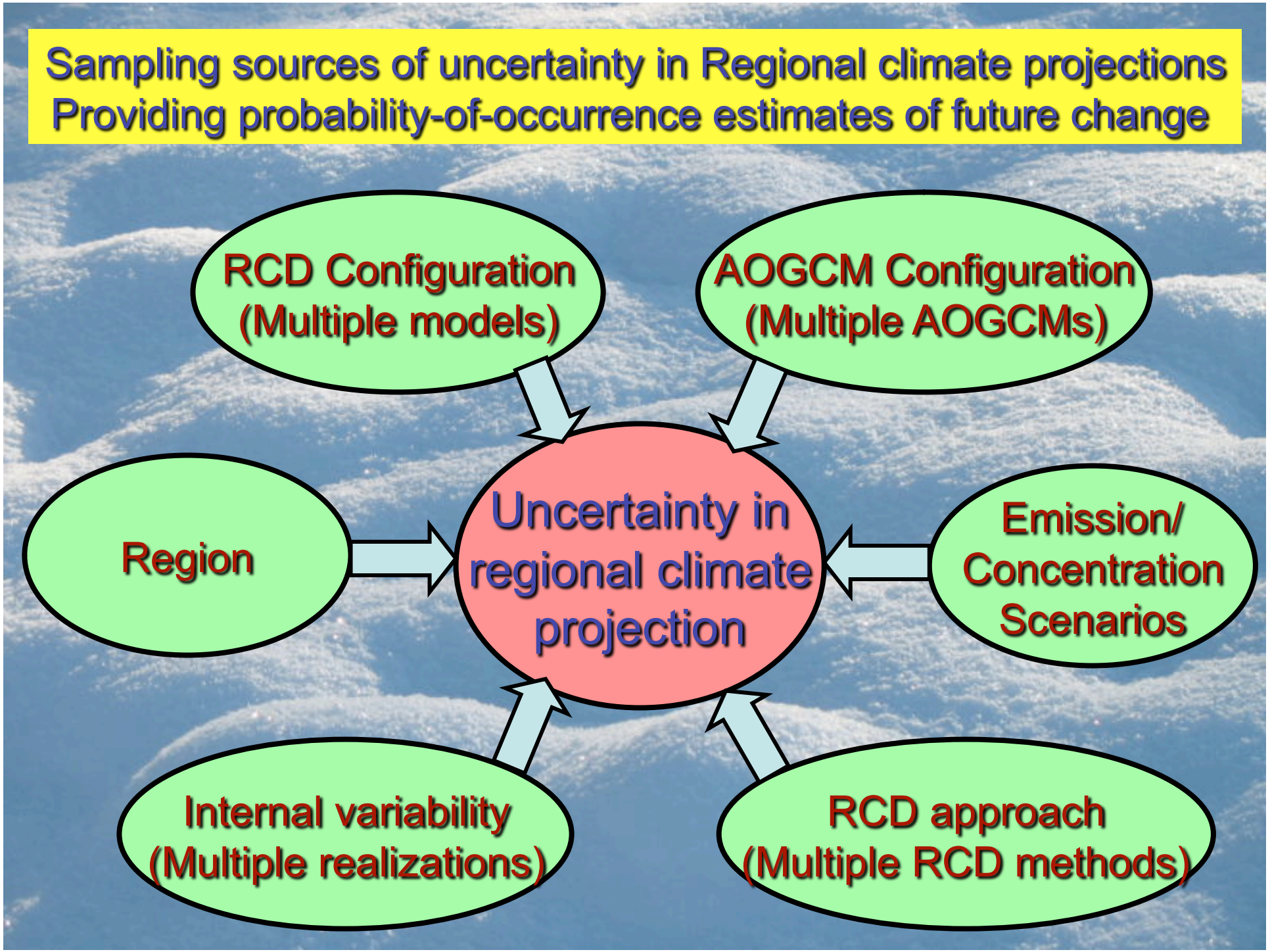
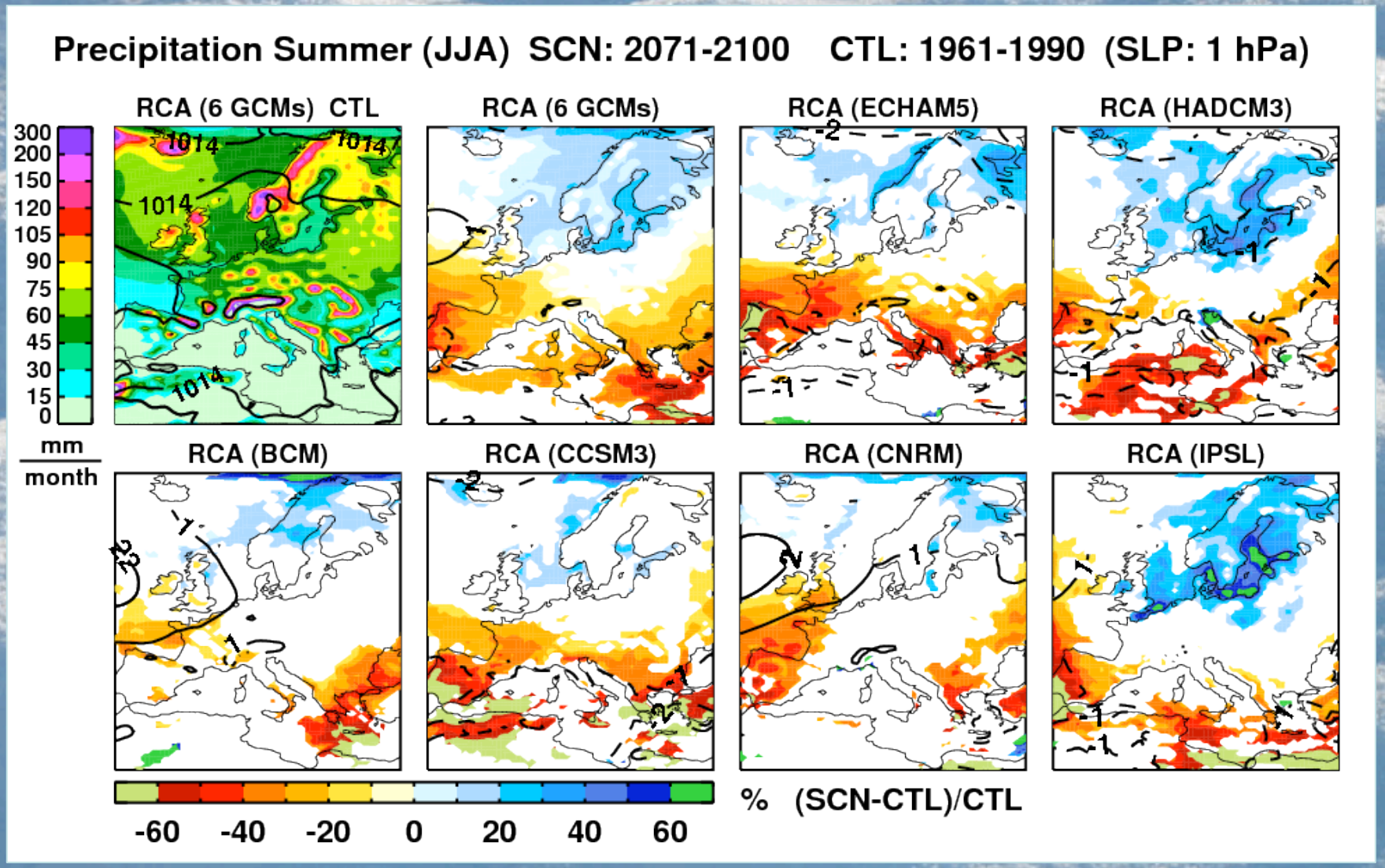
Future directions for modeling Regional Climate variability and change

Colin Jones
Rossby Centre, SMHI

With input from :Grigory Nikulin, Erik Kjellström (SMHI)
Andy Morse (U.Liverpool), Bruce Hewitson (UCT),
Filippo Giorgi (ICTP), Richard Jones (MOHC)
and Louis-Philippe Caron (MISU)


Sampling sources of uncertainty in Regional climate projections
Providing probability-of-occurrence estimates of future change
RCD Configuration
(Multiple models)
AOGCM Configuration
(Multiple AOGCMs)
Region
Uncertainty in
regional climate
projection
Emission/
Concentration
Scenarios
Internal variability
(Multiple realizations)
RCD approach
(Multiple RCD methods)

Finding Robust climate change signals



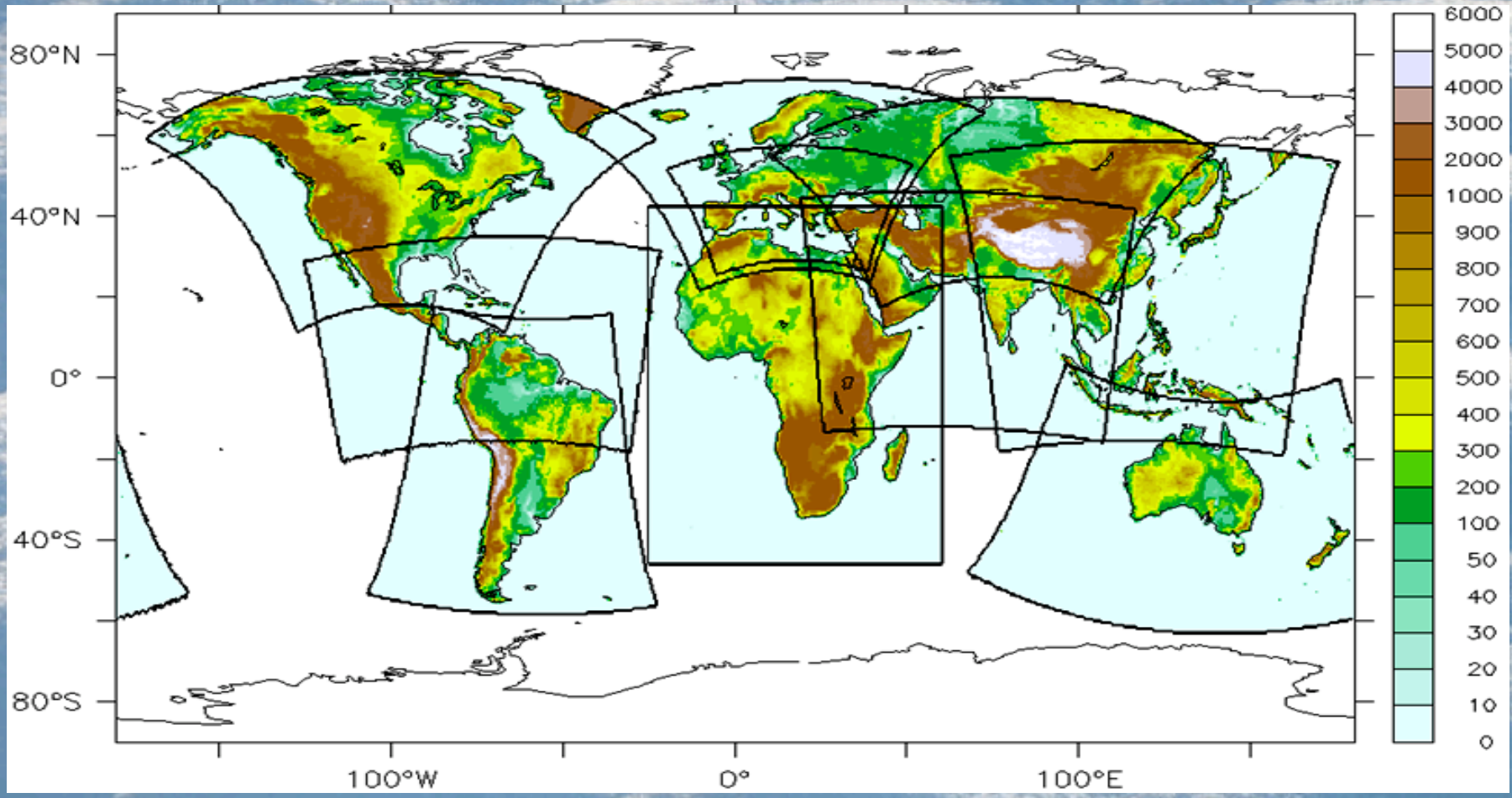
Downscaling numerous GCMs helps to identify robust future changes

Sampling and quantifying sources of uncertainty in regional climate projections

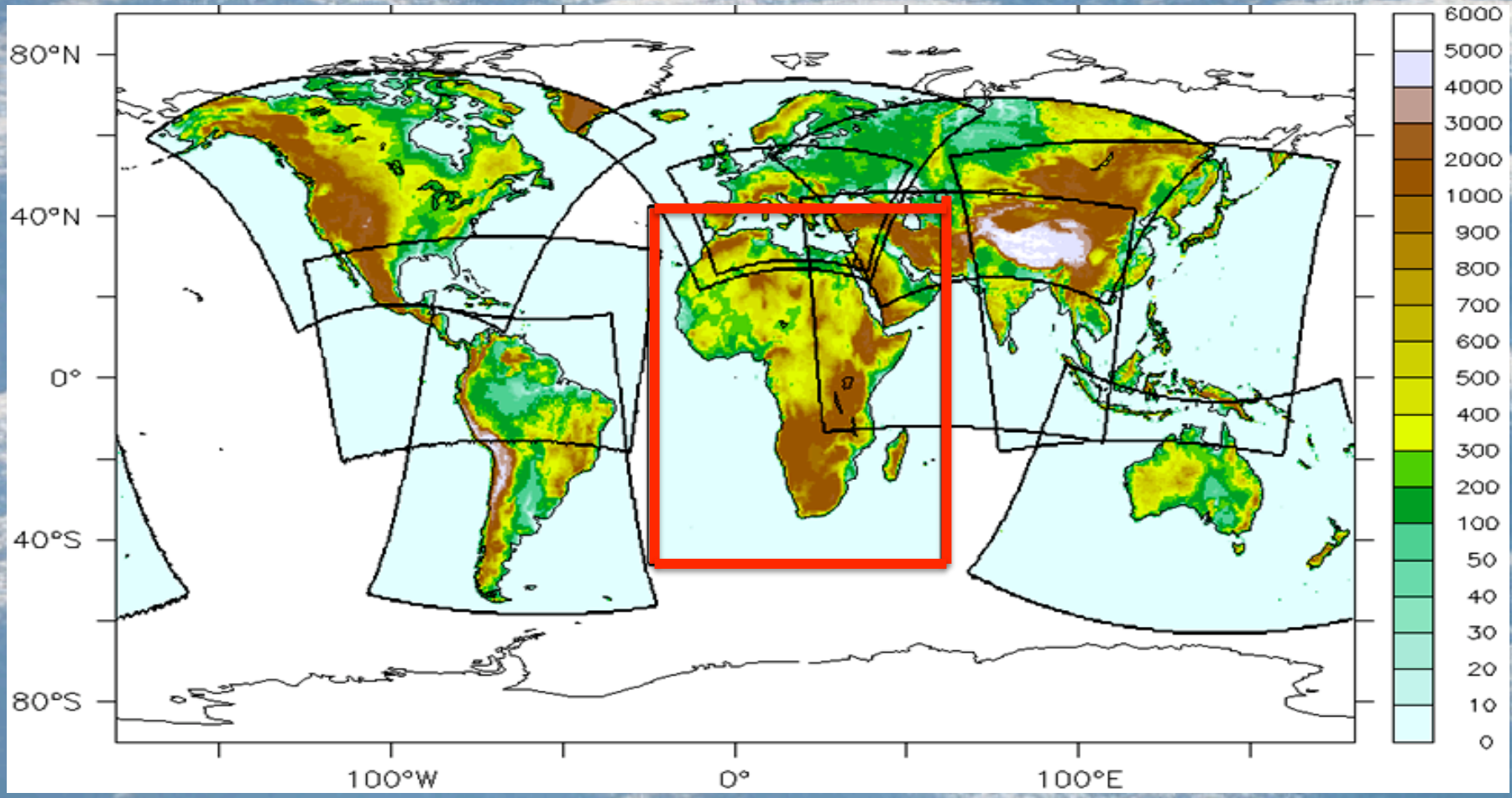
Expanding the lessons learned to all land regions of the world

The Coordinated Regional Downscaling Experiment: CORDEX

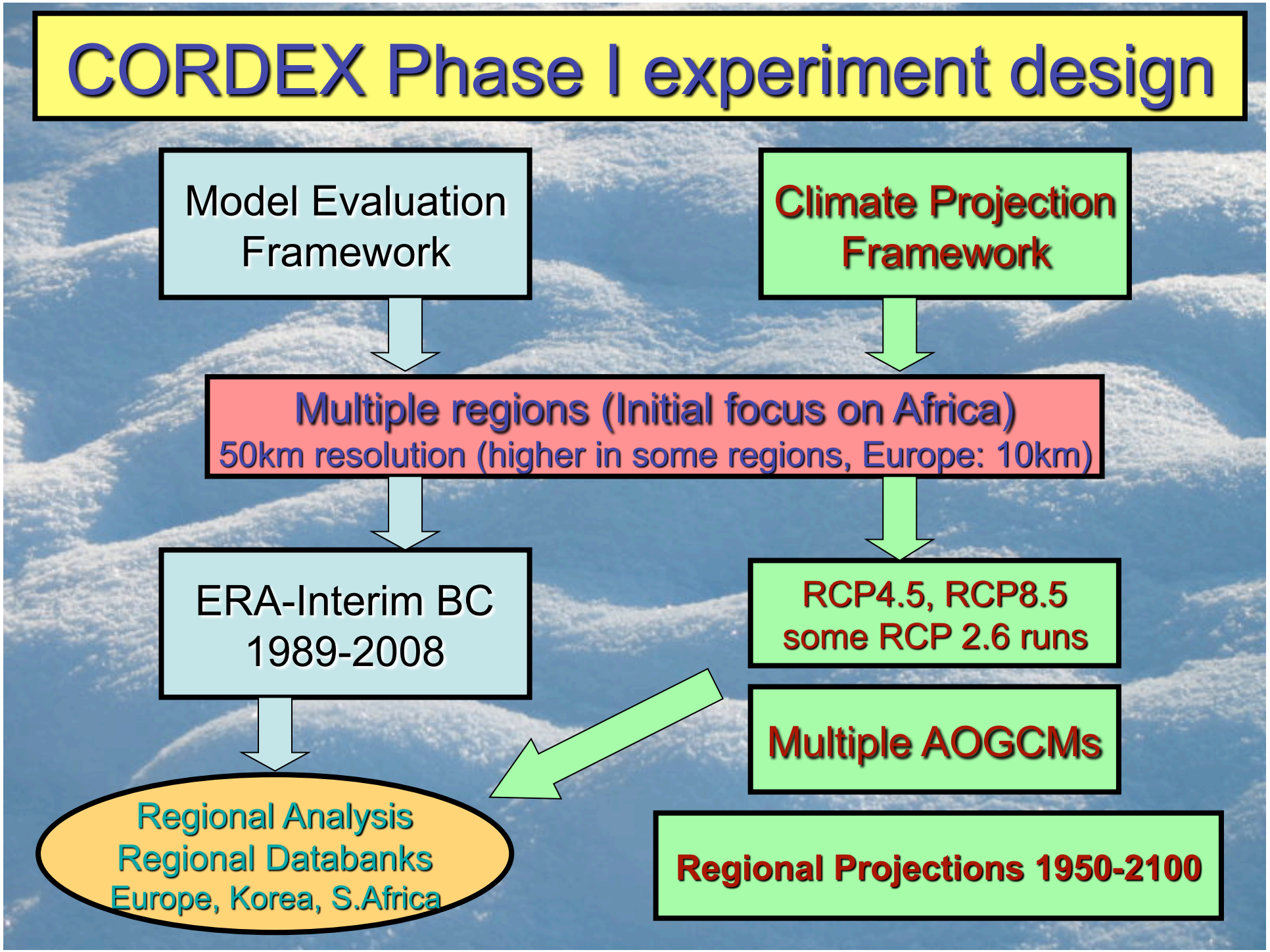
CORDEX DOMAINS (plus Arctic & Antarctica)



CORDEX DOMAINS (plus Arctic & Antarctica)

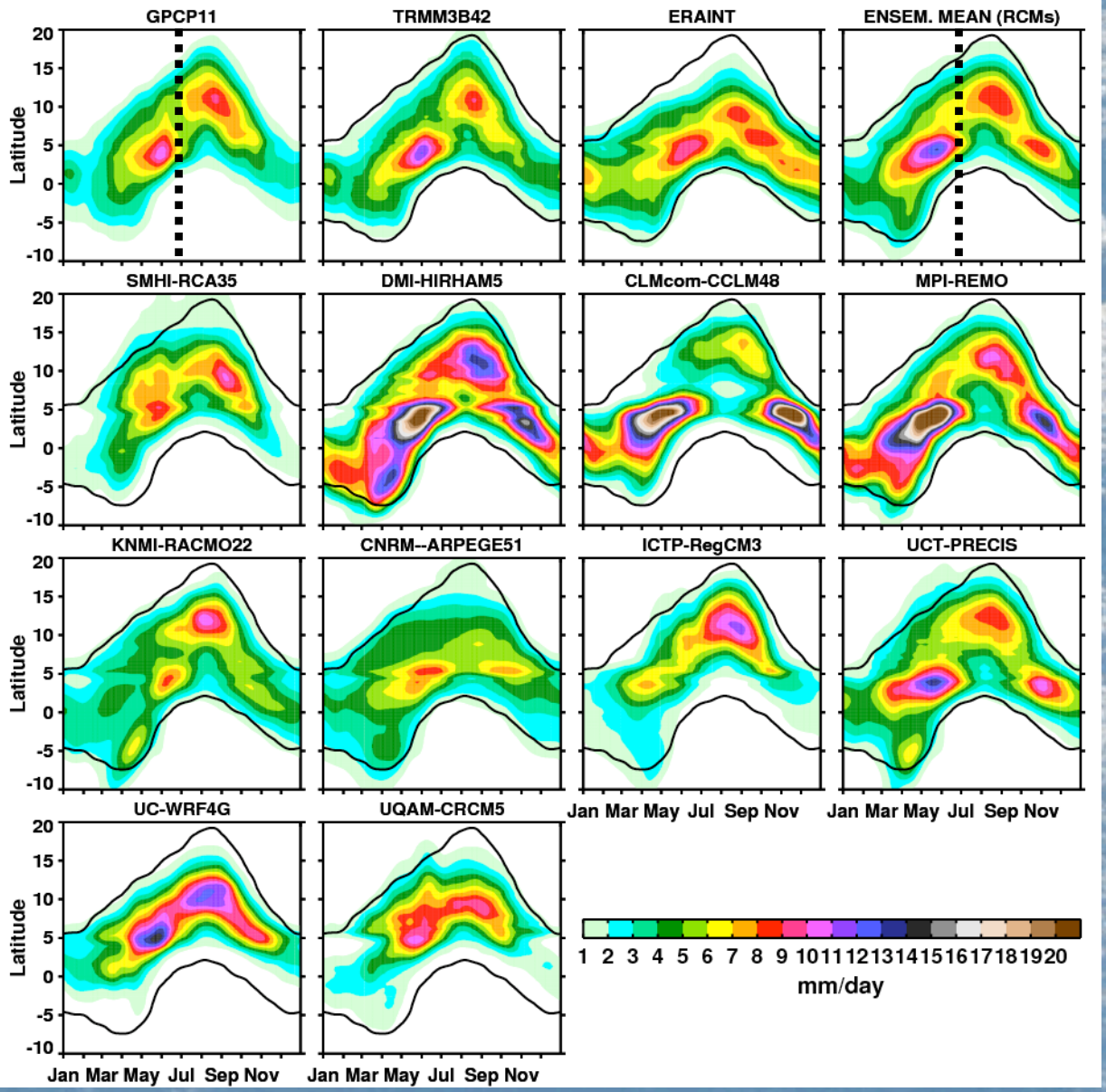


A strong coordinated international effort is presently occurring to generate a suitable matrix of RCM projections for Africa


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 1989-2008
RCP4.5, RCP8.5
some RCP 2.6 runs
Multiple AOGCMs
Regional Analysis
Regional Databanks
Europe, Korea, S.Africa
Regional Projections 1950-2100

Latitudinal progression of the West African Monsoon

Monthly mean precipitation averaged between 10W-10E



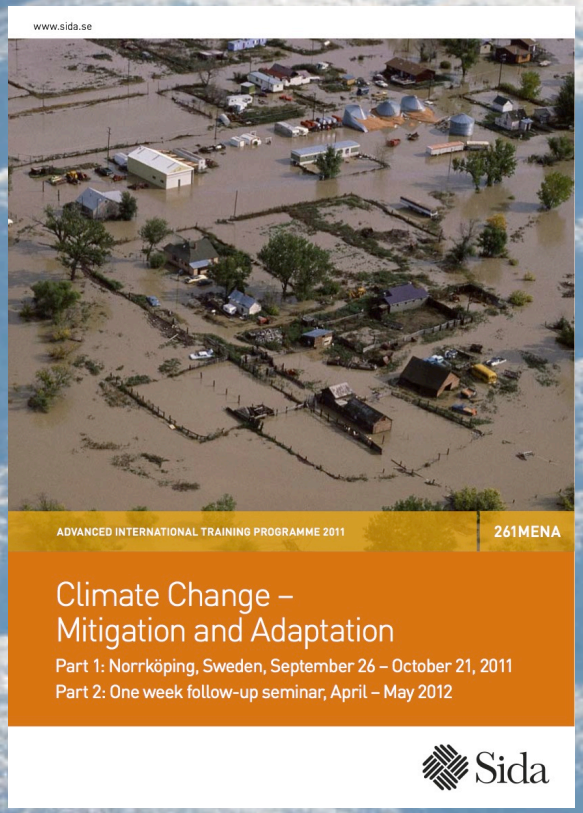
CORDEX aims to:

Develop matrices of regional climate projections for land regions of the world at 50km resolution (or better), sampling the main sources of uncertainty (GCM, RCM, SD, RCP, land-use)

Ensure this data is made available for use by scientists in all regions of the world in order to:

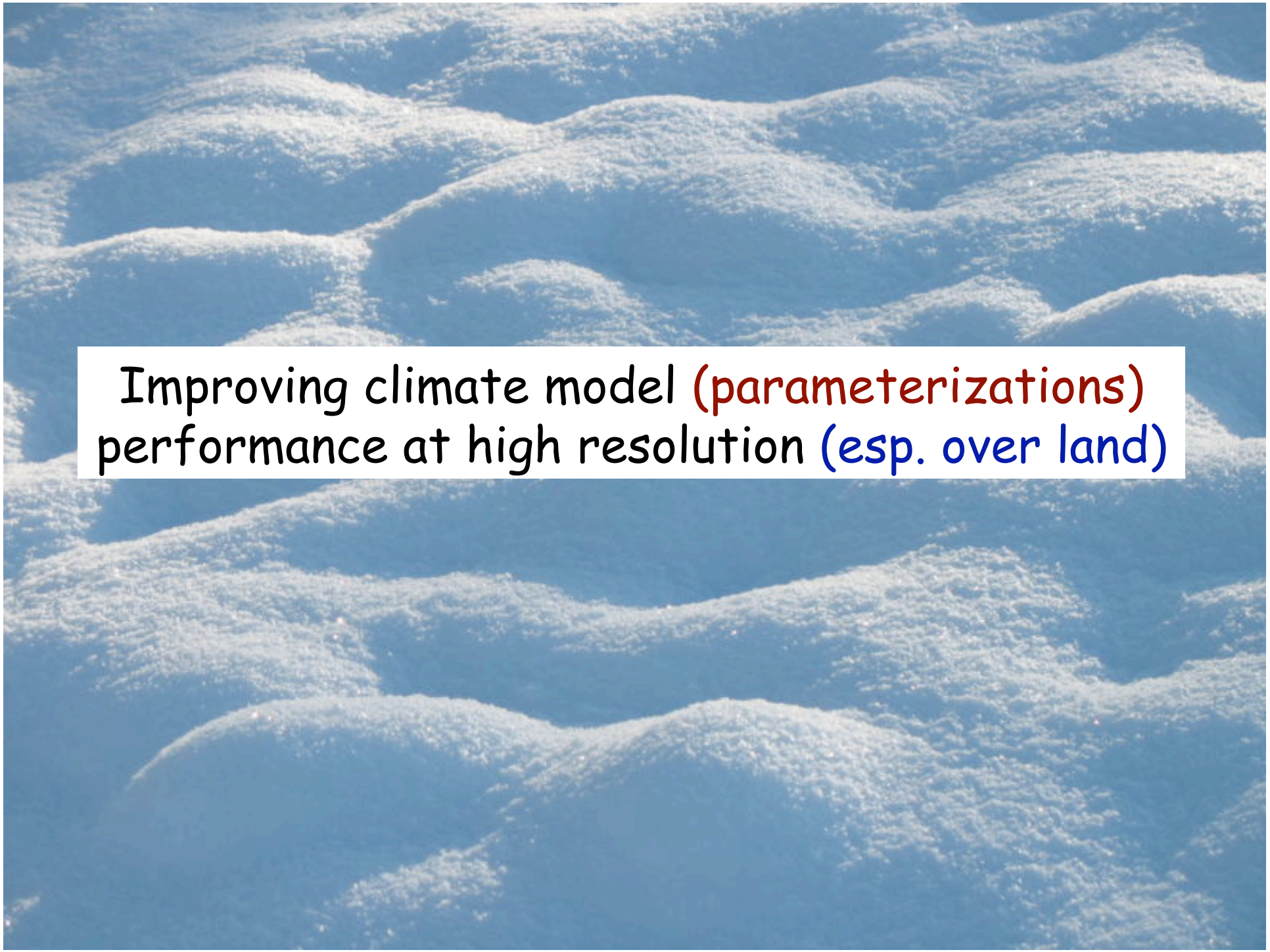
- Contribute to training in/of climate science/ists in all regions
- Engage regional expertise in the evaluation (and production) of regional climate simulations
- Provide data to support local and international expertise in the development of regional climate impact assessments
- Contribute to the development of a local (science) voice to aid in local policy decision-making

Increasing the critical mass of regional climate science expertise



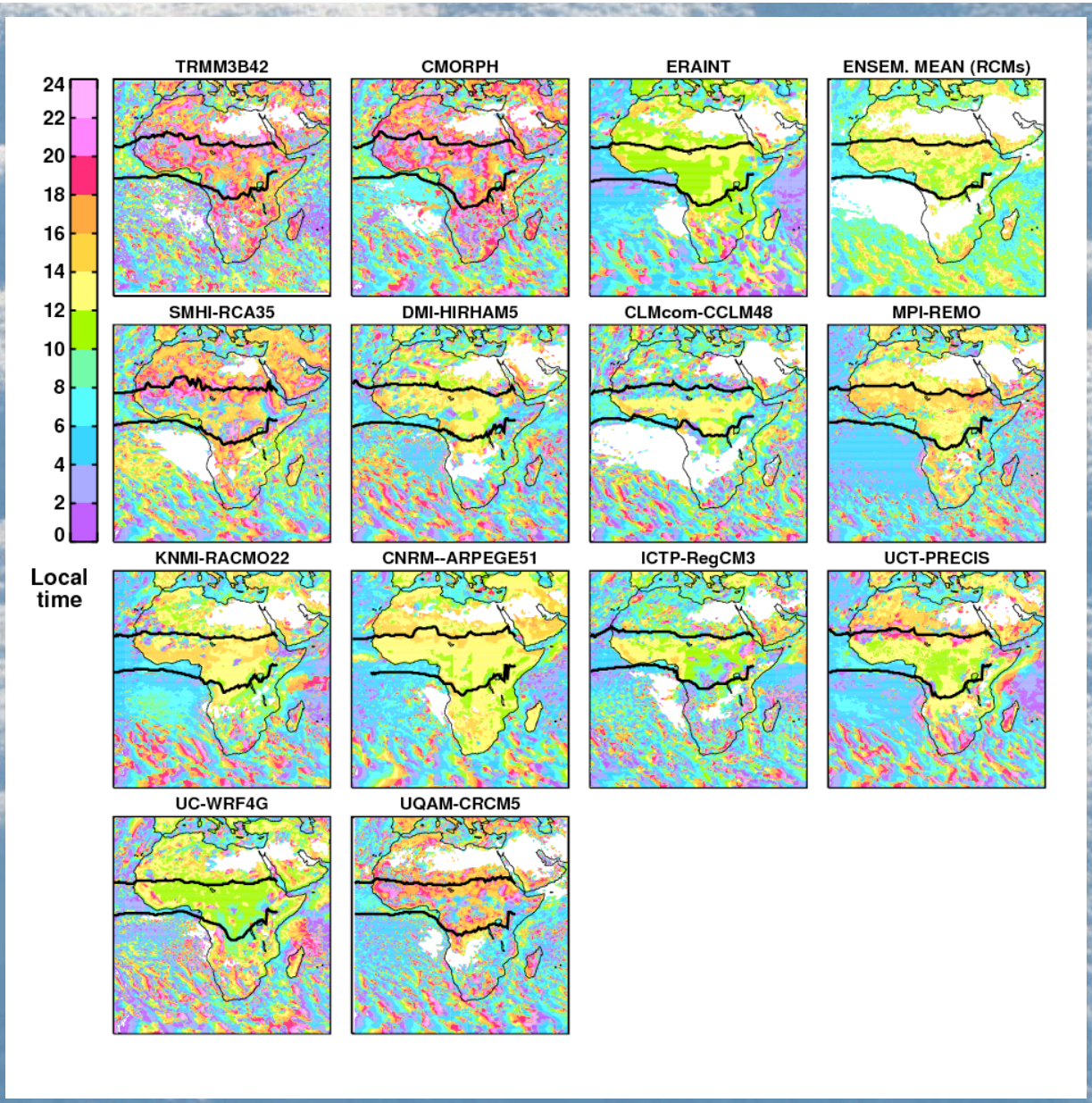
START & WCRP coordinate the Africa-CORDEX evaluation team, led by U. Cape Town, consisting of 30 African scientists leading the evaluation & use of CORDEX simulations in Africa.

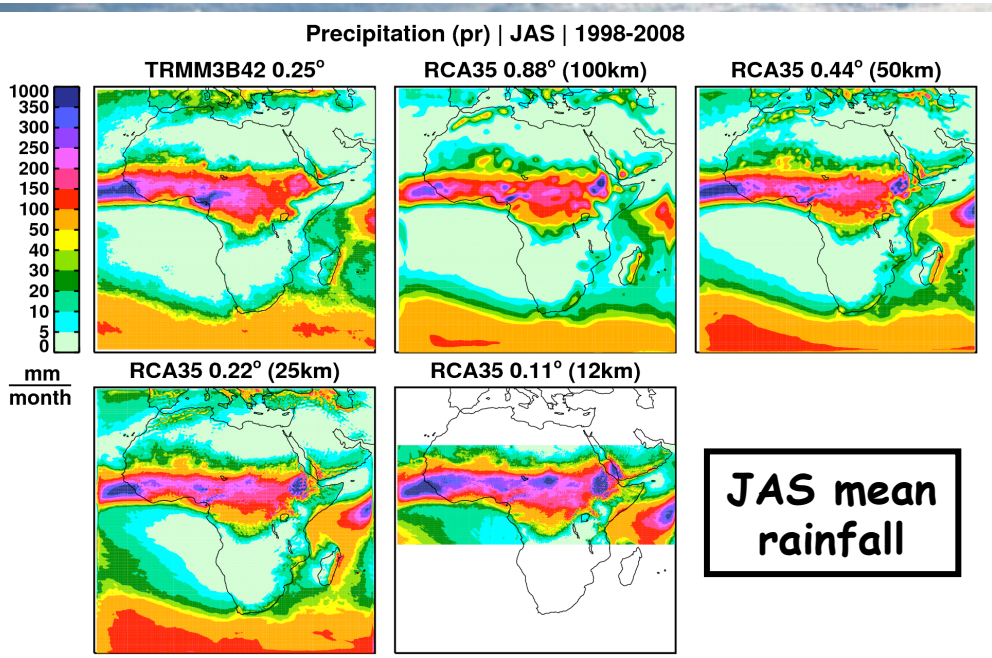
Similar efforts now being discussed for South Asia and South East Asia


Improving climate model (parameterizations)
performance at high resolution (esp. over land)

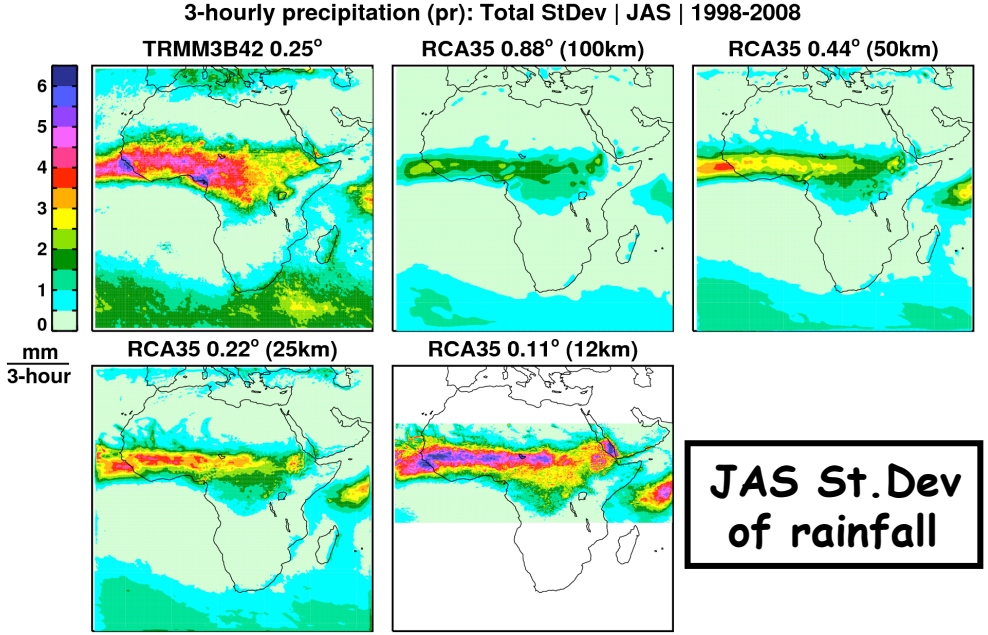
Land-convection problems in CORDEX RCMs

Local Time of maximum rain rate during the day: JAS





JAS mean rainfall

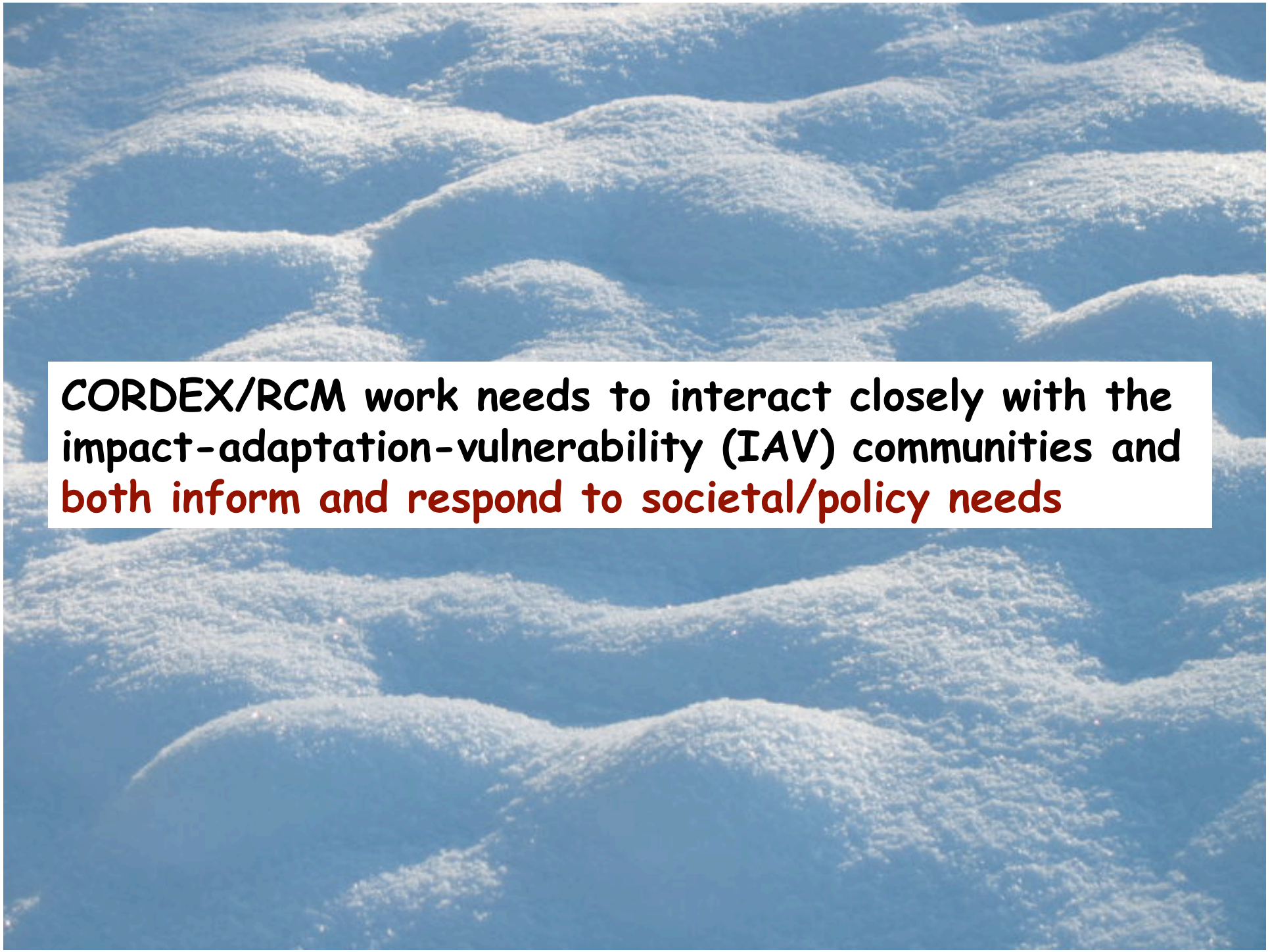


JAS St.Dev of rainfall

With increasing model resolution seasonal mean rainfall is unchanged

Higher time frequency rainfall that makes up the seasonal mean changes (improves) dramatically.

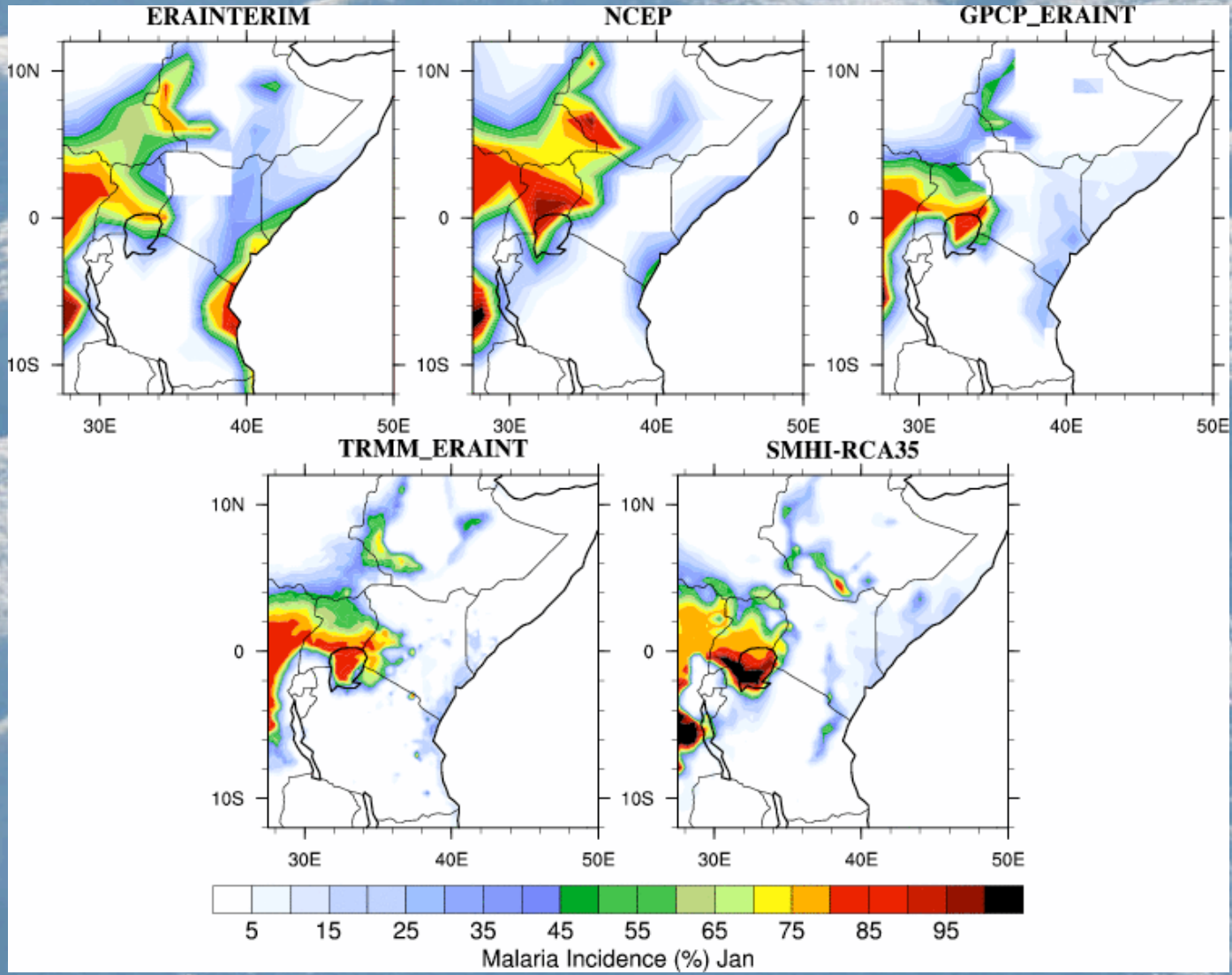
Important for impact studies


CORDEX/RCM work needs to interact closely with the impact-adaptation-vulnerability (IAV) communities and both inform and respond to societal/policy needs

Linking Africa-CORDEX simulations with impact models

The Univ Liverpool Dynamic Malaria Model applied to East Africa

Simulated Seasonal Cycle of malaria incidence

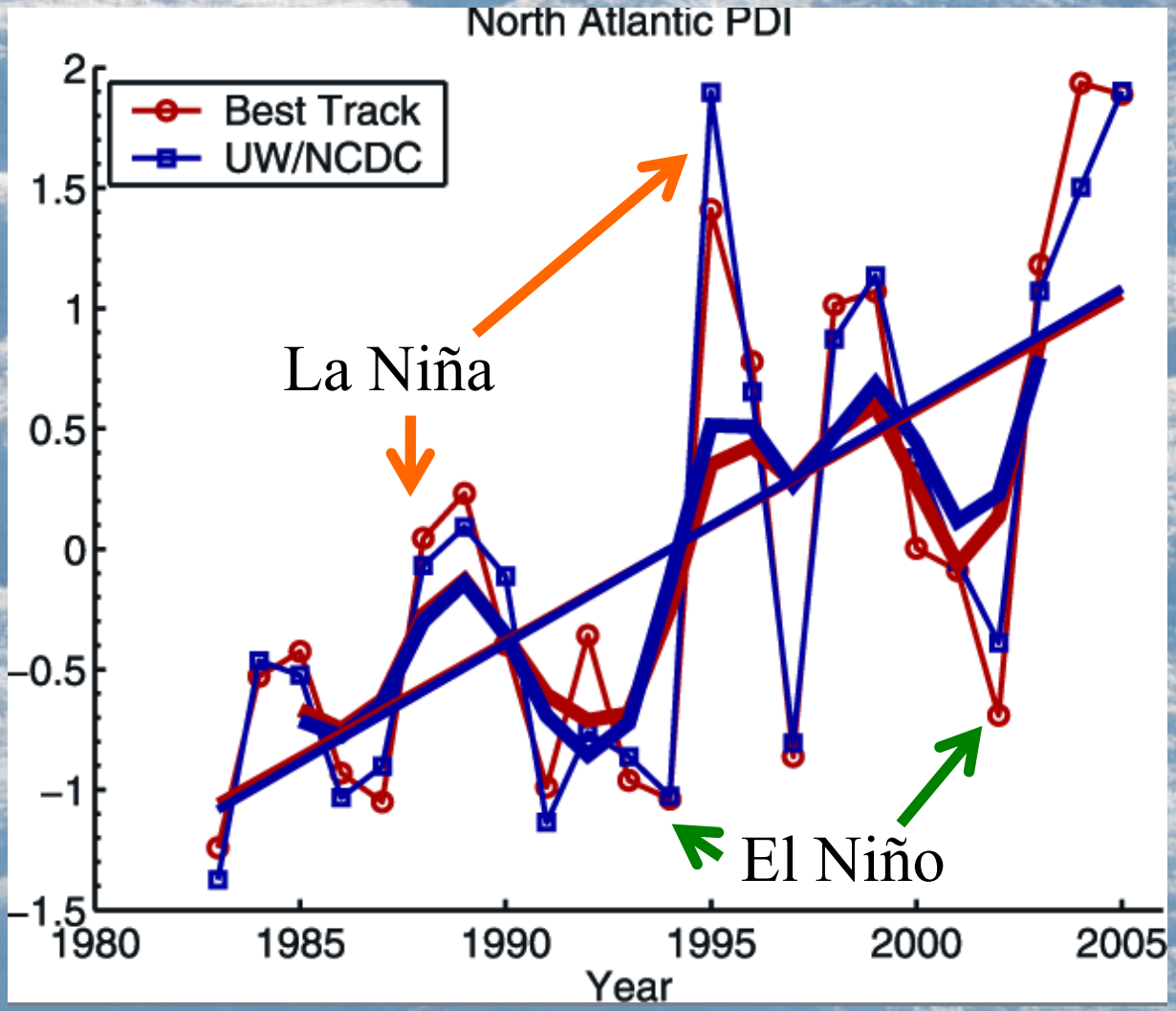


Future areas for coordinated efforts in dynamical downscaling?

Seasonal to interannual prediction

in regions with GCM large-scale forecast skill

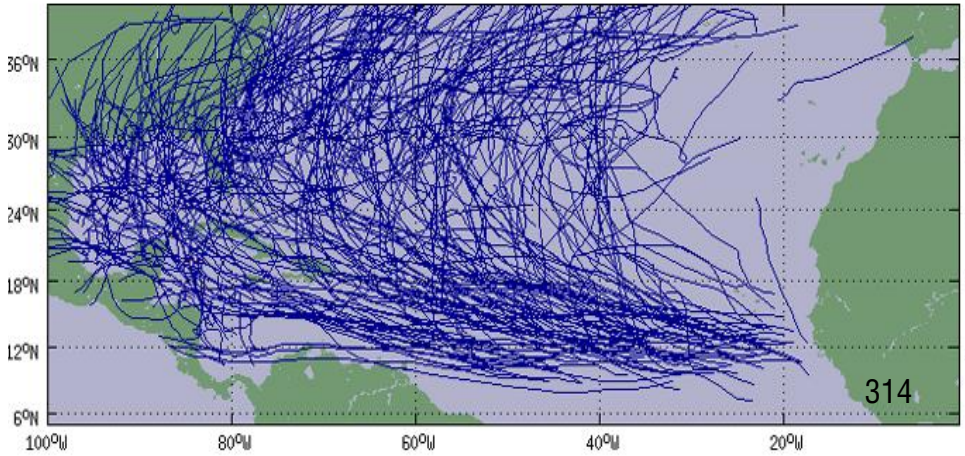
Recent observed trends in Atlantic Tropical Cyclones



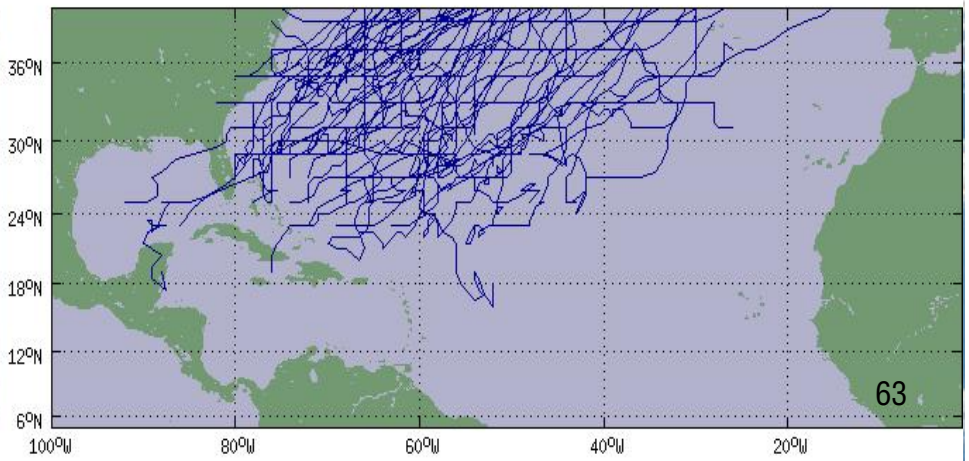
Potential Seasonal and interannual (Smith et al. 2010 + B1: yesterday) predictable component to Atlantic Tropical Cyclone activity

High Resolution helps in simulating Tropical Cyclones

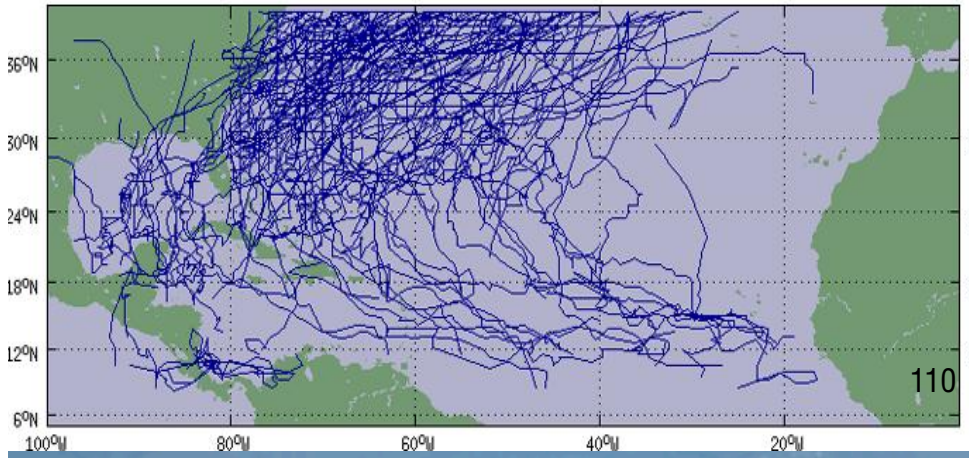
Observations



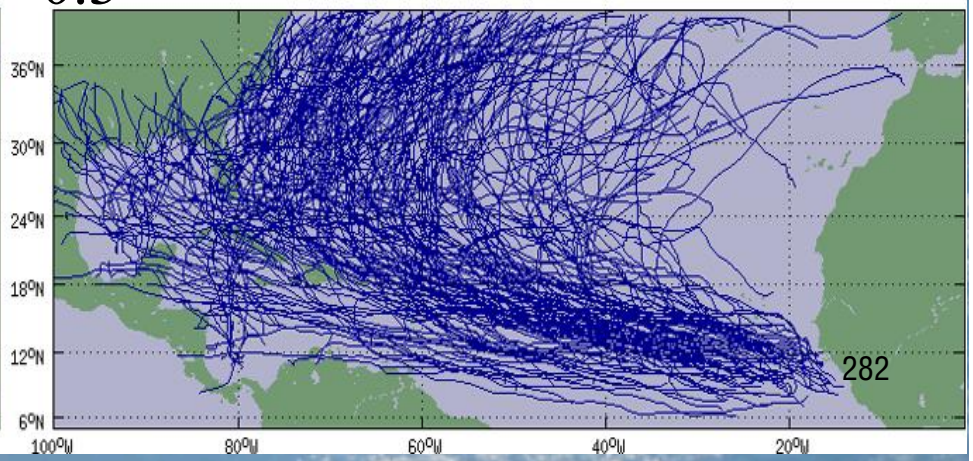
2°



1°



0.3°



Limited-Area version of GEM at 0.3° downscaling Global GEM at 2°