional climate models

climateeducation.net

1. Introduction to climate sytem science and climate modelling – free course, self-pased, individual start date

2. Constructing and applying high resolution climate scenarios - tutored course, Masters level, next start date: spring 2013

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Summary

- Most present-day potential impacts of climate change are related to extreme weather events.
- Quantifying how risks are changing allows us to:
  - Better quantify (and insure against) present-day risks
  - Build resilience to events that are becoming more probable
  - Justify spending on climate adaptation .....
- Validation and interpretation is dependent on region and variable of interest.
- We have a lot of data that belongst to the public, we want to give it back.
- climateeducation.net

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