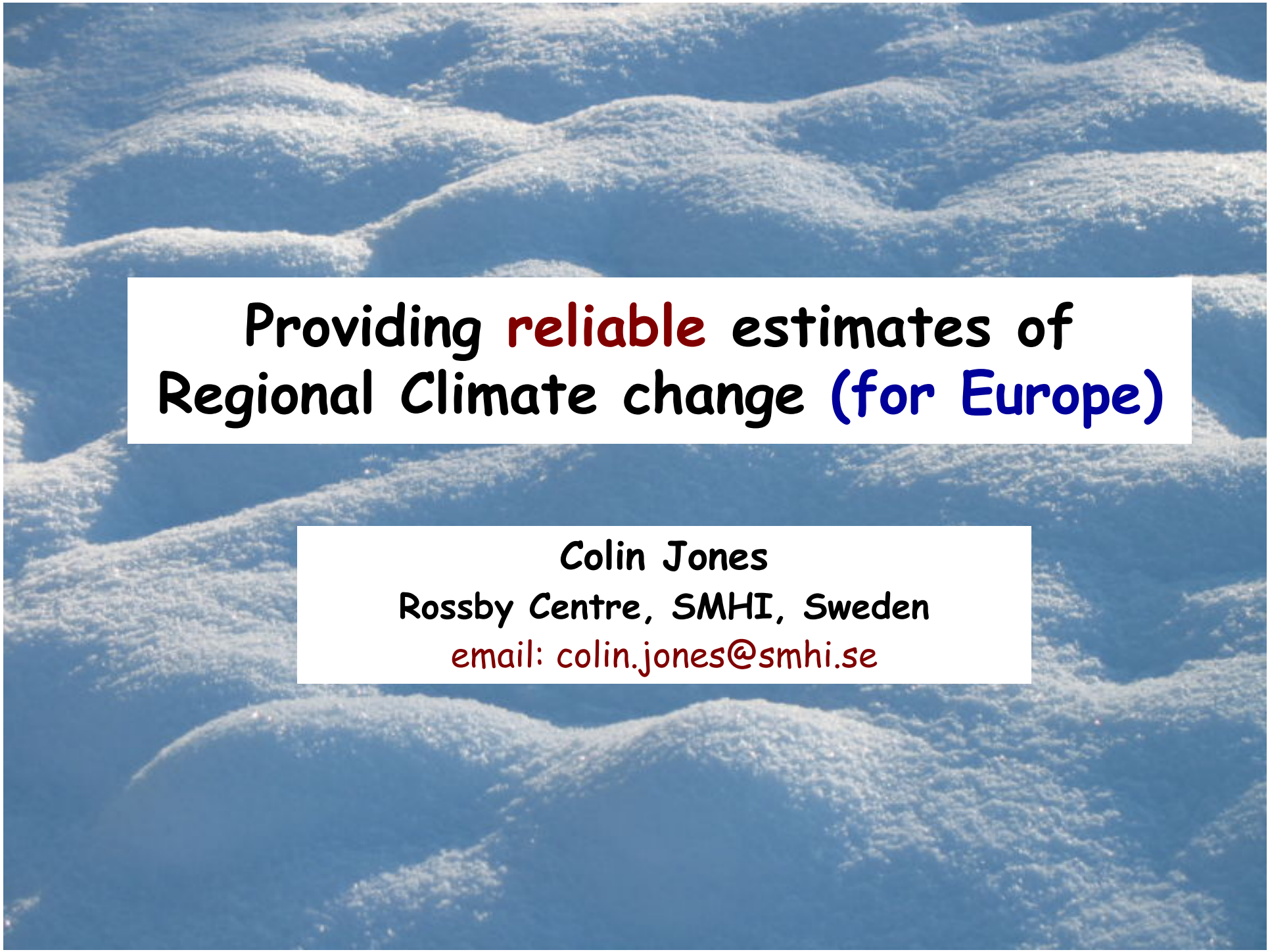


Providing reliable estimates of Regional Climate change (for Europe)

Colin Jones
Rossby Centre, SMHI, Sweden
email: colin.jones@smhi.se

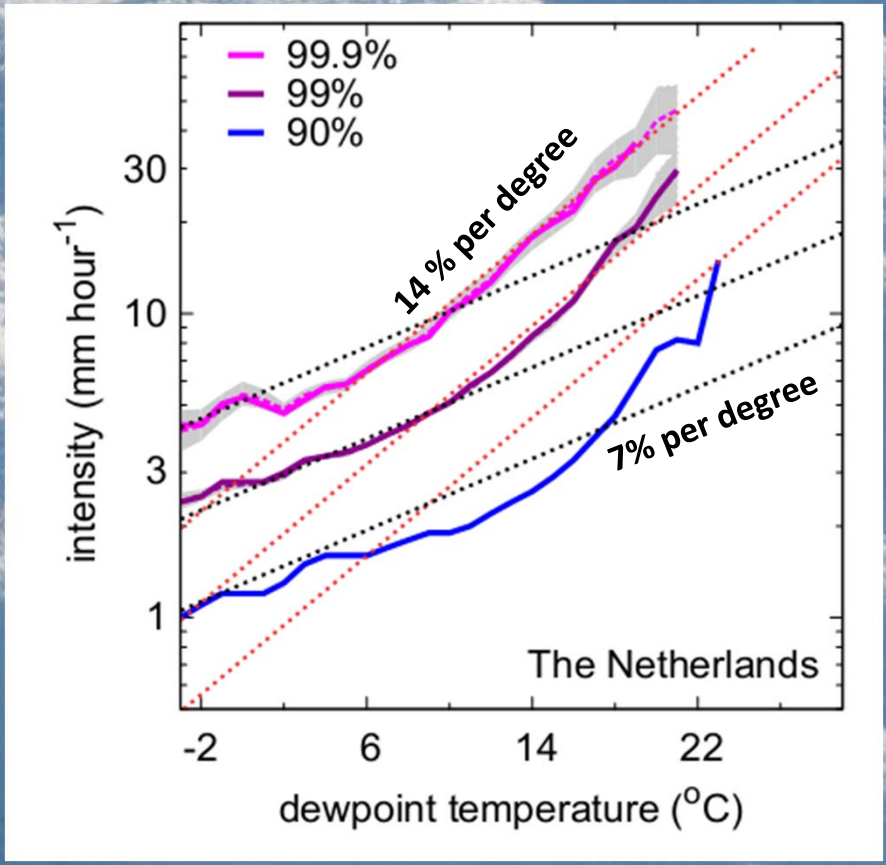
Boscastle, England: Summer 2007

New Orleans, post-Katrina 2005

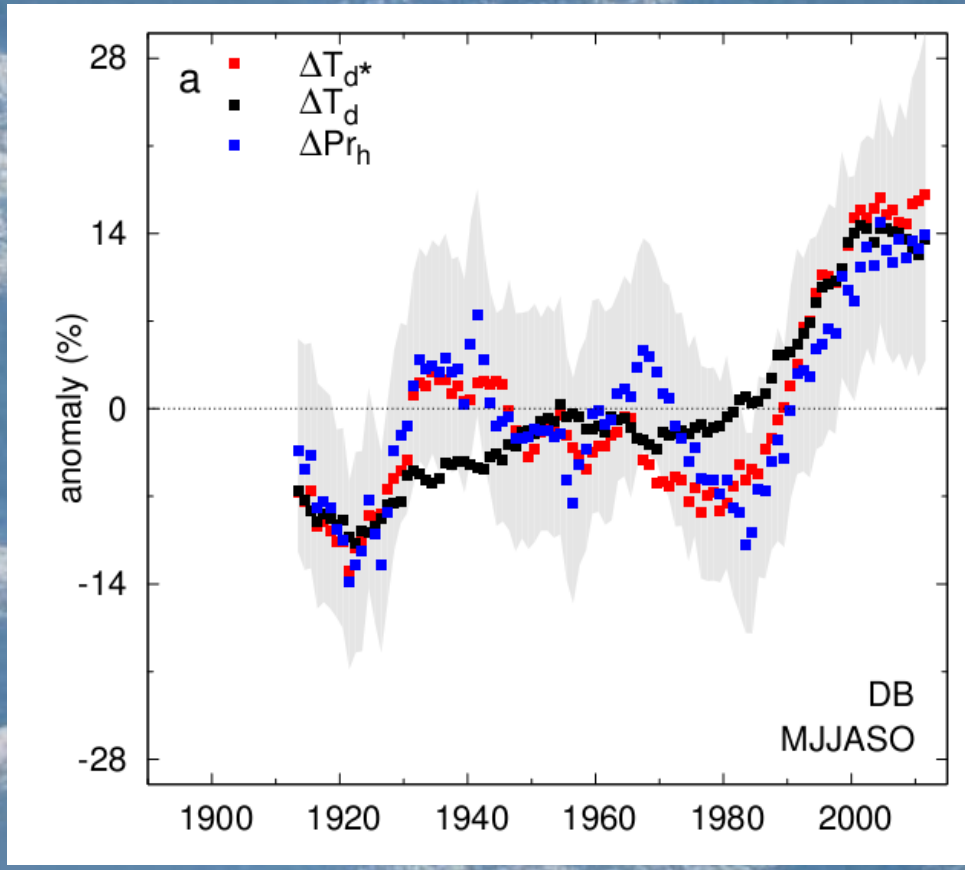
Calcutta: Monsoon flooding

Observed changes in hourly precipitation extremes

Dependency of hourly precipitation extremes on dew point temperature



…explains observed increase in hourly extremes (+15%) in the Netherlands

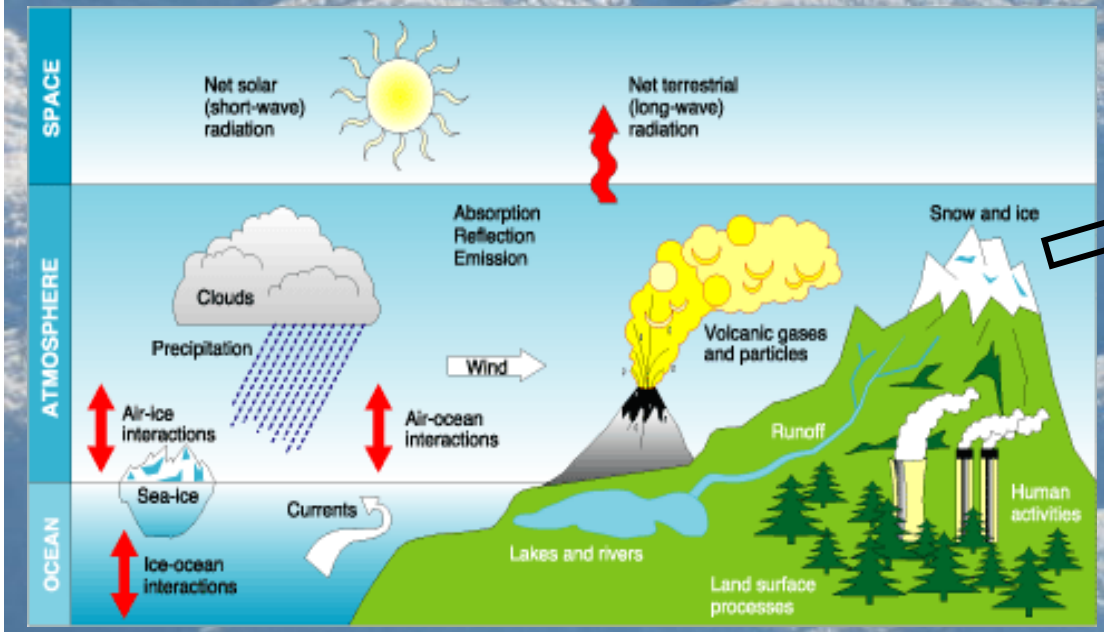


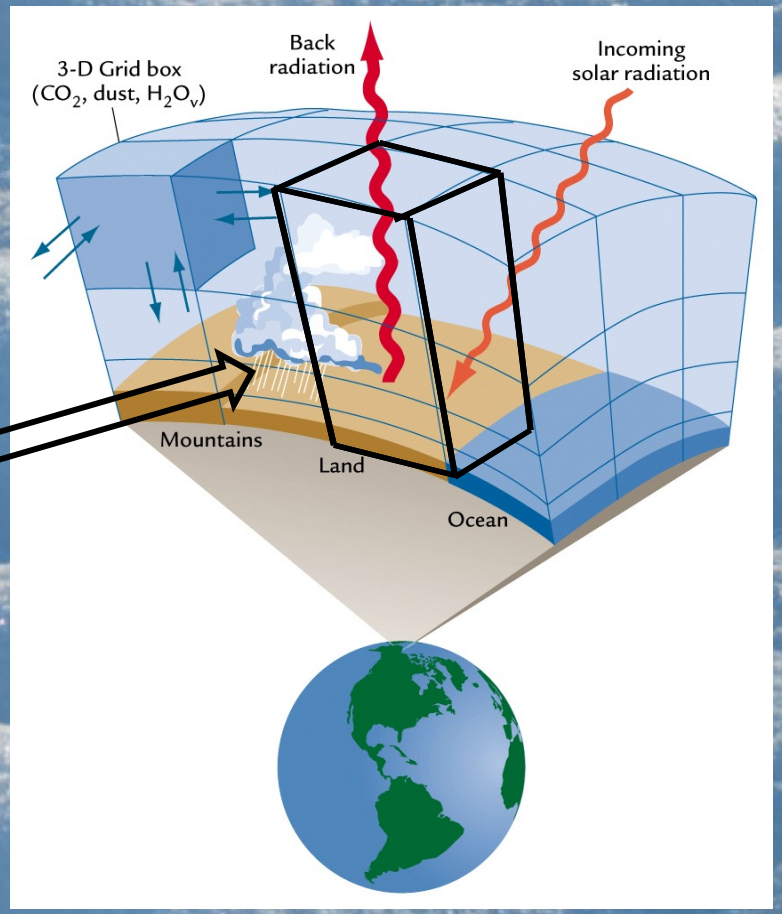
expected increase based on relation on LHS

Observed increase in precipitation extremes

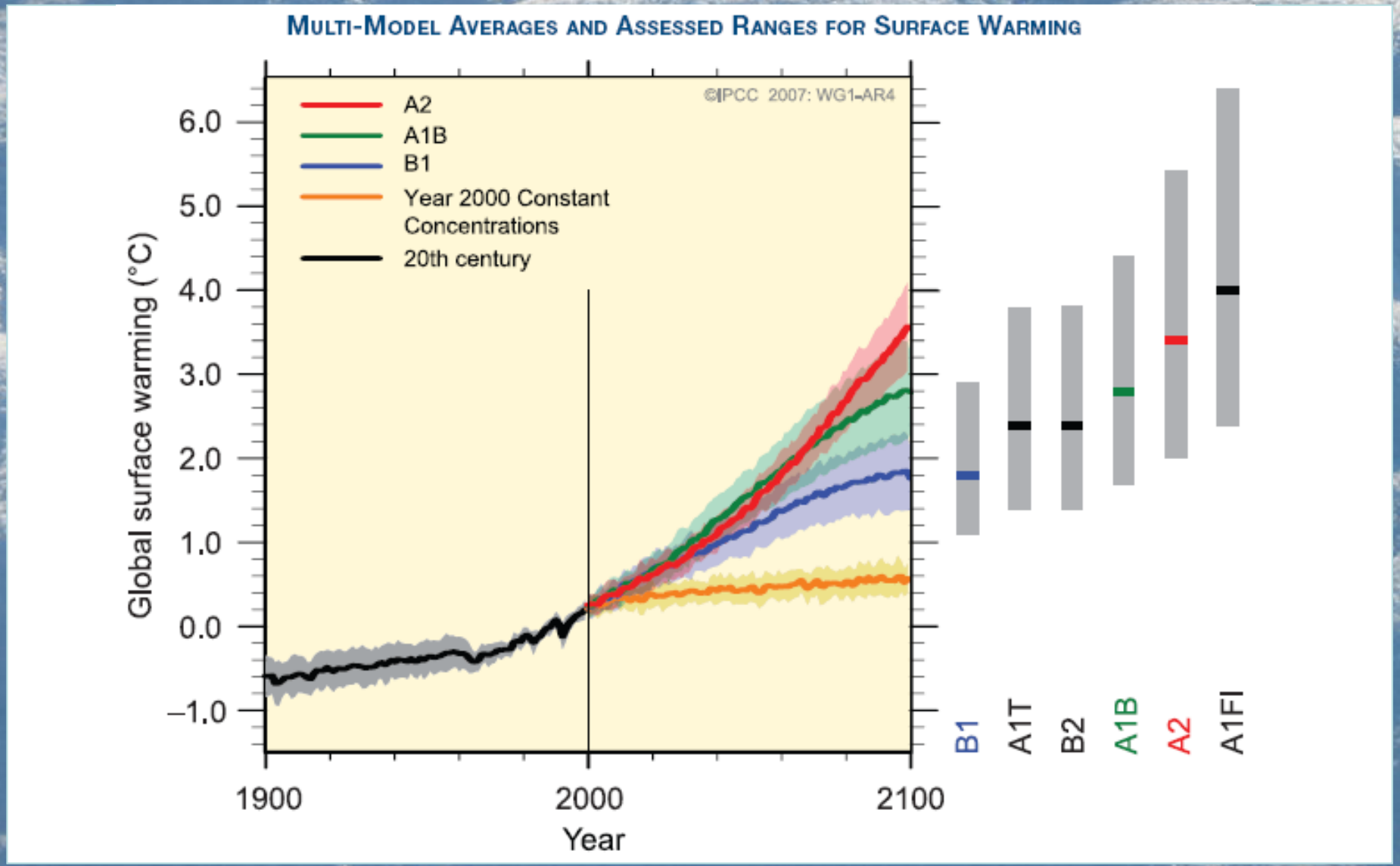
www.knmi.nl/samenw/regioklim

To investigate how the Earth may respond to increases in greenhouse gases, we build simulators/models of the Earth's Climate System, including all the key physical, dynamical & biogeochemical components we can afford to model



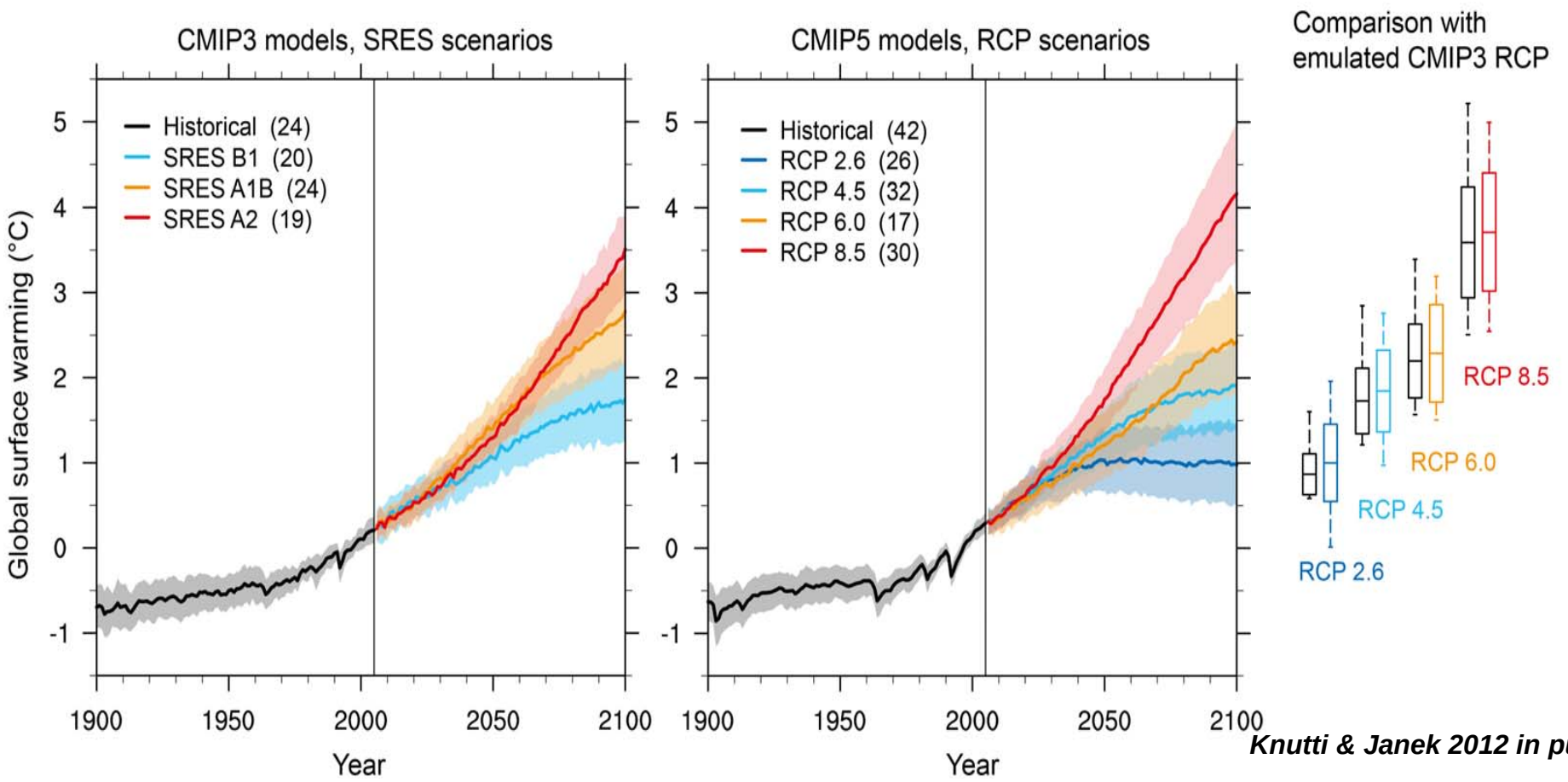


The models are then run through the past and future using observed and a set of estimates of future greenhouse gas emissions that represent plausible future global socio-economic development pathways



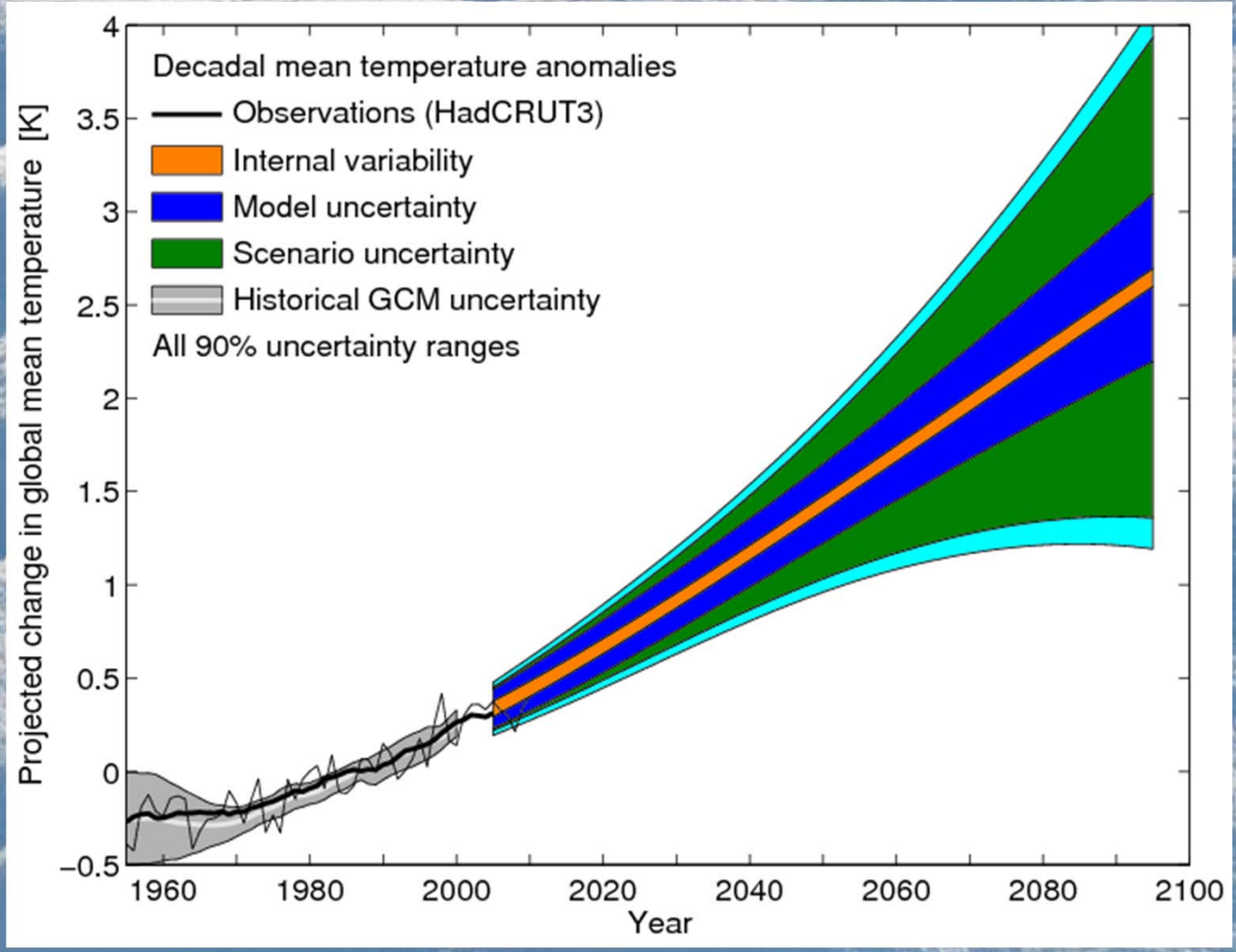
The International Climate modelling community has just completed a new set of global climate projections (CMIP5) using new GCMs and new emission pathways.

These are referred to as Representative Concentration Pathways (RCPs) and complement the earlier SRES scenarios. CMIP5 will be the primary modelling input to the IPCC AR5 report (CMIP3 + SRES was the main input to IPCC AR4)



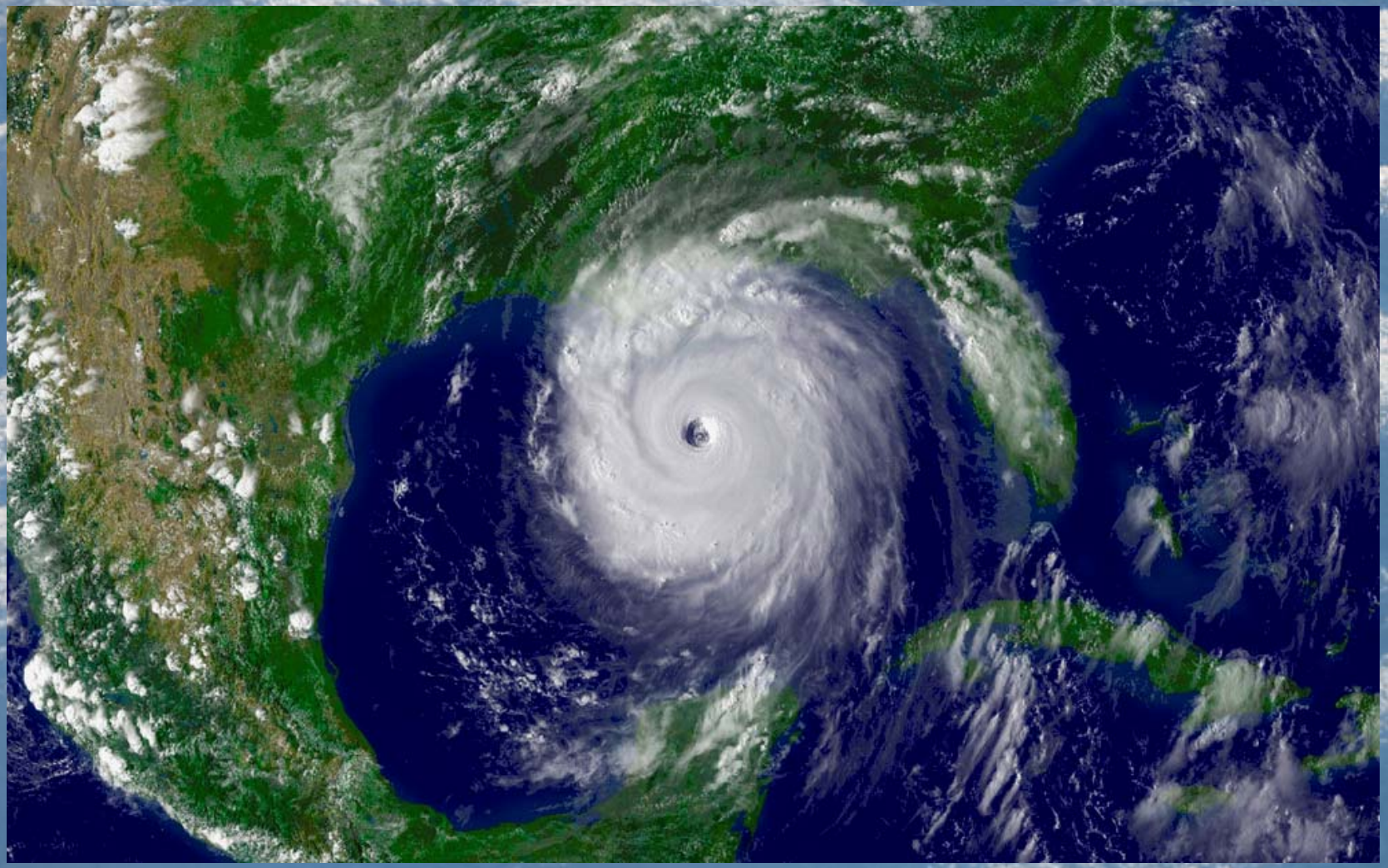
Knutti & Janek 2012 in publ.

All climate projections exhibit a significant level of uncertainty



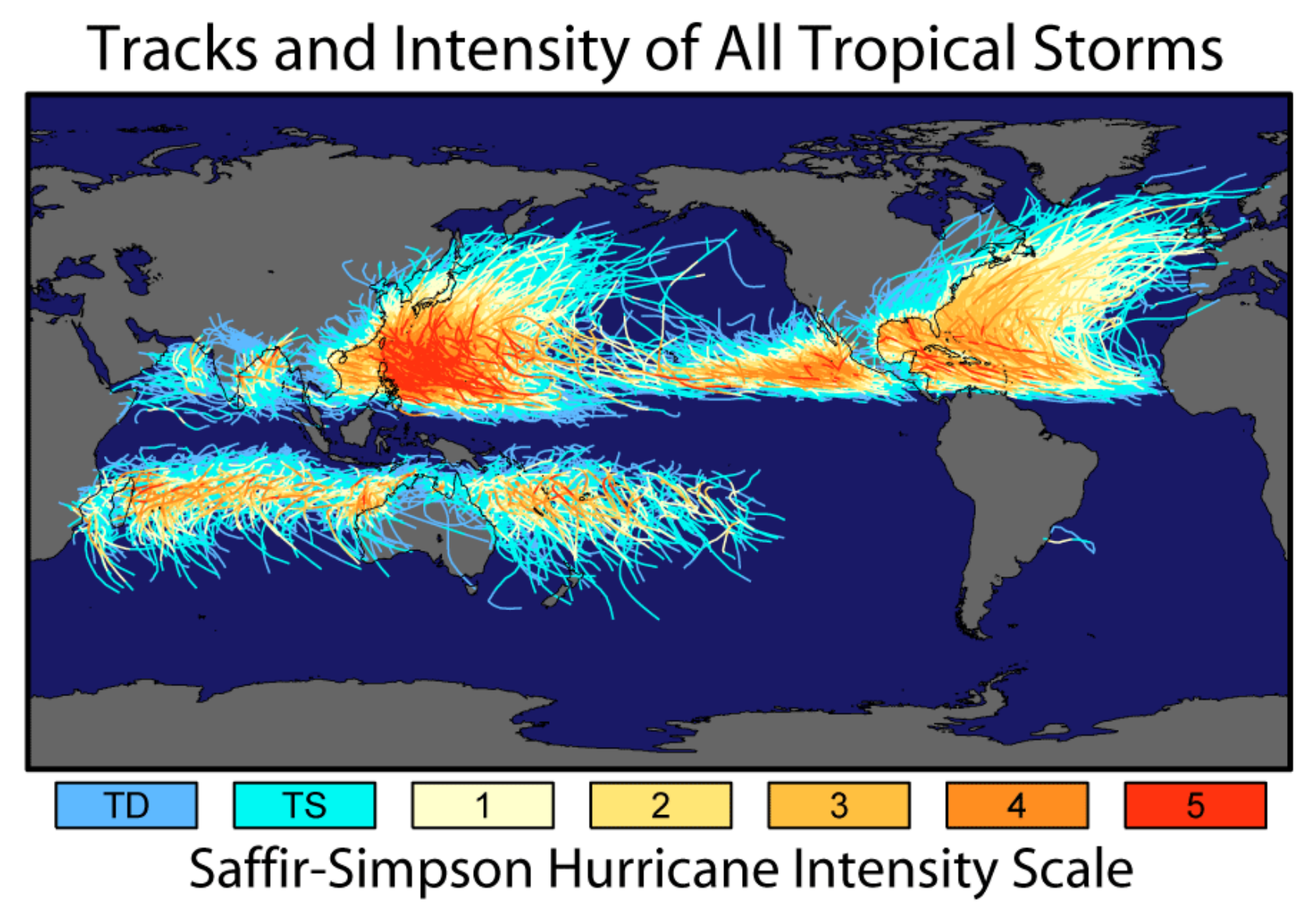
This varies with time into the future and generally increases the smaller the region under considerations

The real climate action and impacts occur at regional to local scales

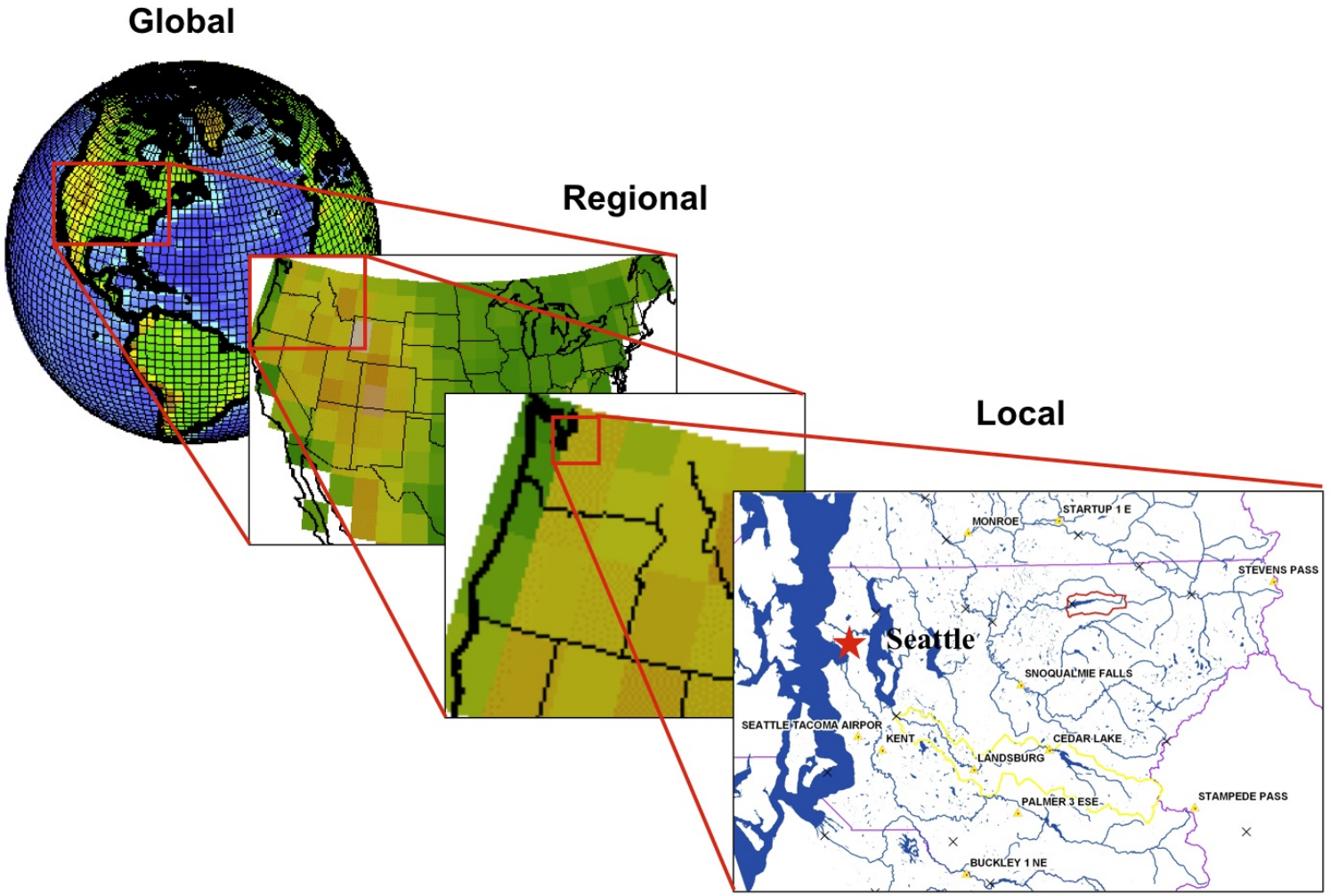


We need to simulate this action and any potential future changes

Regional-scale weather systems are often organized and controlled by larger-scale features that can be captured by Global Models

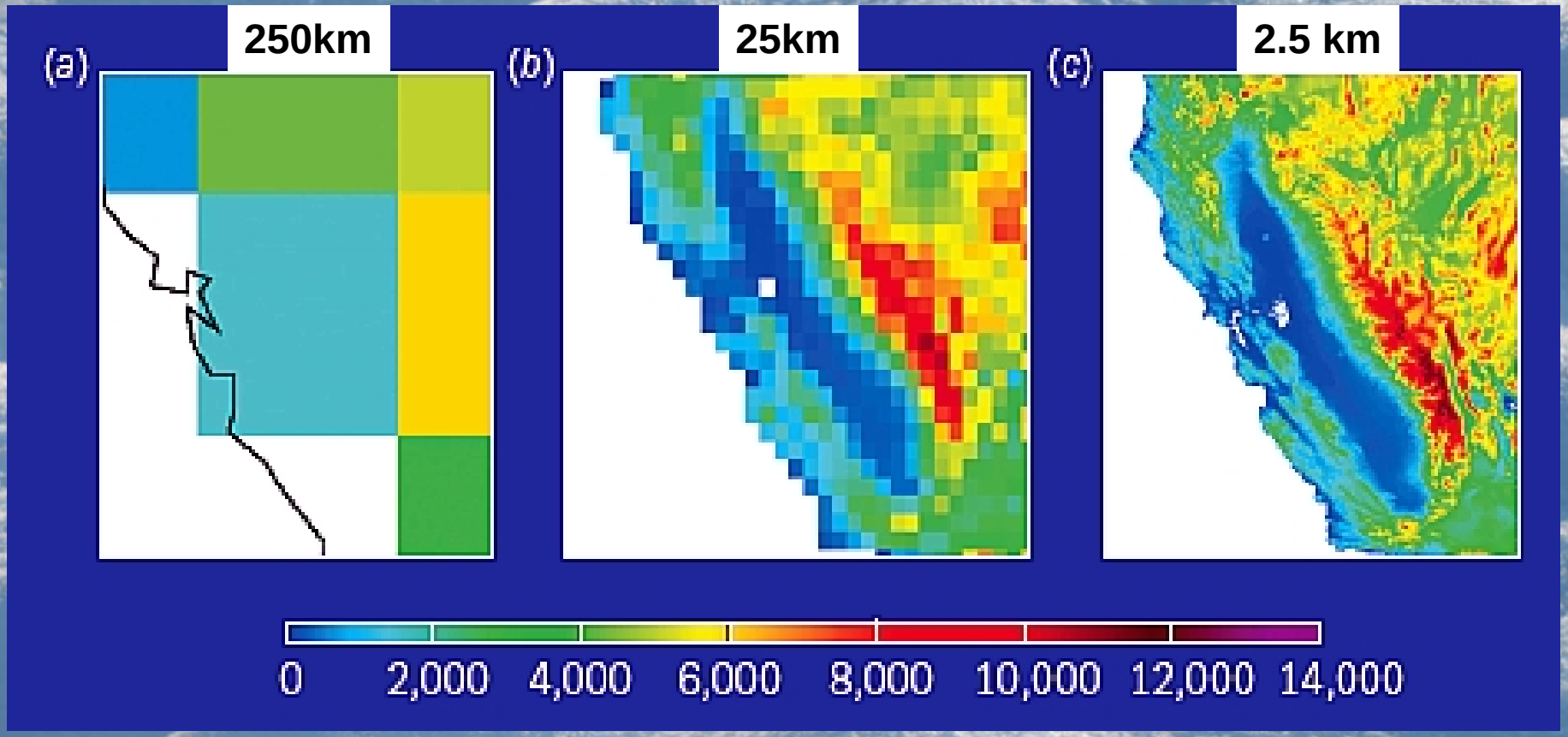


Such scale interactions mean downscaling of planetary scale phenomena to provide regional climate information is feasible



Surface-climate interactions are better captured in high resolution models

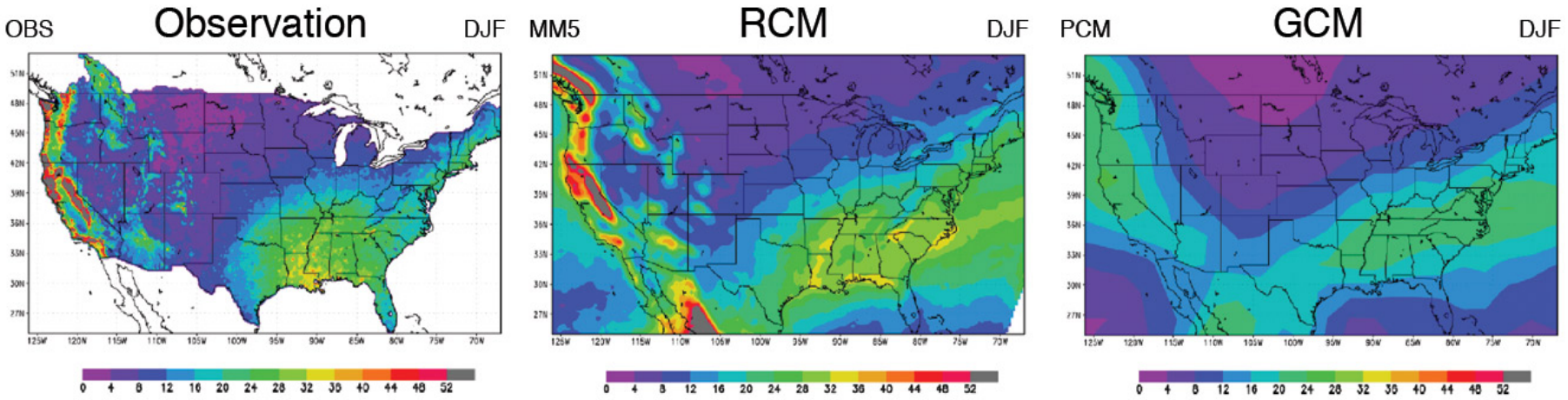
Surface Topography over California in climate models



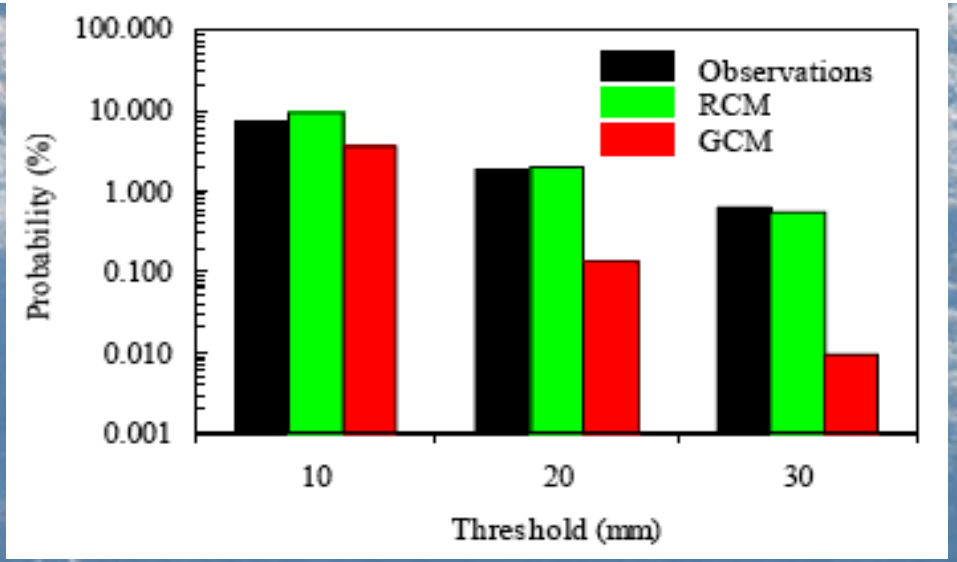
Increasing model resolution by a factor X implies an X^3 increase in computational cost: 2.5km model is ~1000000 more expensive than 250km

Seasonal Mean precipitation improved through dynamical downscaling

A Downscaling Example

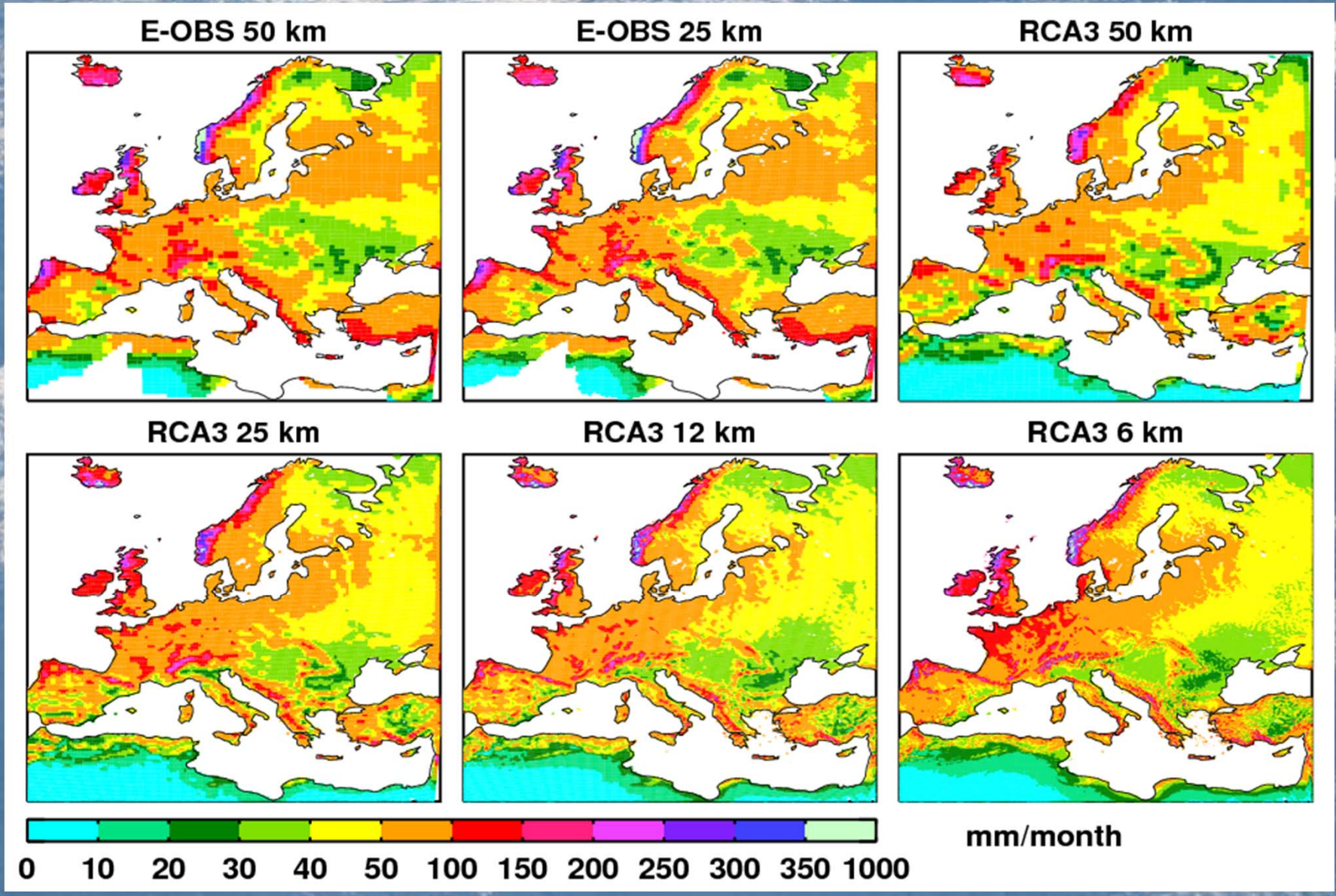


Occurrence of different precipitation thresholds over U.K. improved when a ~300km GCM is downscaled by 25km RCM

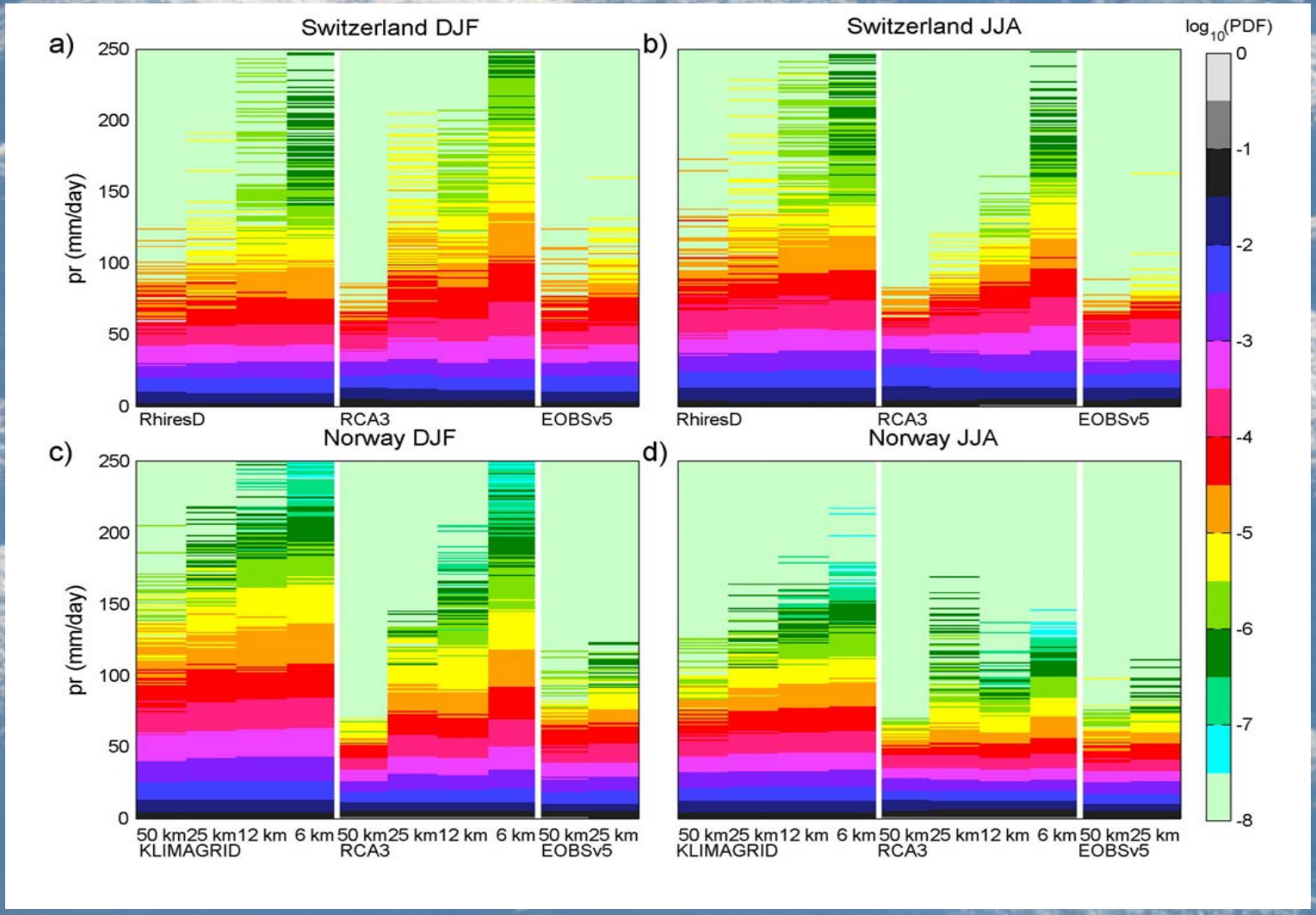


Evaluating benefits of higher RCM resolution for present day conditions

DJF Mean Precipitation 1987-2007 as a function of resolution

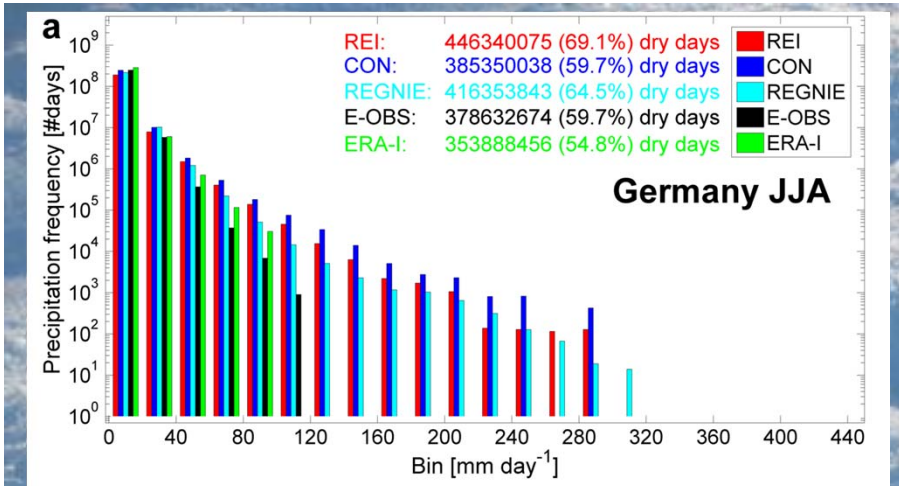


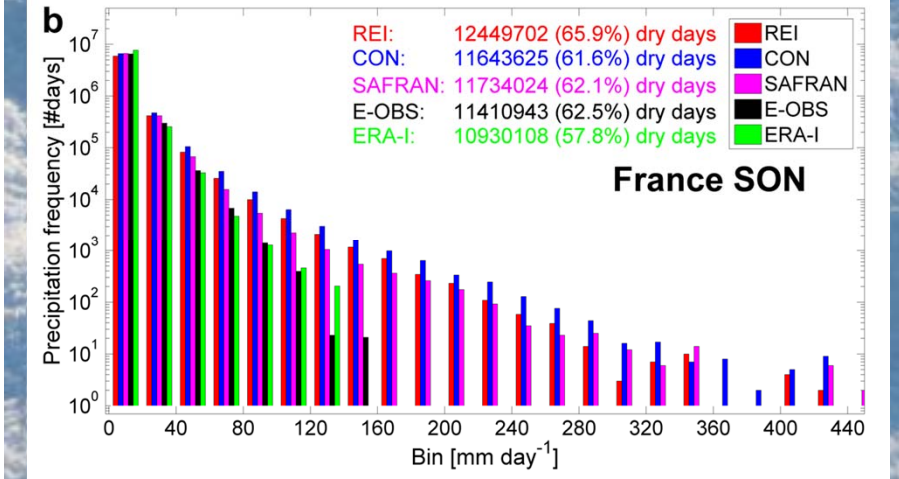
Assessing the benefits of increased model resolution on simulated daily precipitation intensity distributions

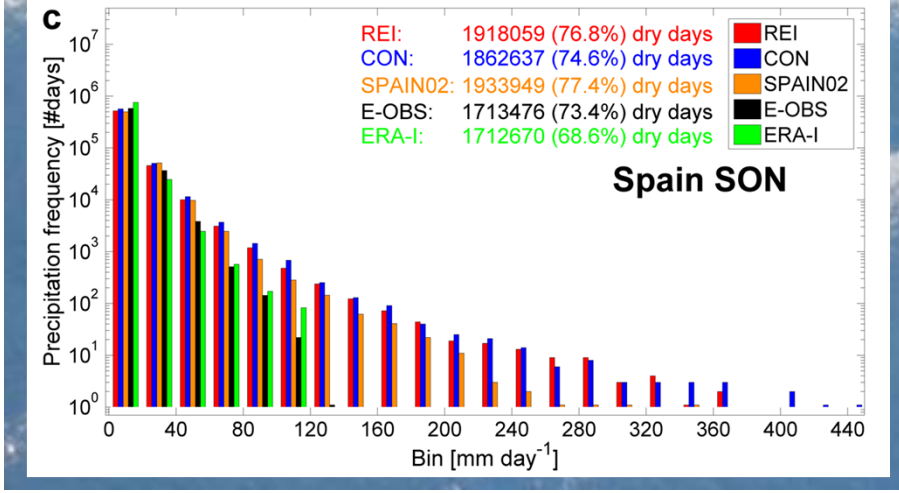


Spatial resolution of observations used for evaluation becomes important

Guettler et al 2012 in review







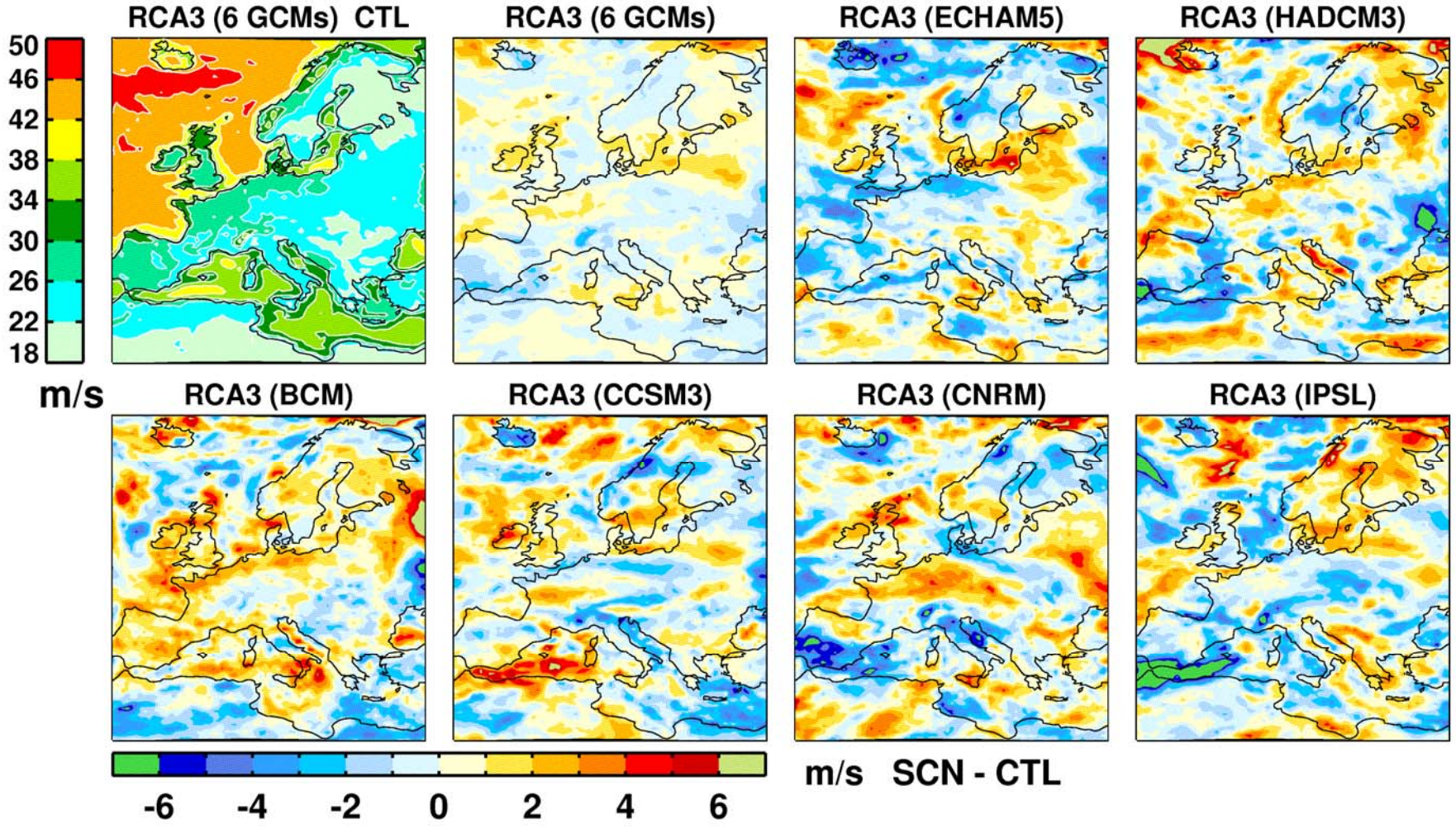
Frequency of daily rainfall intensity classes for 3 European regions when an RCM is forced by ERA-interim and run in continuous mode (CON) or reinitialized (REI) every 24 hours


Developing reliable estimates of future changes
in localized extreme climate events

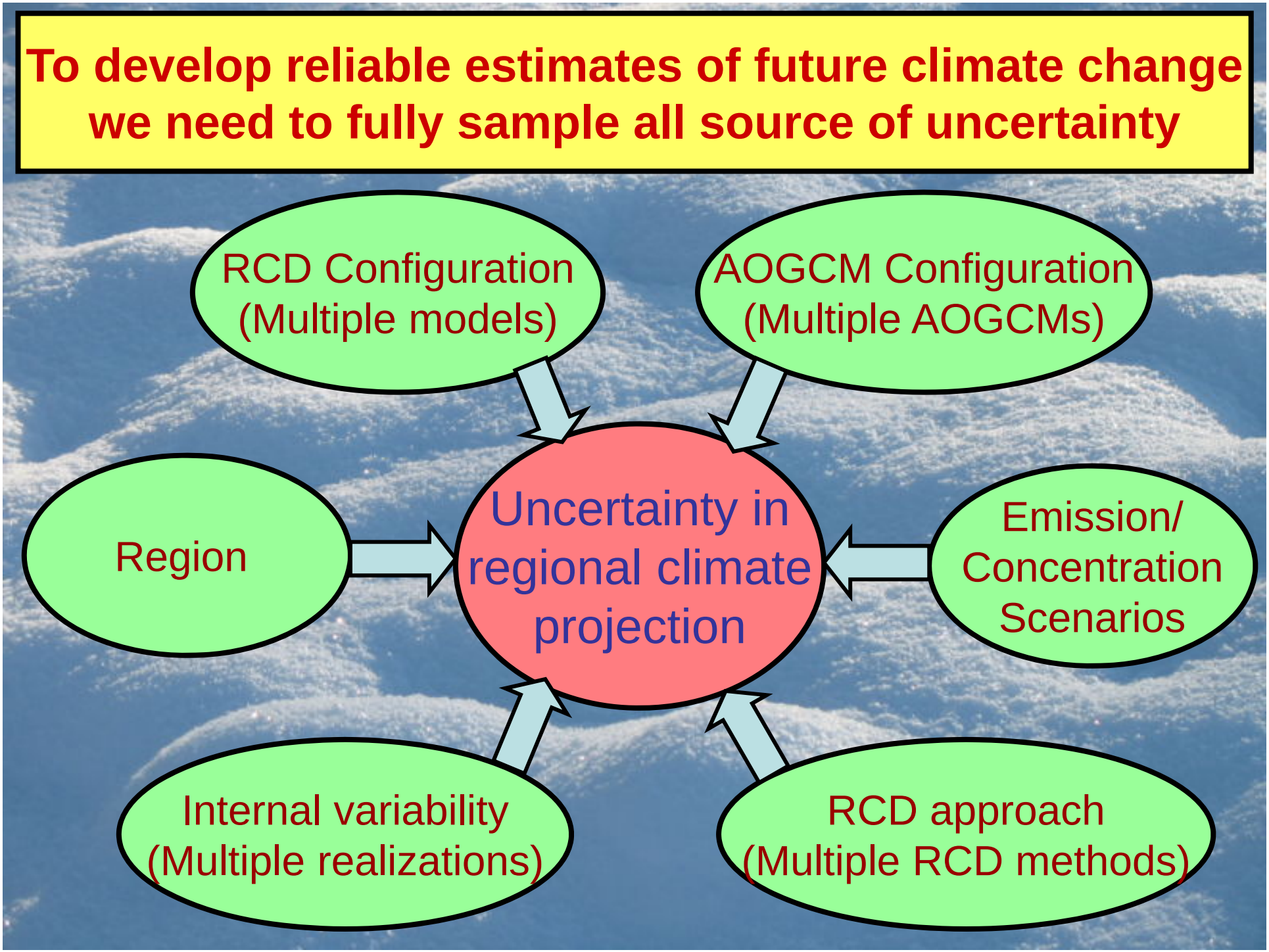
The level of uncertainty in climate change signals increases as the area of interest becomes smaller and variable assessed becomes more extreme/rare

50yr return values of maximum near surface windspeed

CTL: 1961-1990 SCN: 2071-2100



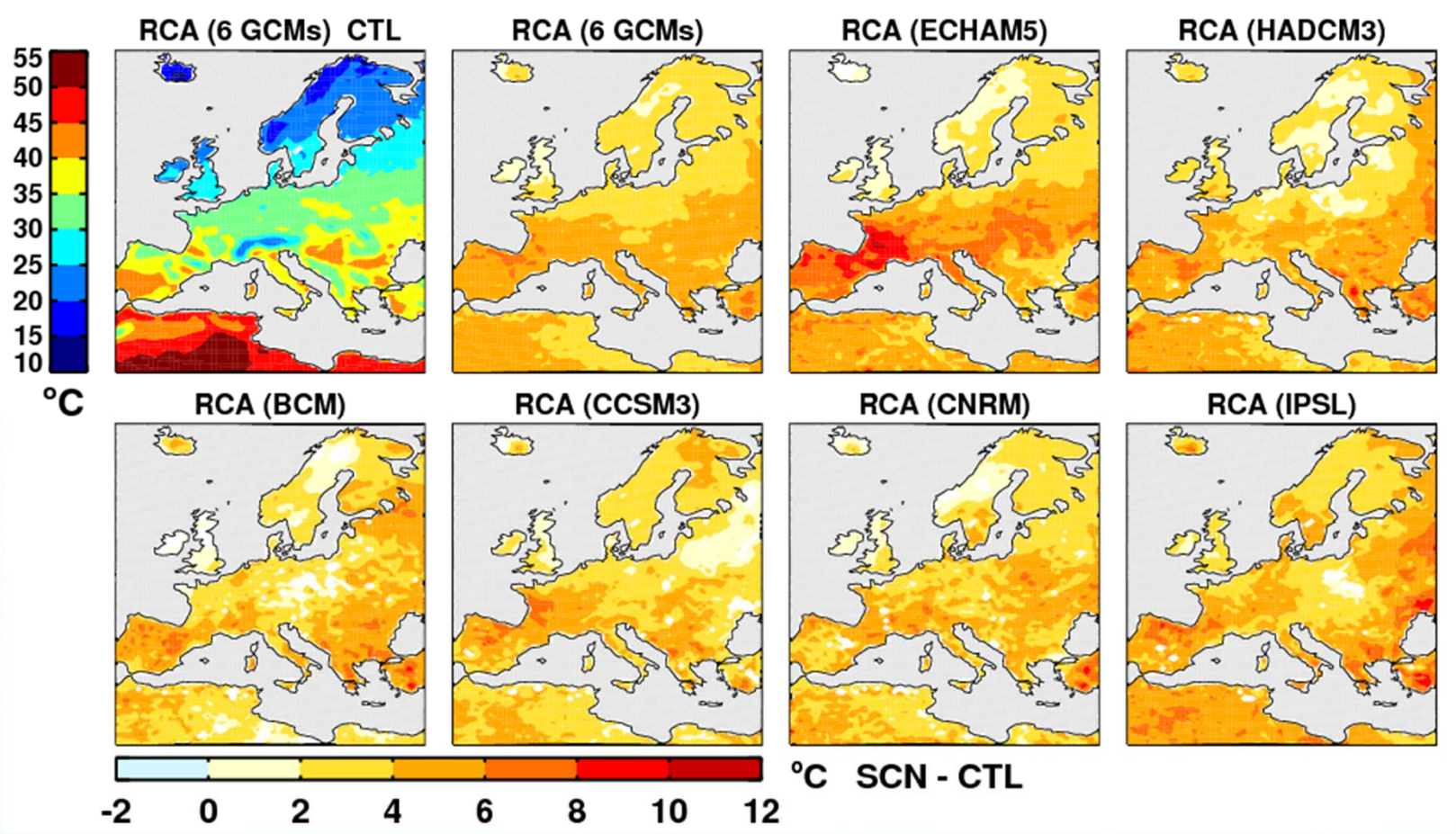
To develop reliable estimates of future climate change we need to fully sample all source of uncertainty



Fully sampling the different sources of uncertainty increases the reliability and robustness of detected future climate signals

20yr return value of near surface maximum daily temperature

CTL: 1961-1990 SCN: 2071-2100



All simulations show an intensification of warm extremes towards the end of the century with similar north-south gradients, of varying magnitude

CORDEX: Coordinated Regional Downscaling Experiment

An international project sponsored by the World Climate Research Progra

A community effort, to develop ensembles of high-resolution Regional Climate projections for 1950-2100,covering the majority of land-regions of the globe and sampling the main sources of uncertainty

Make this data freely available and useable to users, with common output and file/format structure at distributed European archives

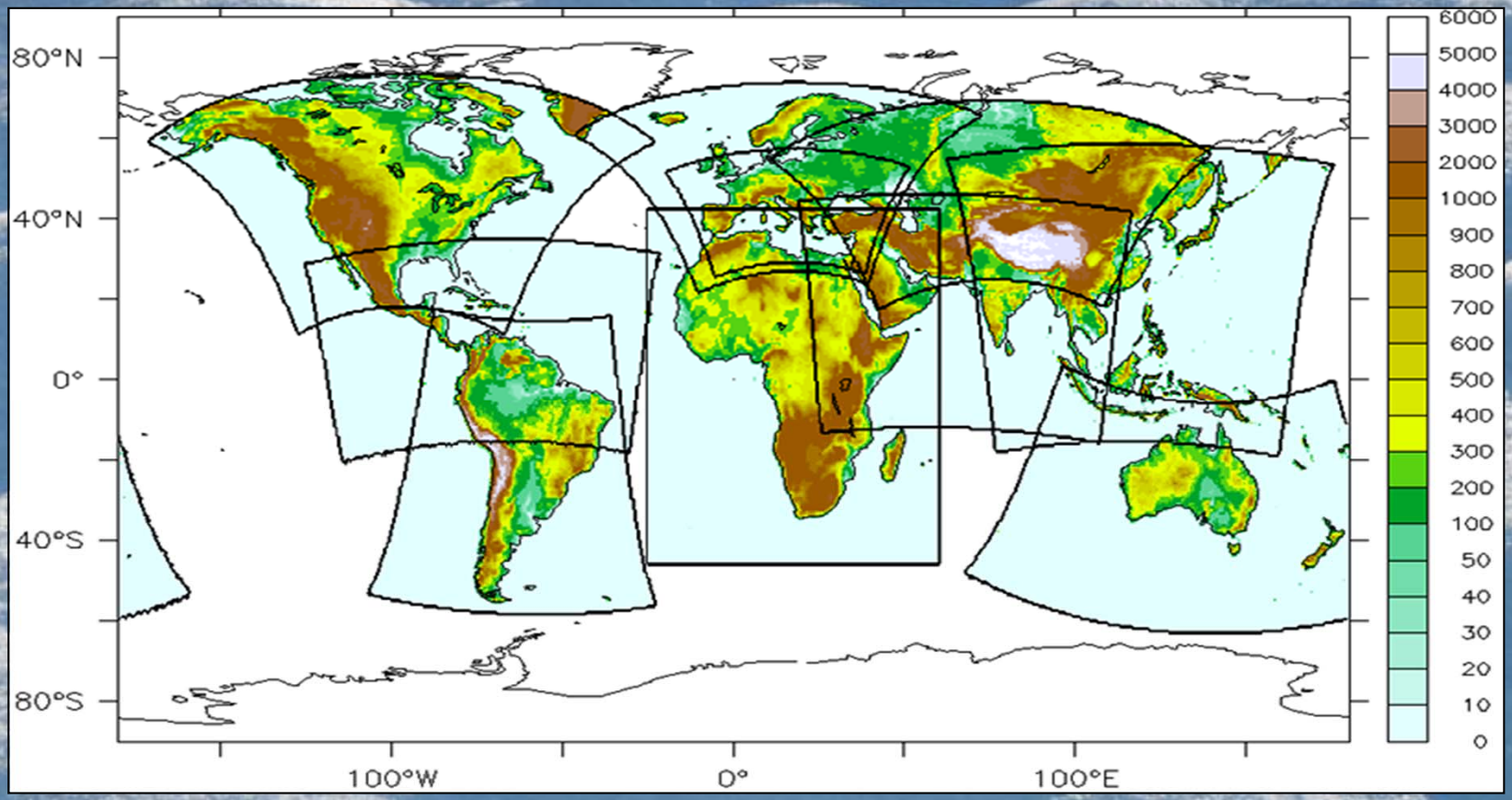
Provide a framework for testing Regional Climate Models and Downscaling techniques for the recent past and future scenarios.

Foster coordination between downscaling efforts around the world & encourage local participation in this process esp .developing nations

Downscaling is based on the most recent CMIP5 RCP GCM simulations

http://wcrp.ipsl.jussieu.fr/cordex/about.html

CORDEX domains (plus Arctic & Antarctica)

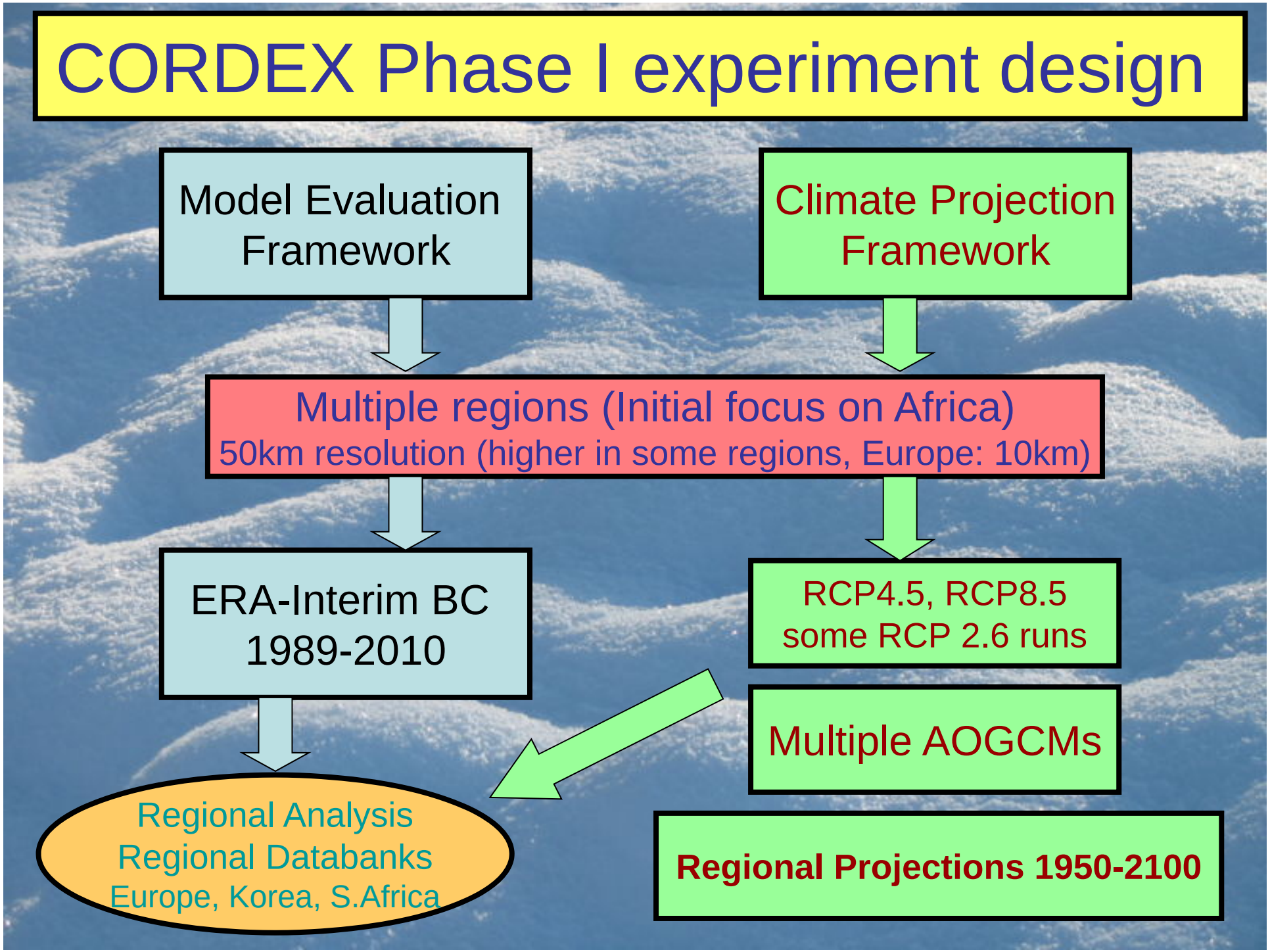


Euro-CORDEX (coordinator *CSC*, Hamburg) **builds on the EU Ensembles project**

8 European RCM groups coordinating downscaling of ~20 different CMIP5 GCM data sets spanning 1950-2100 and 3 different RCPs

Simulations at 50 & 12.5km resolution. Data openly available from ~May 2013

http://www.euro-cordex.net/


CORDEX Phase I experiment design
Model Evaluation Framework
Climate Projection Framework
Multiple regions (Initial focus on Africa)
50km resolution (higher in some regions, Europe: 10km)
ERA-Interim BC 1989-2010
RCP4.5, RCP8.5
some RCP 2.6 runs
Multiple AOGCMs
Regional Analysis
Regional Databanks
Europe, Korea, S.Africa
Regional Projections 1950-2100