Accounting for uncertainty in climate projections and the premise of decadal climate predictions

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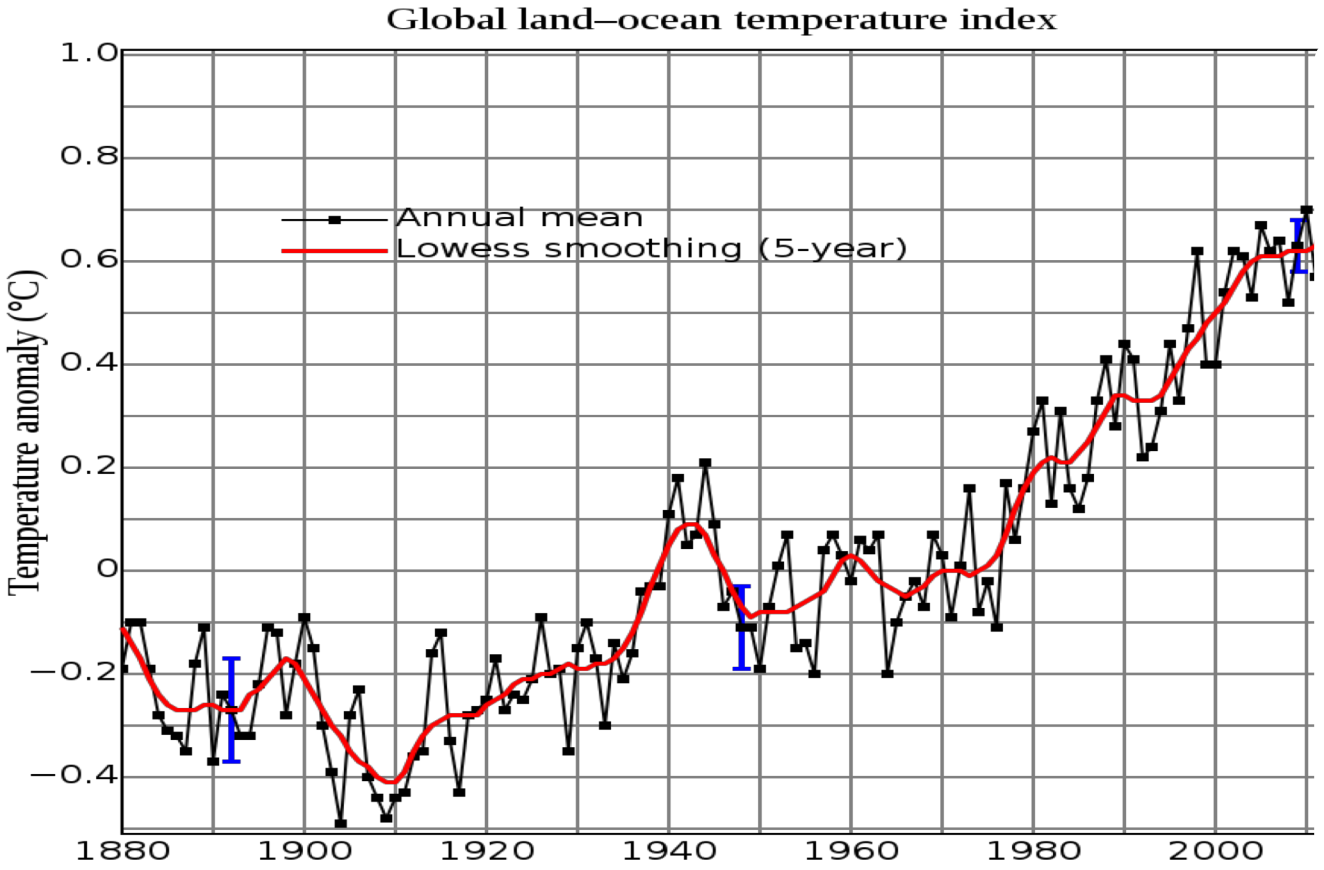
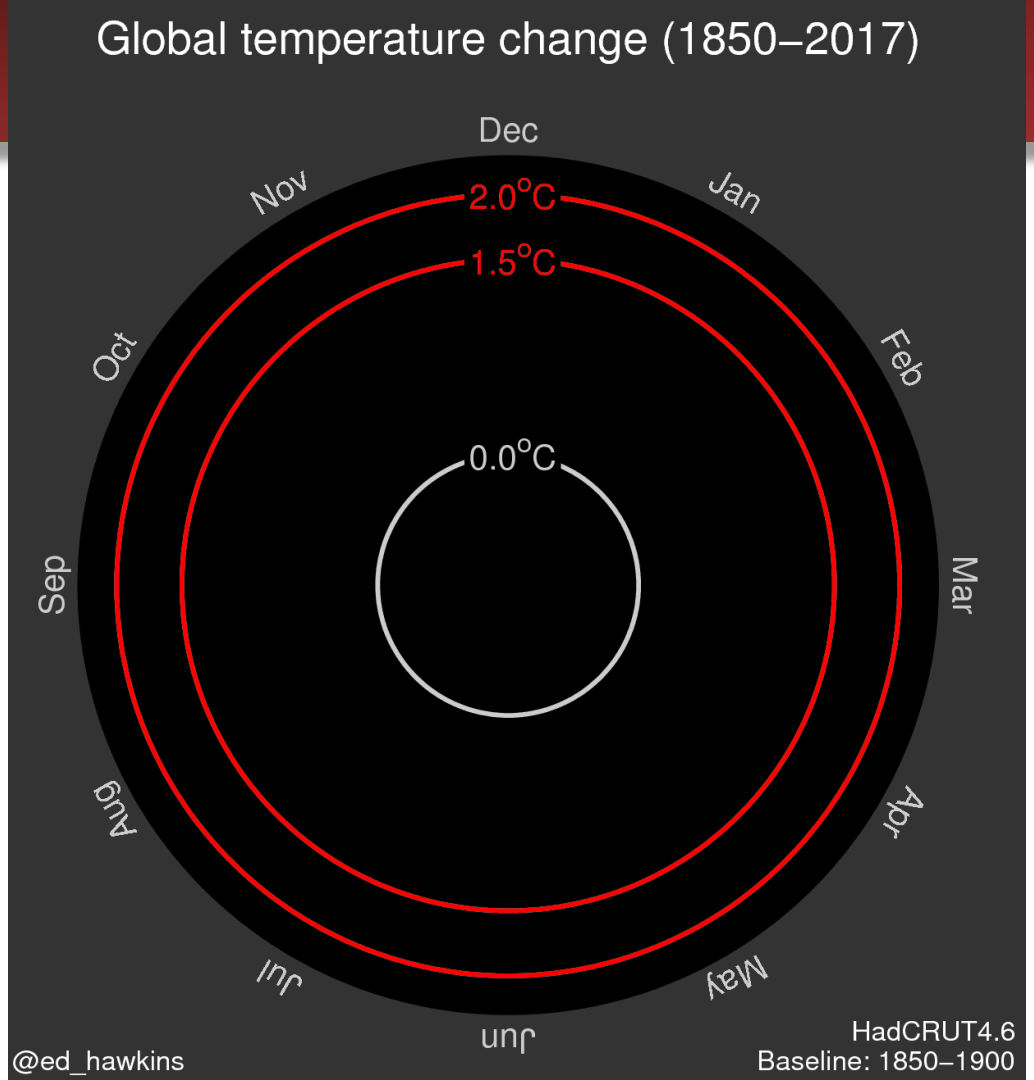
Outlines

- News from the global warming
- What is a climate projection?
- Decadal prediction
- Downscaling methods
- Results from our group => Giovanni Sgubin

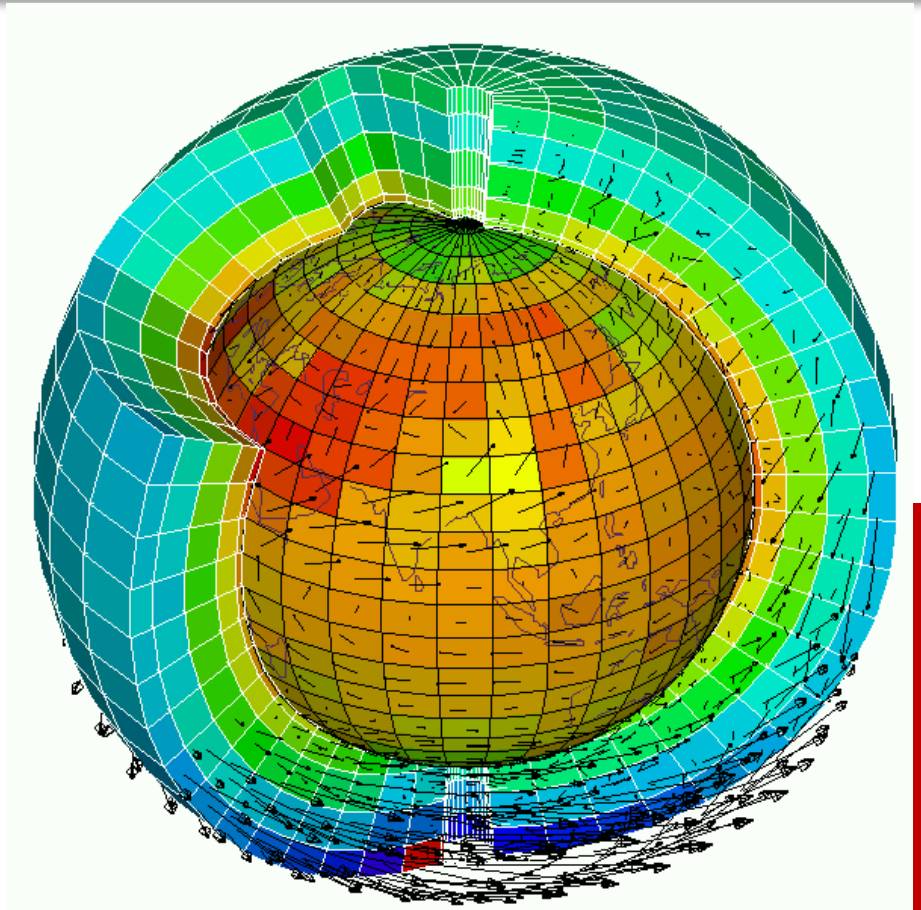
News from the global warming

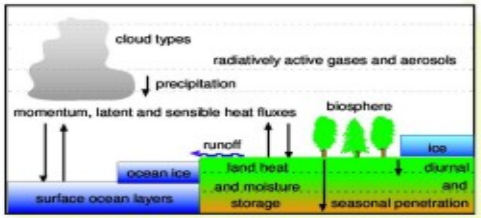


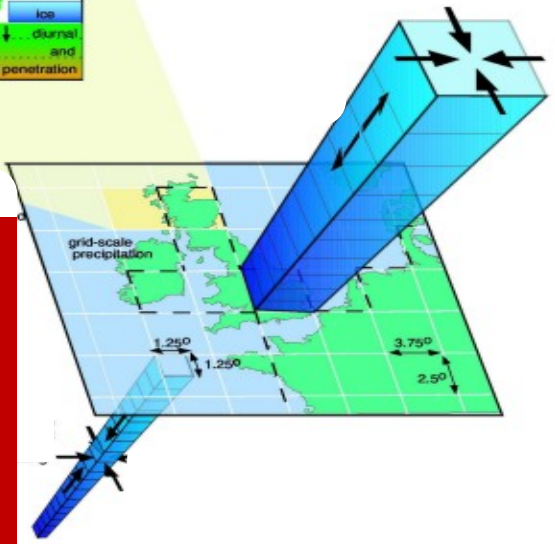
Source:
NASA-GISS


Global temperature change (1850–2017)
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
2.0°C
1.5°C
0.0°C
@ed_hawkins
HadCRUT4.6
Baseline: 1850–1900

Climate models







CMIP: coupled model intercomparison project

⇒ 6th phase is on-going

⇒ CMIP5

Det

°C

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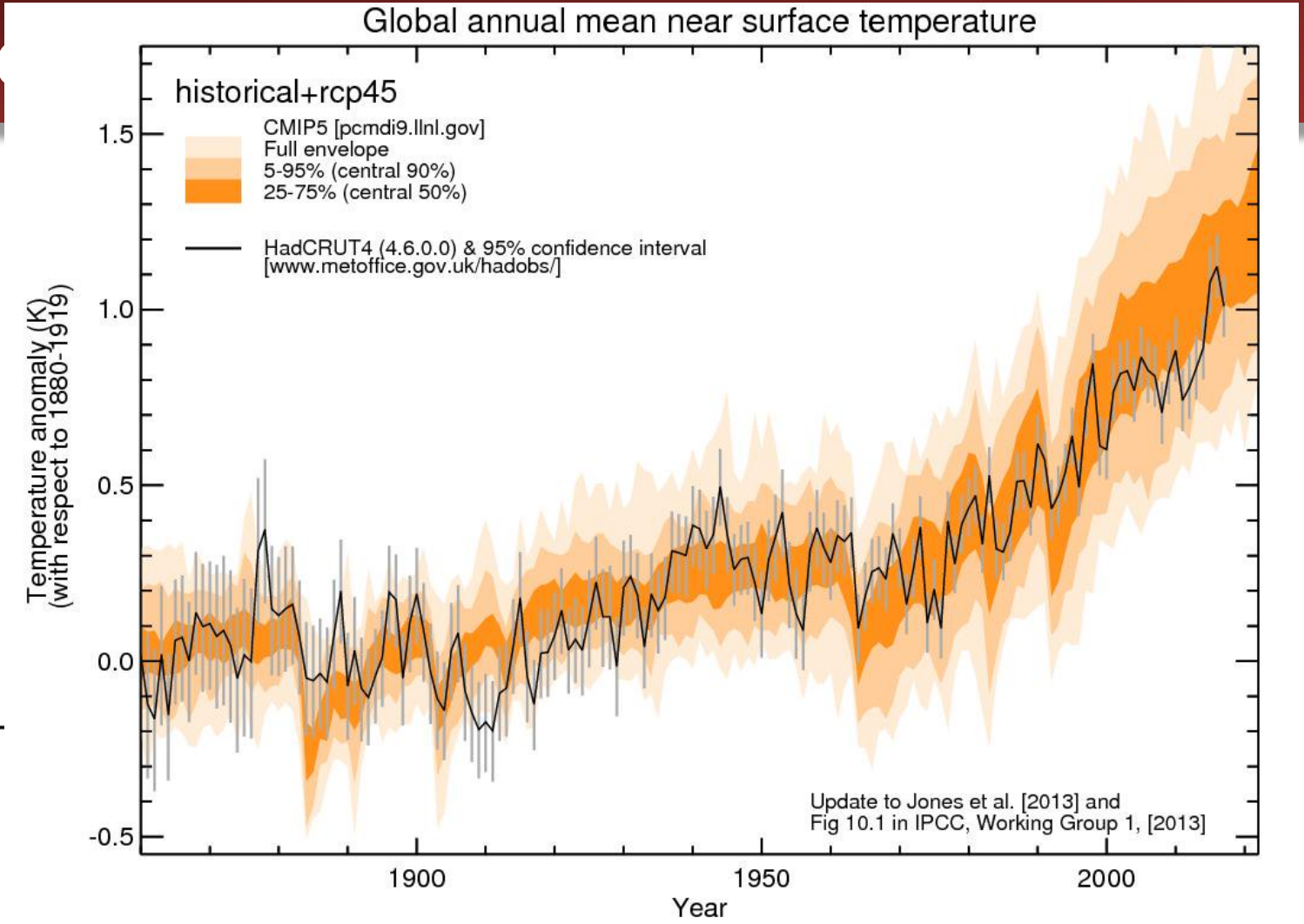
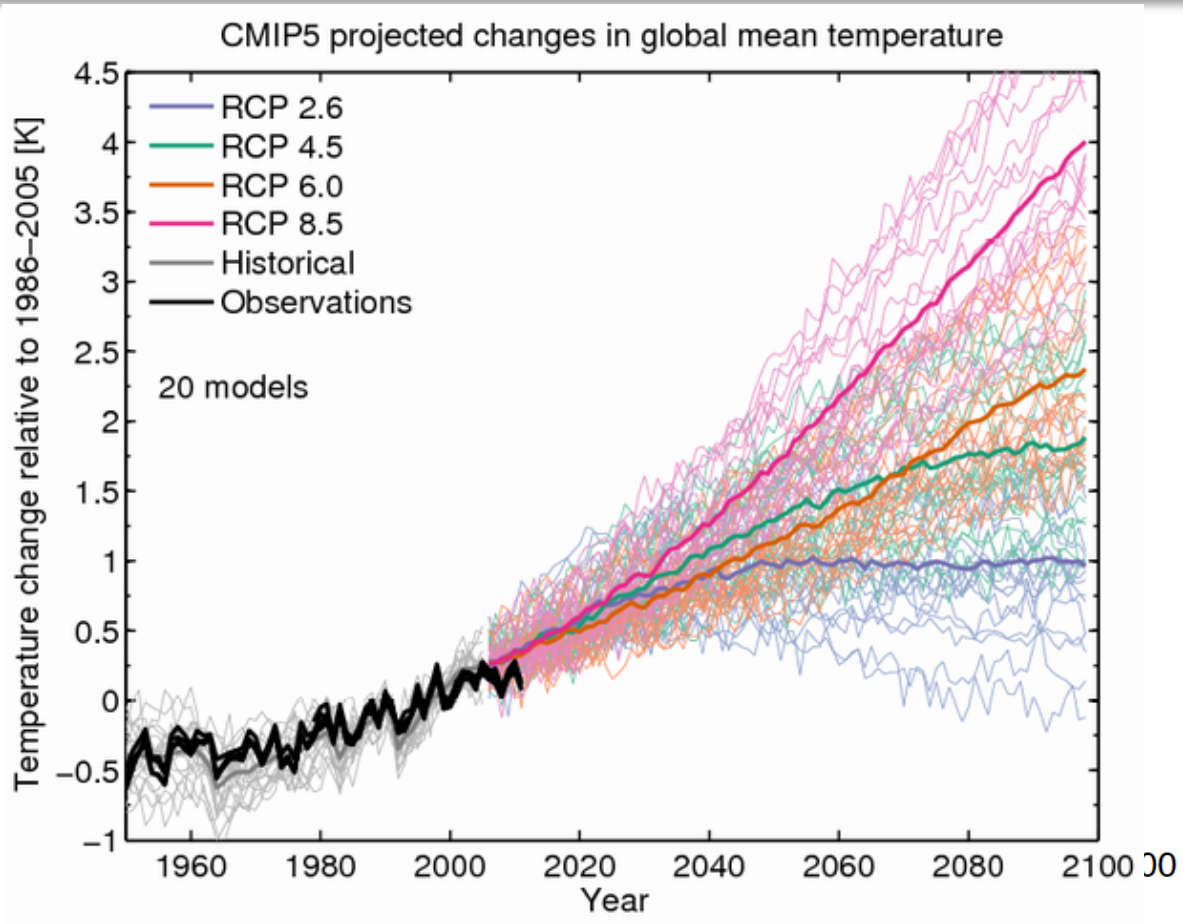
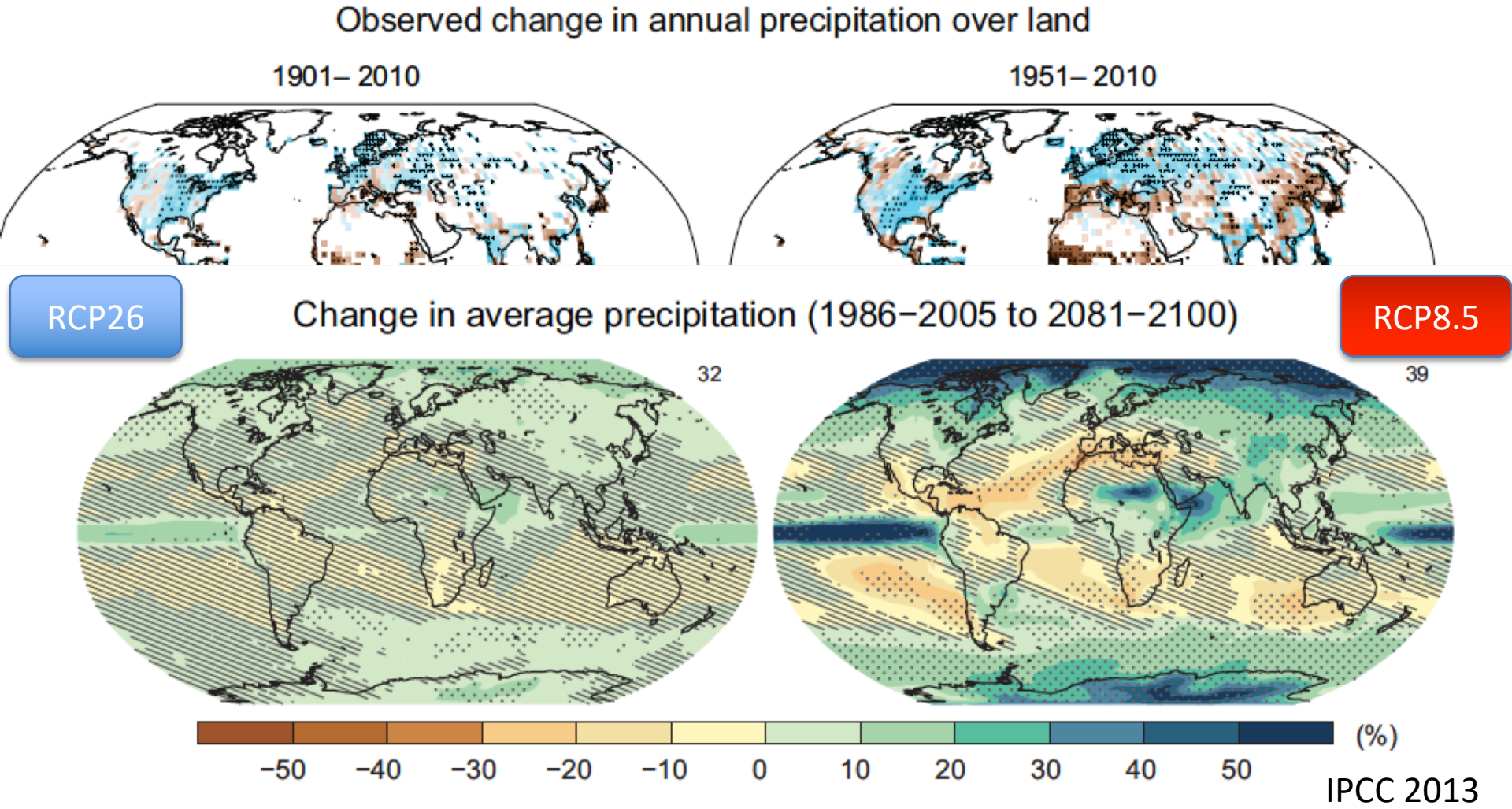

Global annual mean near surface temperature
historical+rcp45
CMIP5 [pcmdi9.llnl.gov]
Full envelope
5-95% (central 90%)
25-75% (central 50%)
HadCRUT4 (4.6.0.0) & 95% confidence interval
[www.metoffice.gov.uk/hadobs/]
Temperature anomaly (K)
(with respect to 1880-1919)
1.5
1.0
0.5
0.0
-0.5
1900
1950
2000
Year
Update to Jones et al. [2013] and
Fig 10.1 in IPCC, Working Group 1, [2013]

Climate projections

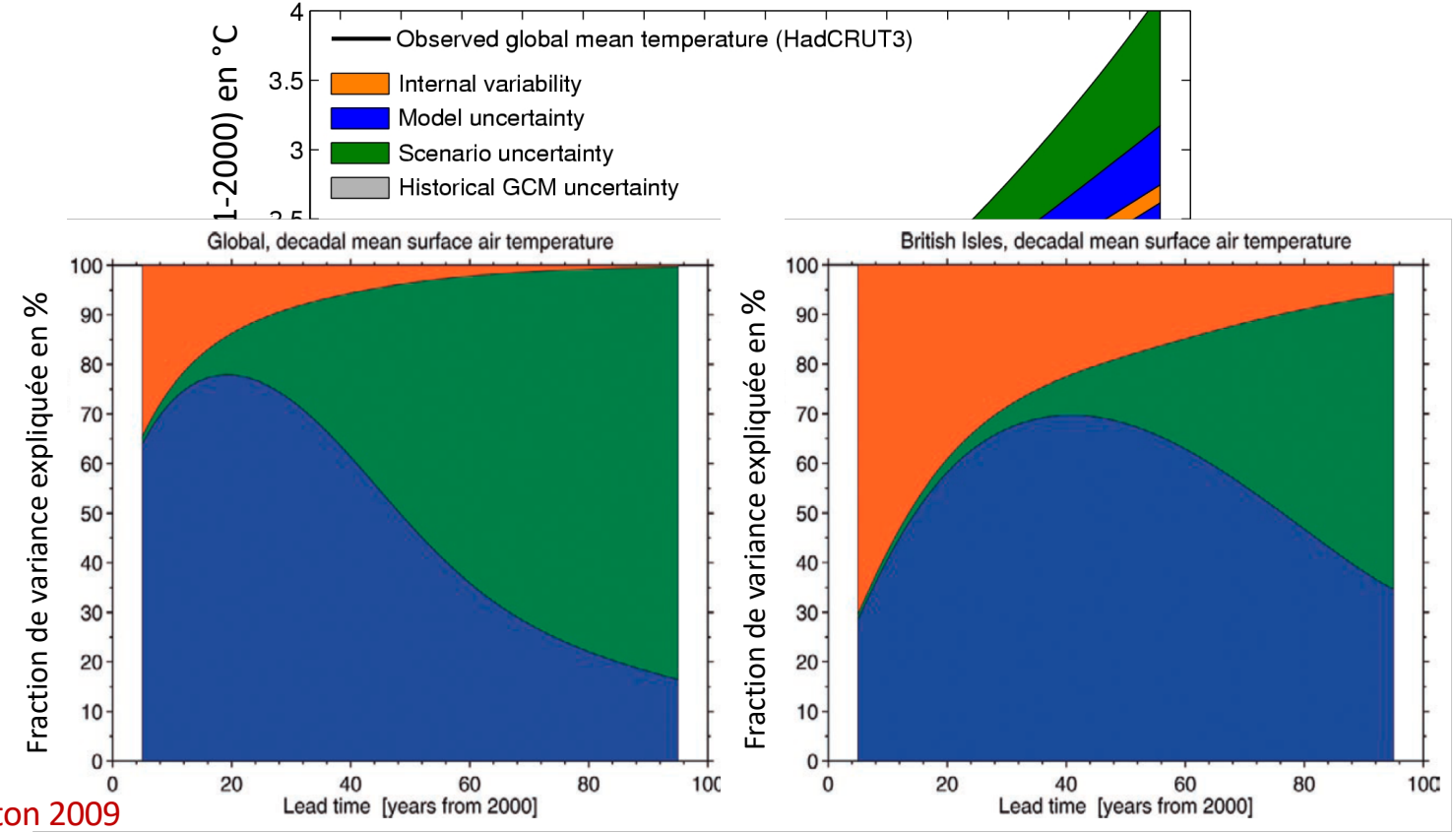


IPCC 2013


Observed change in annual precipitation over land
1901– 2010
1951– 2010
RCP26
Change in average precipitation (1986–2005 to 2081–2100)
RCP8.5
32
39
(%)
−50
−40
−30
−20
−10
0
10
20
30
40
50

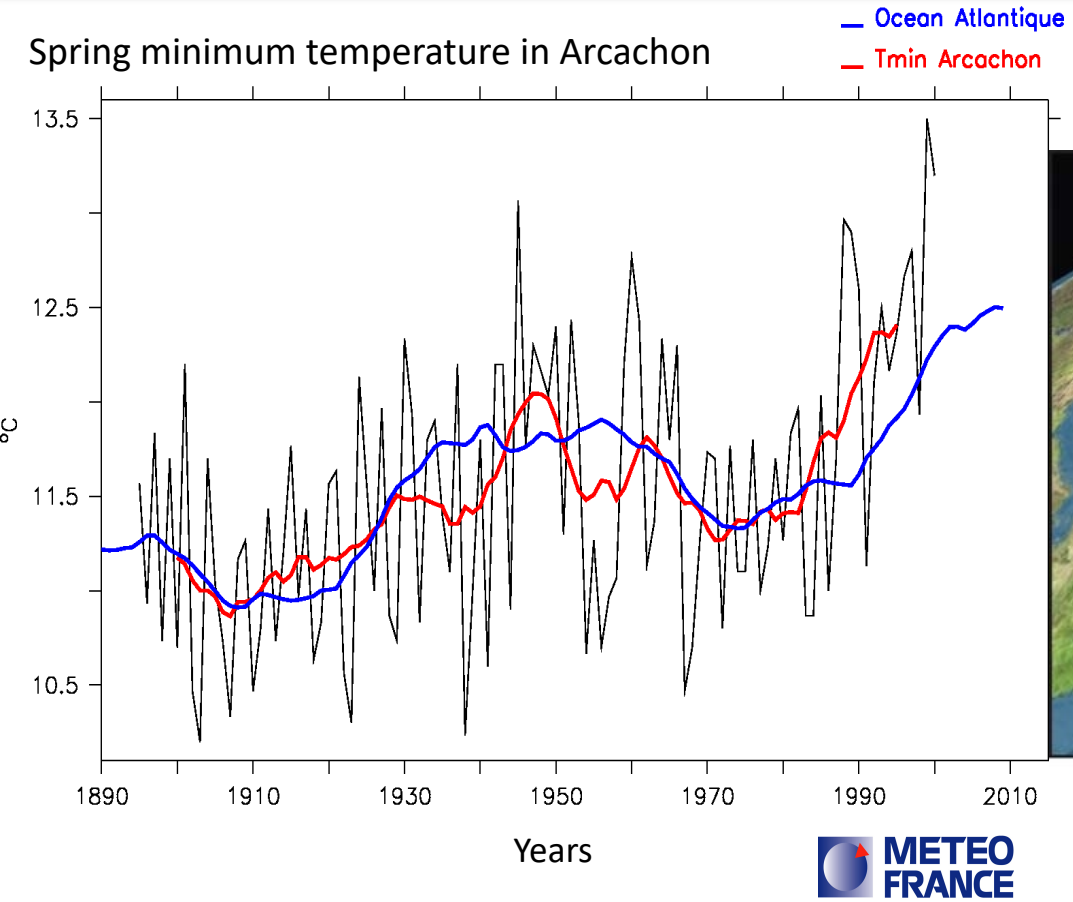
IPCC 2013

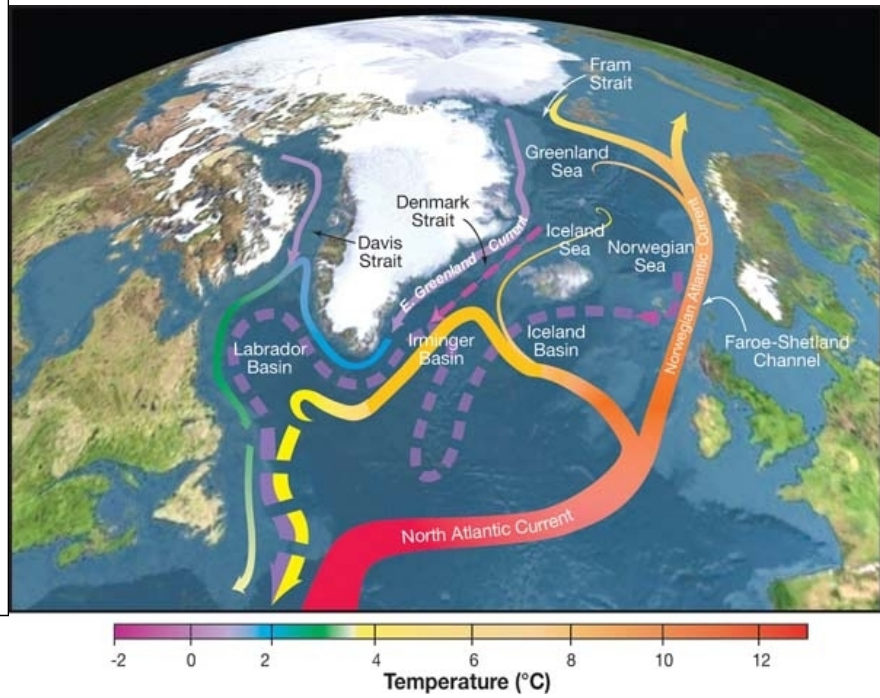
Sources of uncertainties



Hawkins & Sutton 2009

Decadal variations at the regional scale





Decadal predictions

Initial Conditions

External forcing

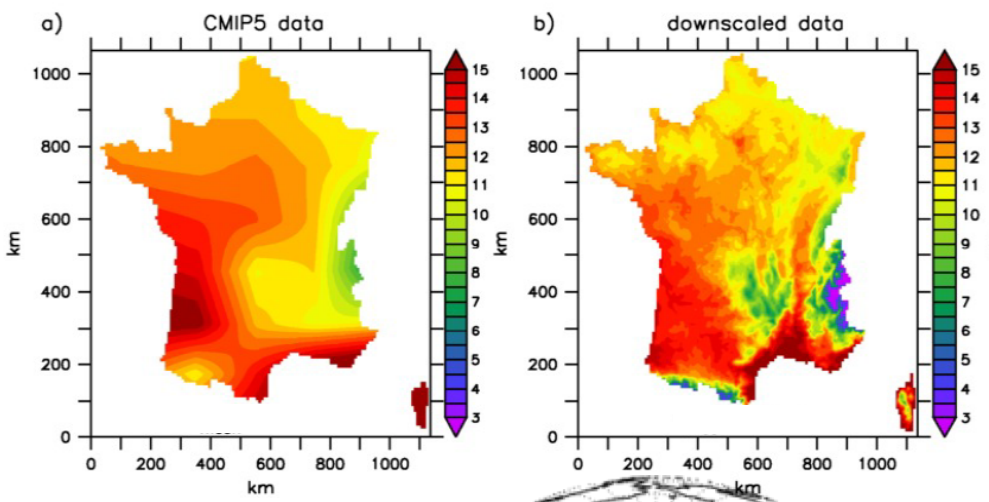
Weather **Seasonal prediction** **Decadal prediction** **Centennial projection** **Ice age cycle**

day week month year decade century millennium

Time scale

Downscaling

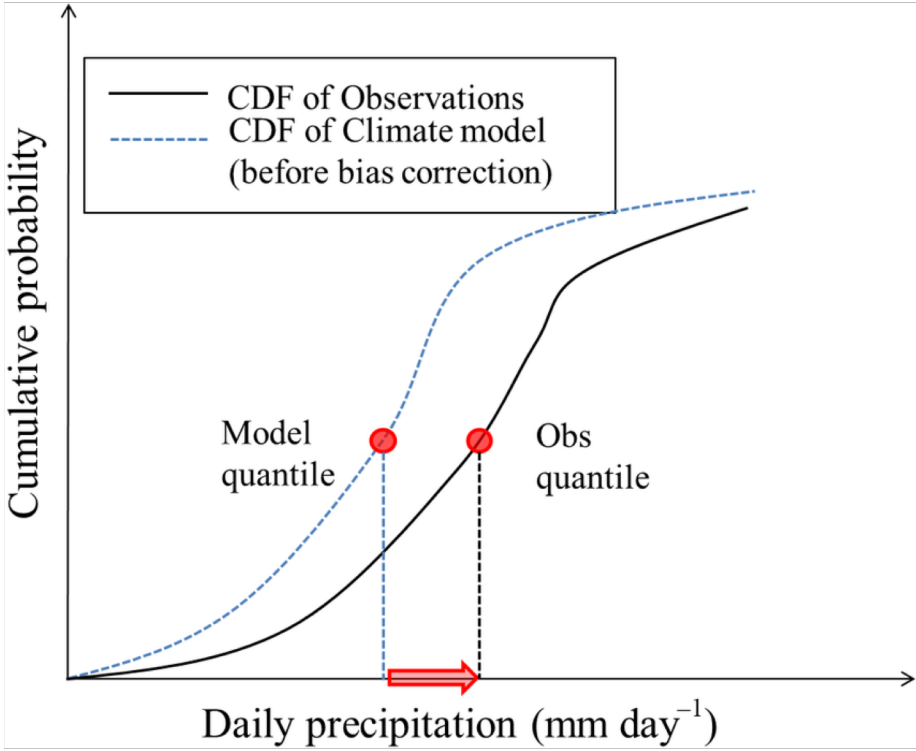
- **Statistical downscaling:**
  e.g. Analog method => create statistical relationship between large scale **predictors** and regional scale **predictant**
- **Dynamical downscaling**:
  e.g. CORDEX project: regional model with higher resolution nested in a global model



WCRP CORDEX

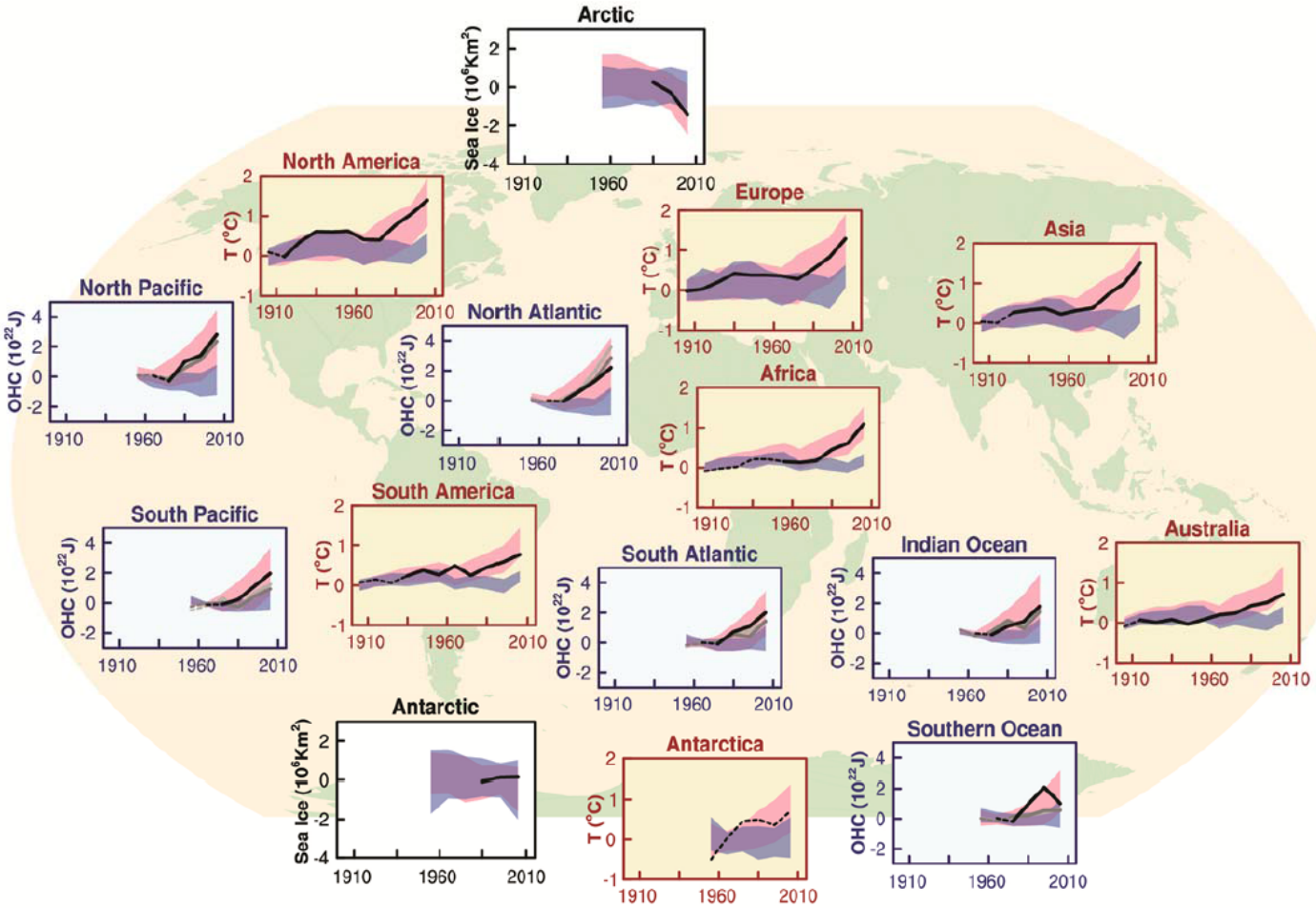
Debiasing model data

- Removing potential drift in climate predictions
- Correct the modelled distribution of a given variable with the observed one: quantile-quantile approach
- Link (EU projects) with the Climate Data Factory, a company dedicated to develop climate services and who is applying the methods from Matthieu Vrac (LSCE) on various field.
- Use of cumulative Distribution Function-transform



the climate data factory

THANK’S!


Arctic
Sea Ice (10^6Km^2)
North America
T (°C)
Europe
Asia
North Pacific
OHC (10^{22}J)
North Atlantic
Africa
South America
South Pacific
South Atlantic
Indian Ocean
Australia
Antarctic
Sea Ice (10^6Km^2)
Antarctica
Southern Ocean
OHC (10^{22}J)
1910
1960
2010