How does climate change alter the distributions of weather?

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What we are? –
the world’s largest climate modelling facility

> 300,000 volunteers, 30,000 active, 130M model-years
The climateprediction.net weather@home project

- Volunteer distributed computing using idle processor time
- Large ensembles to capture unpredictable events: thousands of runs per decade

- Simulate 1960-present with GCM HadAM3P - Atmosphere only (1.875° x 1.25°), 19 levels
- Embedding HadRM3P – high resolution RCM
- Forced with observed SSTs and sea ice
weather@home regions
We can ask how the risk of an extreme event occurring has changed due to human greenhouse gas emissions.
SST patterns of the world that might have been

DJF SST response pattern to anthropogenic forcing for the HadGEM2-ES (left) and IPSL-CM5A-MR (right) models
Sample event from weather@home

Mean 10m wind speed, dec 27

Mean sea level pressure, dec 27
Sample event from weather@home

Mean 10m wind speed, dec 28

Mean sea level pressure, dec 28
Sample event from weather@home

Mean 10m wind speed, dec 29

Mean sea level pressure, dec 29
Sample event from weather@home

Mean 10m wind speed, dec 30

Mean sea level pressure, dec 30
Sample event from weather@home

Mean 10m wind speed, jan 1

Mean sea level pressure, jan 1
The highest precipitation ever recorded in winter in Oxford
4-day precipitation Elbe catchment 2013

Return periods of 4–day average precipitation Elbe catchment

- 2013 "all forcings"
- 2013 "natural" single ensembles
- 2013 "natural"

Image: nasa.gov
Heat wave and drought in Serbia 2012

JJA
1960–1970
2000–2010
2012 (E–OBS)

Return Period [years]

Temperature [°C]

Wet Bulb Globe Temperature [°C]

Return Period [years]

climateprediction.net

the world’s largest climate forecasting experiment for the 21st century

Environmental Change Institute
Scientific questions

1. How does the shape of the distribution depend on the variable?
2. How does the shape of a distribution change depending on sampling frequency (daily, monthly, ...) and geographical region (UK, SUK, Eastern Europe, ...)?
3. How do the statistics and extremes change under a changing climate?
4. How does this change depend on the parameters in 2.?
5. How does this change depend on the exact simulation of the “world that might have been?”
6. ... more you want to explore.