How does climate change alter the distributions of weather?

WCRP/ICTP summer school Trieste

21st July-1st August 2014

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

> 300,000 volunteers, 30,000 active, 130M model-years

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the world's largest climate forecasting experiment for the 21st century
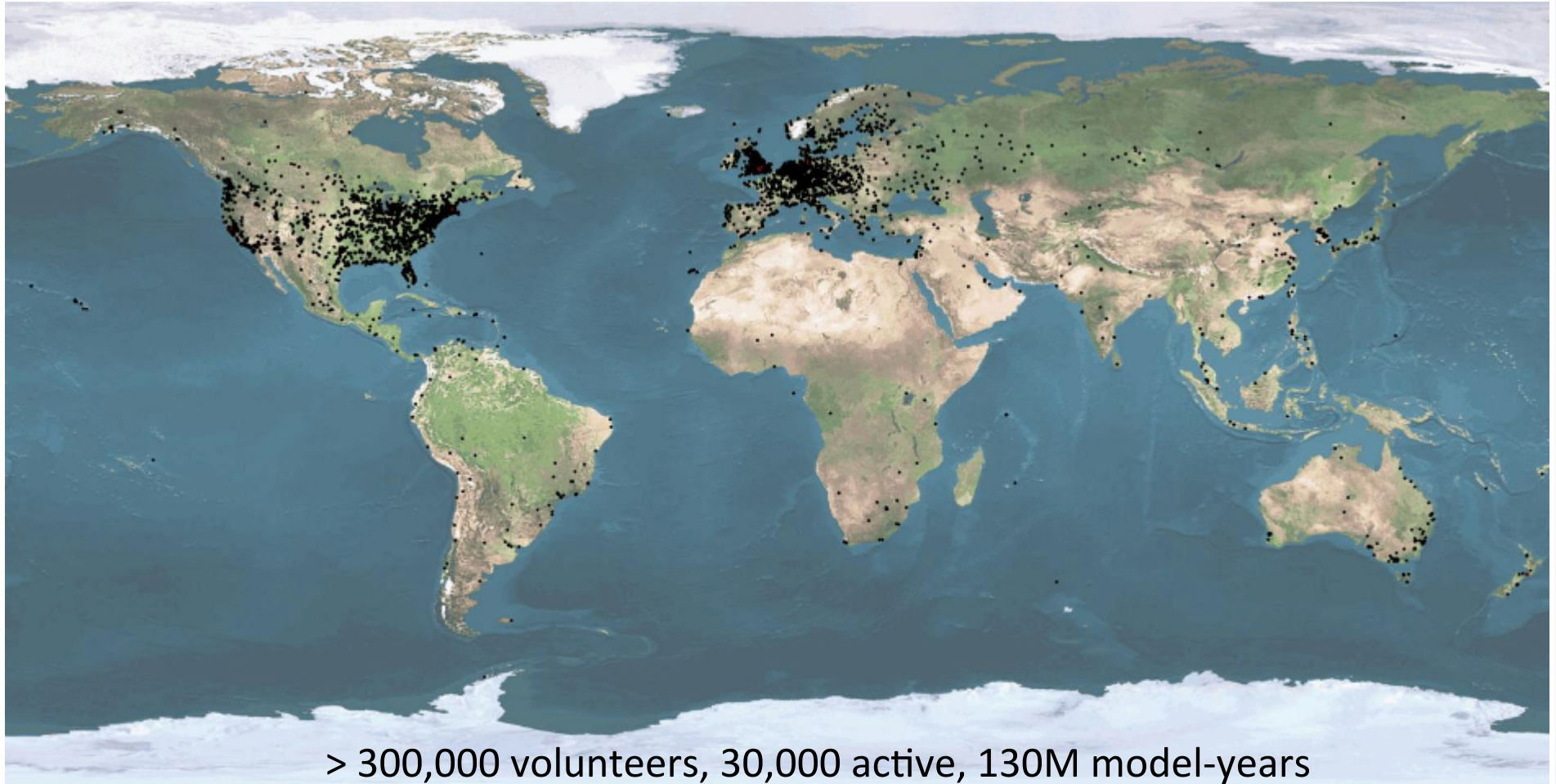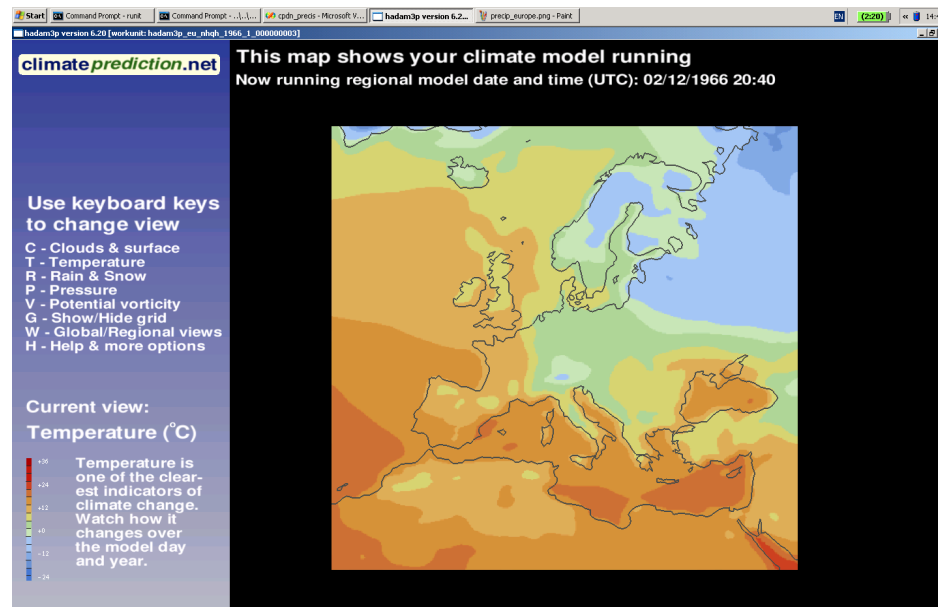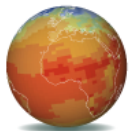
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The climate*prediction*.net weather@home project

- 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
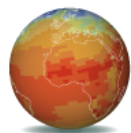
climate*prediction***.net**
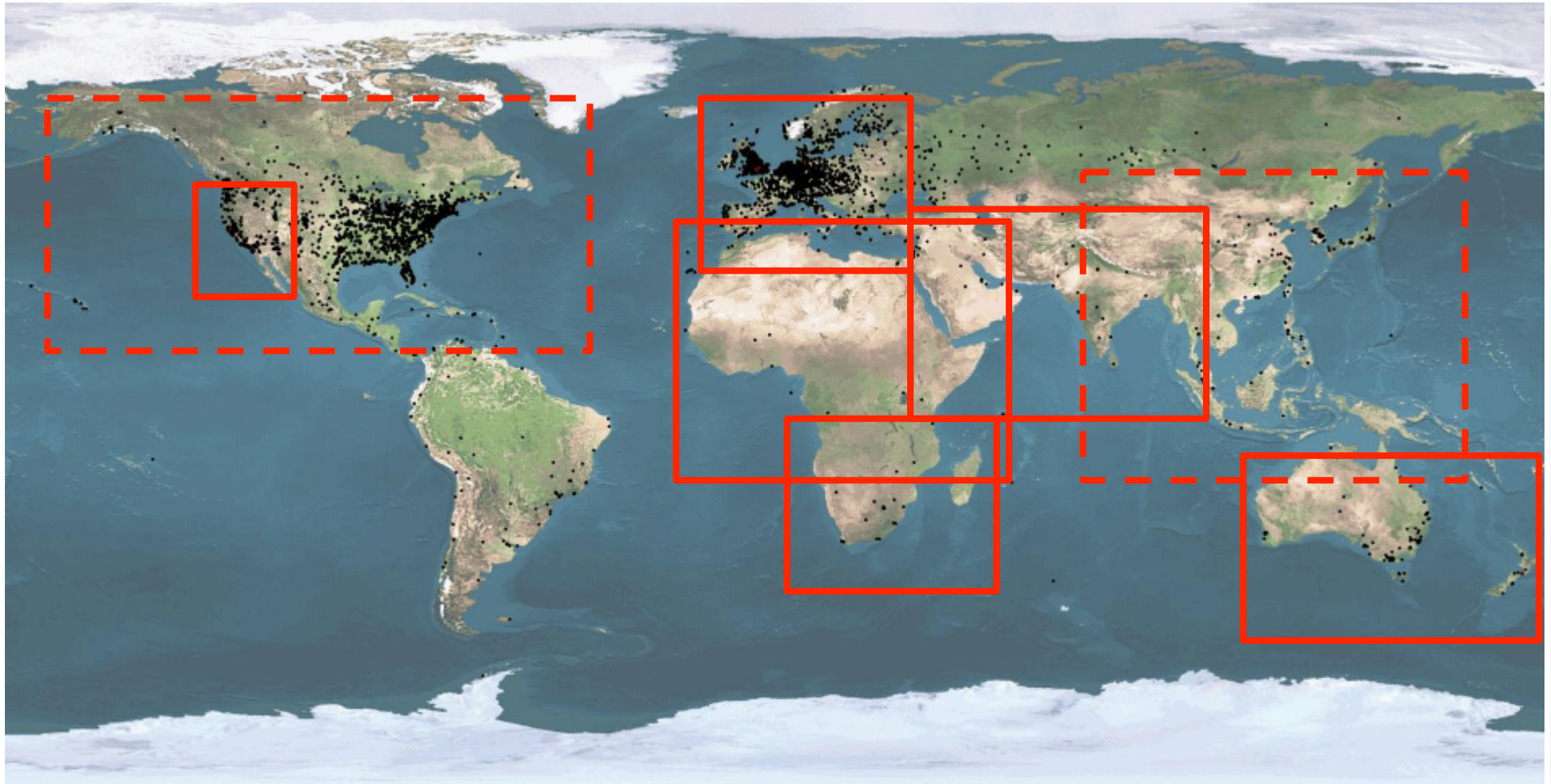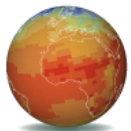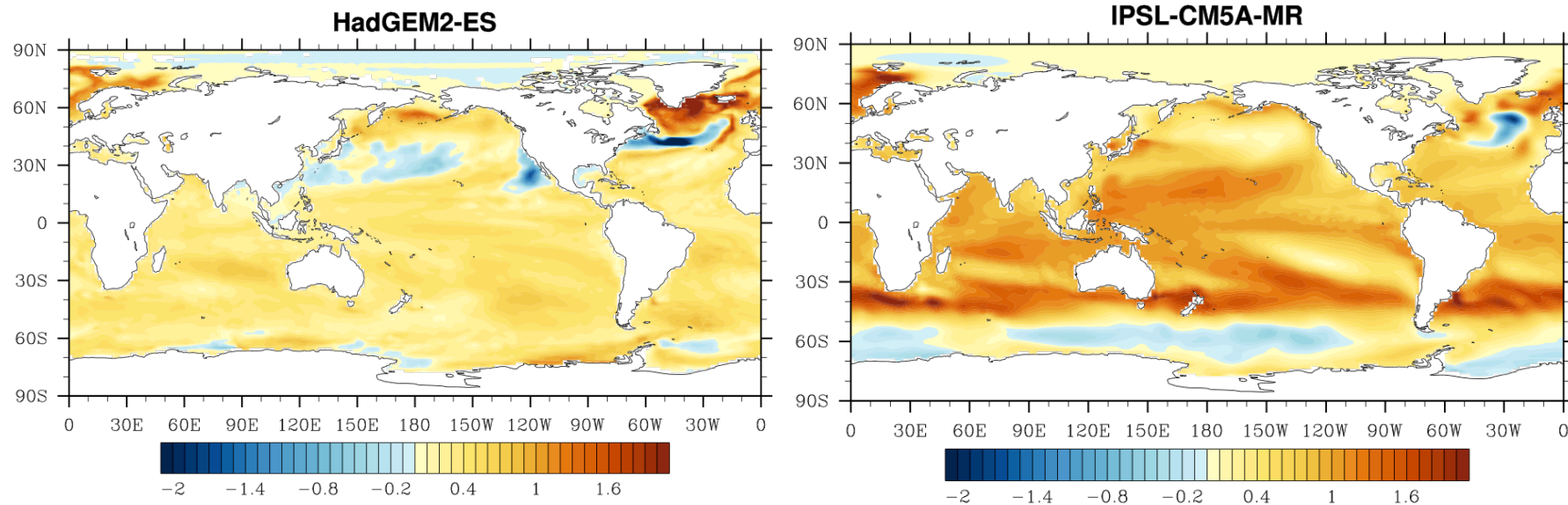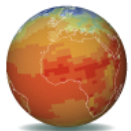the world's largest climate forecasting experiment for the 21st century

weather@home regions

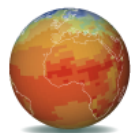# We can ask how the risk of an extreme event occurring has changed due to human greenhouse gas emissions

SST patterns of the world that might have been

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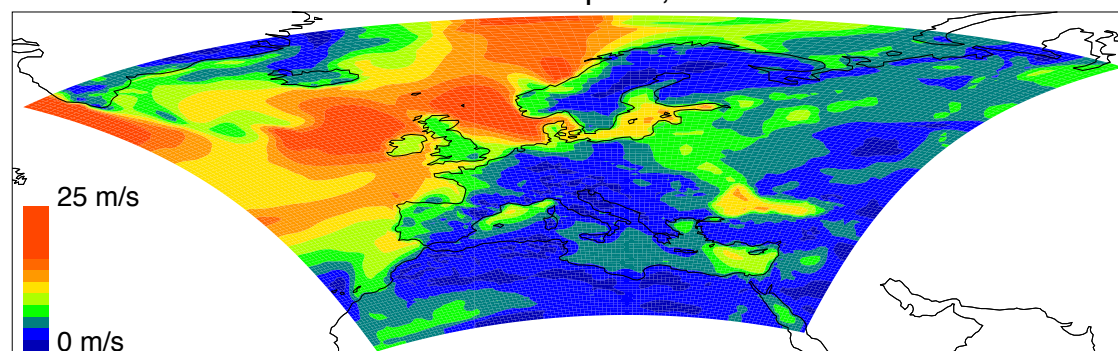IPSL-CM5R-MR (right) models

Sample event from weather@home

Mean 10m wind speed, dec   27

25 m/s

0 m/s

Mean sea level pressure, dec   27

104 hPa

94 hPa

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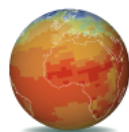
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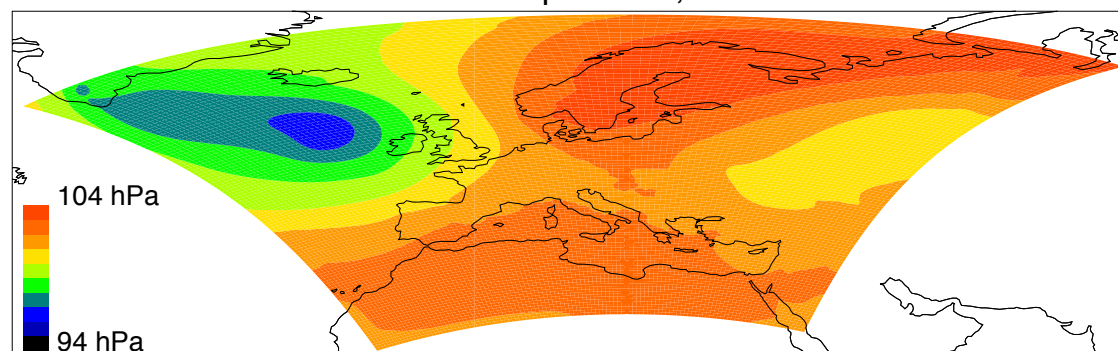eci UNIVERSITY OF OXFORD
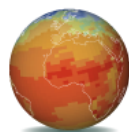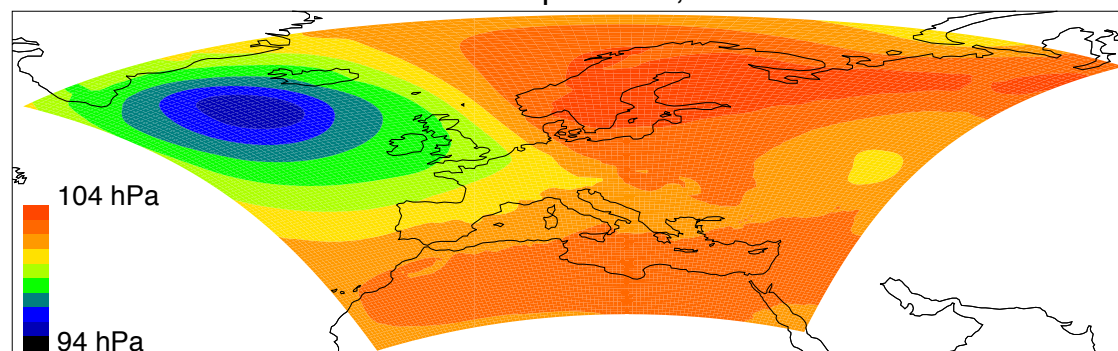
Sample event from weather@home

Mean 10m wind speed, dec   28

Mean sea level pressure, dec   28

Sample event from weather@home

Mean 10m wind speed, dec   29

25 m/s

0 m/s
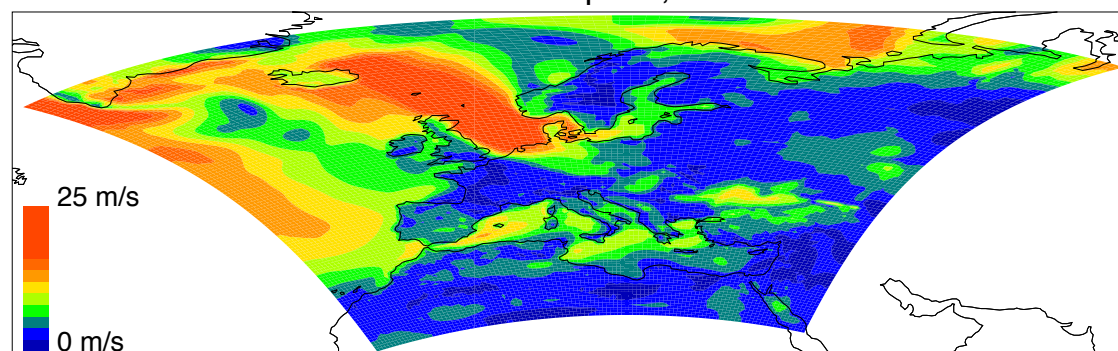
Mean sea level pressure, dec   29

104 hPa

94 hPa

Sample event from weather@home

Mean 10m wind speed, dec   30

25 m/s

0 m/s

Mean sea level pressure, dec   30

104 hPa

94 hPa

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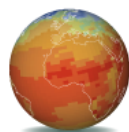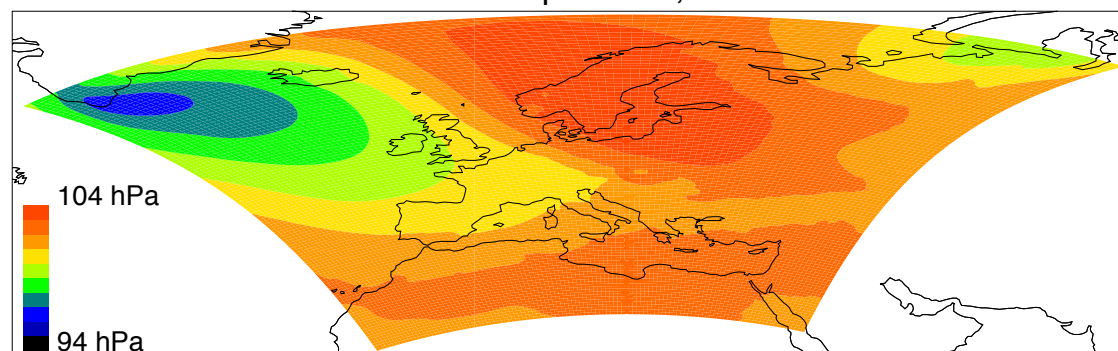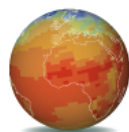
Sample event from weather@home

Mean 10m wind speed, jan   1

25 m/s

0 m/s

Mean sea level pressure, jan   1

104 hPa

94 hPa

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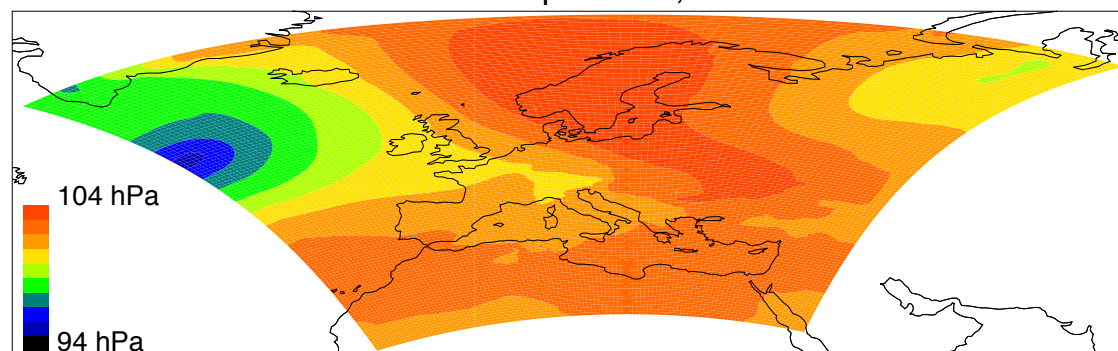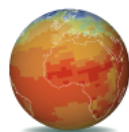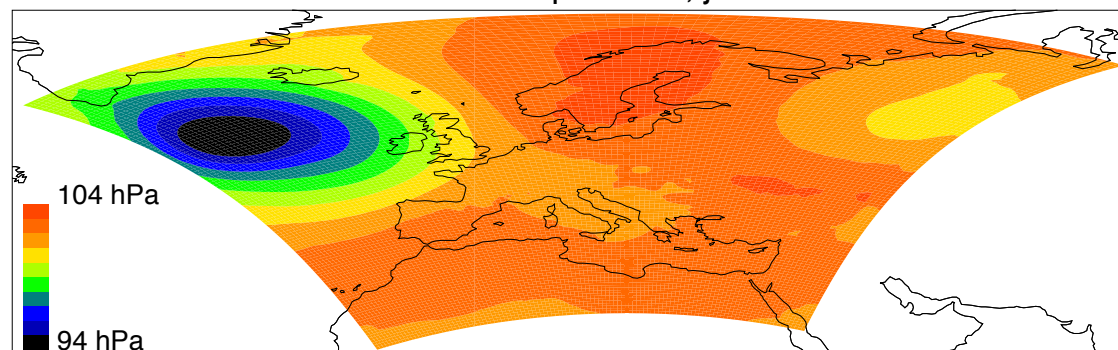eci   UNIVERSITY OF OXFORD

The highest precipitation ever recorded in winter in Oxford

Southern UK Rainfall - 29470 Simulations

4-day precipitation Elbe catchment 2013

Return periods of 4–day average precipitation Elbe catchment

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

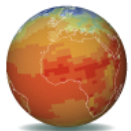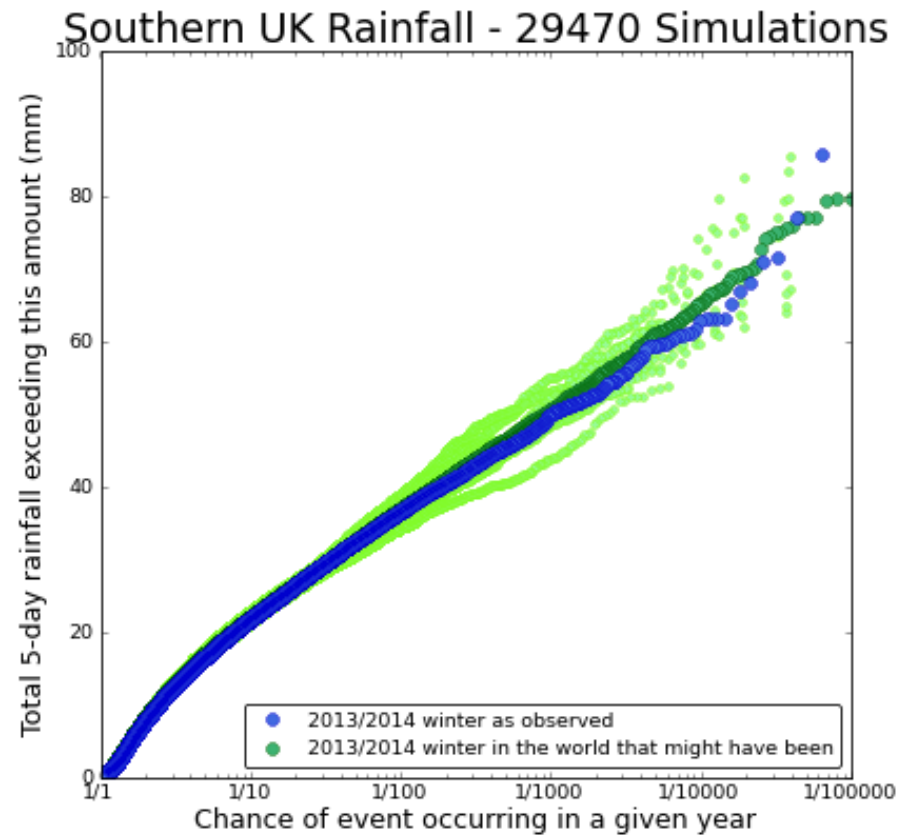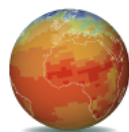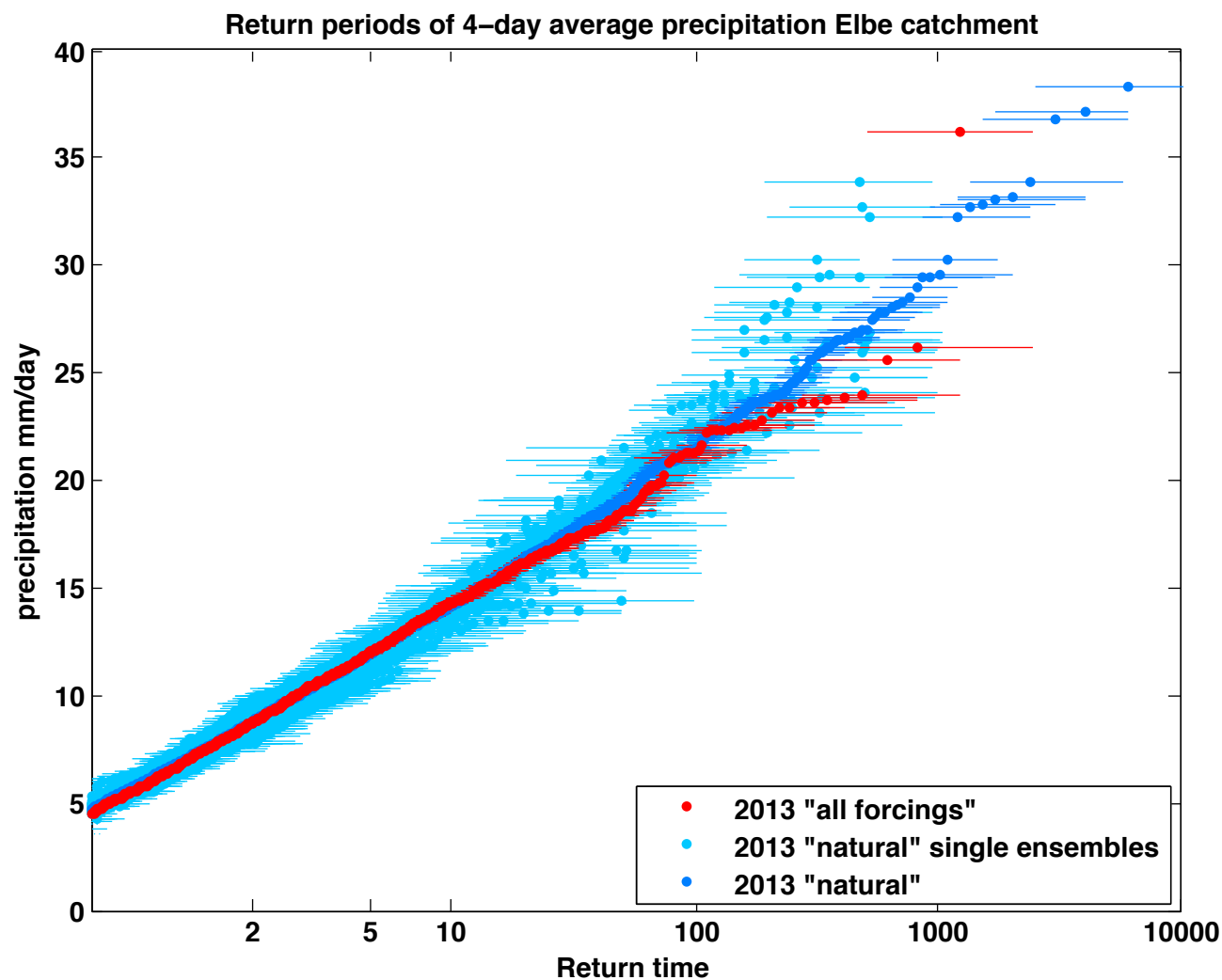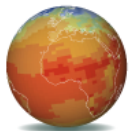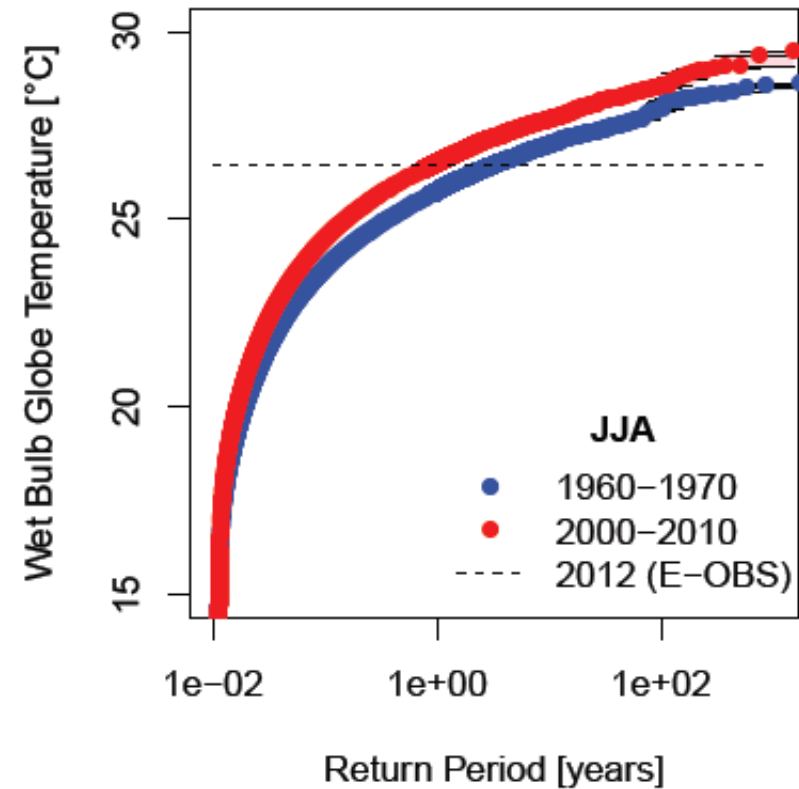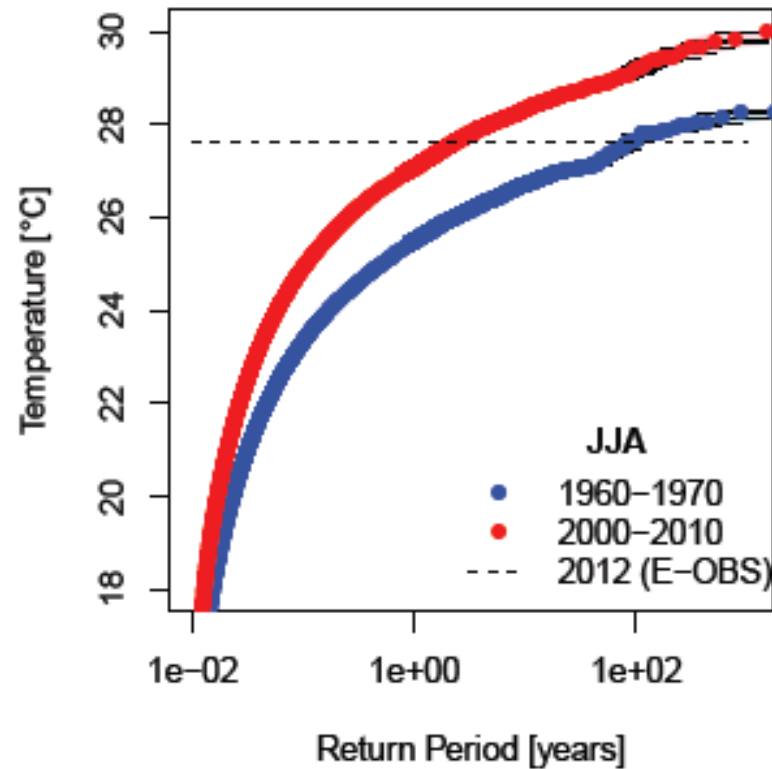Axes: precipitation mm/day (y-axis), Return time (x-axis)

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Image: nasa.gov

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Heat wave and drought in Serbia 2012

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.