

The background of the slide is an aerial photograph of a mountain range. The mountains are covered in dense green forest, and the valleys between them are also filled with trees. The lighting suggests a bright day, with some shadows cast across the ridges.

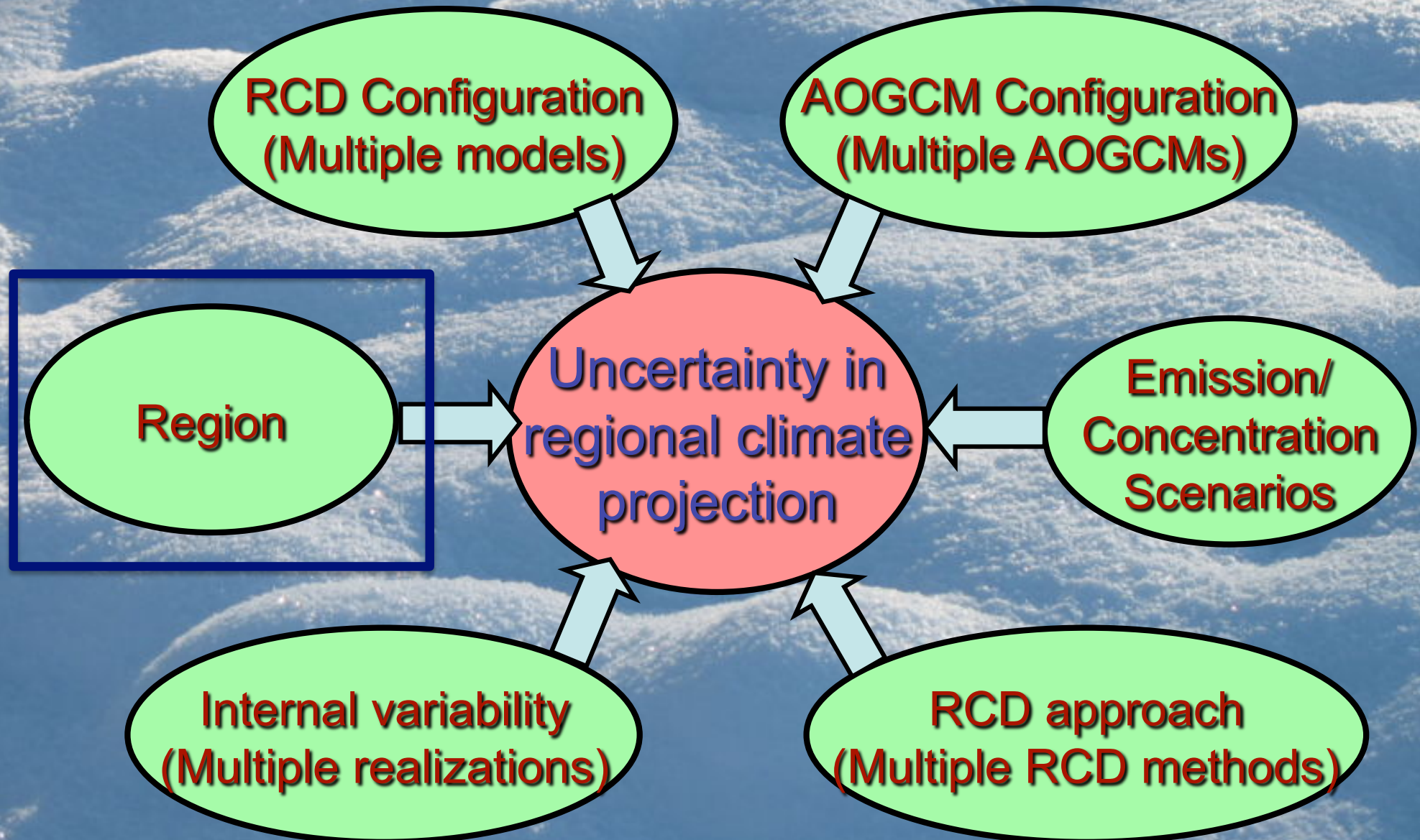
CORDEX

Recent Progress

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Thanks to: Grigory Nikulin (SMHI), Andy Morse (ULiv), Sandro Calamnati (ENEA), Duane Waliser & Jiwon Kwon (JPL), Chris Lennard (UCT), Ole Christensen (DMI), Martin Juckes (STFC), Richard Jones (MOHC) and CORDEX modeling groups

Sampling the sources of uncertainty in RCD-based Regional climate projections



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

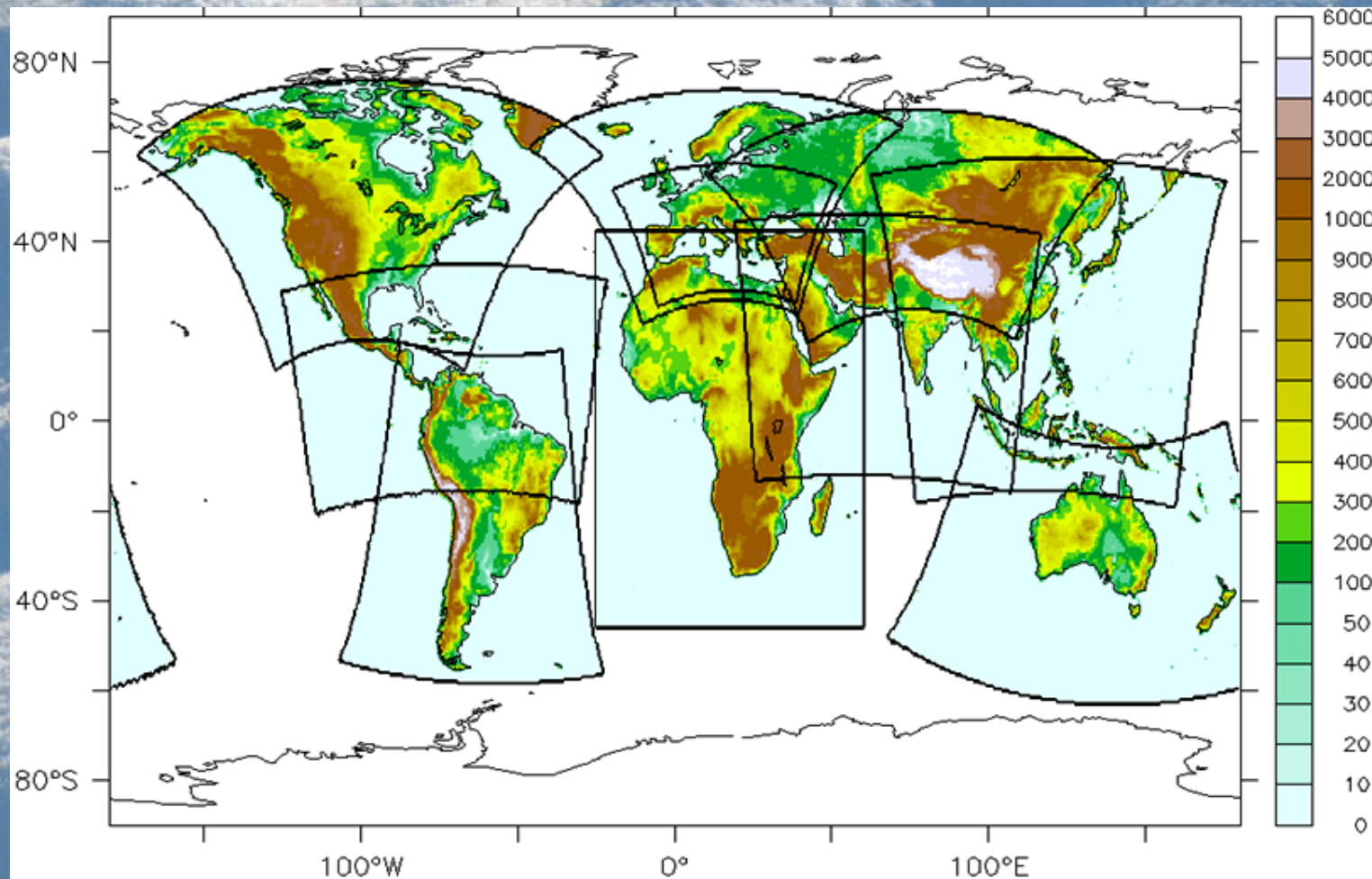
RCP4.5, RCP8.5

Multiple AOGCMs

Regional Analysis
Regional Databanks

Projections 1951-2100 + timeslices
Decadal hindcasts & predictions

CORDEX DOMAINS (plus Arctic & Antarctica)



- 12 domains with a resolution of 0.44° (approx. $50 \times 50 \text{ km}^2$)
- Focus on Africa
- High resolution $\sim 0.11^\circ \times 0.11^\circ$ for Europe (by some institutions)

The TFRCD mandate was extended by 1 year @JSC Feb 11 until end 2011

The TF will be replaced by a permanent WCRP Panel WGRCSI:
WG on Regional Climate Science and Information

Construction/mandate of WGRCSI was developed in a white Paper led by Greg Flato (JSC), with input from JSC members and the TF co-chairs

WGRSCI should cover : Regional climate modeling and projections. Linking to GCM activities in one direction and climate change impacts and adaptation in the other. Panel should be transdisciplinary with modelers, stat. downscalers, impact modelers, adaptation/vulnerability scientists. It should have suitable geographical coverage in terms of membership.

The new WG was announced at the WMO Assembly in May 2011 by JSC chair (I think!)

We hope a WG and mandate for this WG will be drafted at the next JSC So it can begin. Post 2011 CORDEX will not have a formal WCRP home

Pan-CORDEX conference was held in Trieste March 2011

An Africa-CORDEX diagnostics/training panel now formed and had a first training workshop in Trieste for 30 African scientists where they were given output from 10 RCM (ERA-int) runs 1989-2008, and given guidance in the analysis of these simulations (for their respective regions of Africa) using a R-based analysis package.

2nd training workshop in Cape Town Nov 2011 followed by a possible side event at COP17 Durban, organized by UNDP.

3rd training session early 2012. Aim is to have Africa-CORDEX climate change papers drafted by this group before July 2102 (AR5)

A similar group now being formed for South Asia, led by IITM.

Discussions now occurring with S.E. Asian Bank to support a similar capacity building and impacts/evaluation panel for S.E. Asia.

All capacity building efforts are a WCRP/START collaborative effort

CORDEX East-Asia had a workshop Sept 2011, hosted by KMA to begin to organize and share East Asia downscaling activities

Euro-CORDEX will have a meeting Nov 17-18 to plan CMIP5 downscaling over Europe (esp. 0.11° RCM simulations)

Polar-CORDEX (Arctic and Antarctic) coordinated by John Cassano U. Colorado. 1st planning meeting in Sweden March 2012.

Meeting between AgMIP and CORDEX held in New York April 2011 to develop a set of climate - agriculture assessment Projects: initially over North, South and central America

CORDEX project detailed in Clivar Exchanges special issue on CMIP5

First review paper of ERA-interim forced Africa-CORDEX ensemble In review (minor revisions) with Journal of Climate.

CORDEX/Regional Climate poster session at OSC + CORDEX talks

Data and format issues:

6hr model level data (1950-2100) available from some CMIP5 GCMs
Translators have been developed, allowing parallel downscaling.
e.g. at SMHI we have 5 (soon 6) global data sets for driving our RCM.
We can now run multi-region, multi-GCM CORDEX simulations in parallel

CORDEX main data archive: <http://cordex.dmi.dk/>

Discussions occurred with Euro ESG groups (BADC, DKRZ, IPSL) thru' the is-ENES project to bring CORDEX archiving within the CMIP5 ESG structure. Is-ENES2 will support CORDEX archiving in ESG.

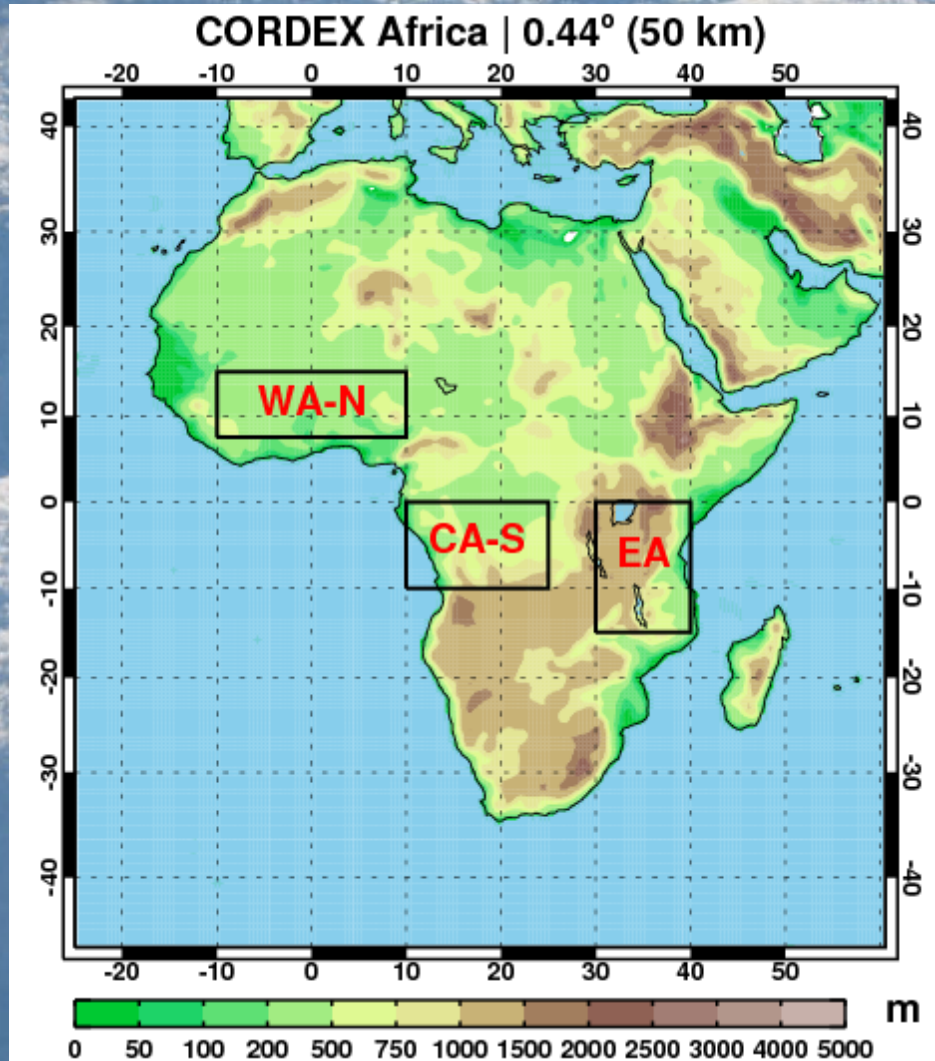
A set of CORDEX data has been loaded and broadcast between ESG nodes in Sweden and UK. Some extra facets required in the ESG for CORDEX data names. NCAR developers have this info.

http://wcrp.ipsl.jussieu.fr/RCD_Projects/CORDEX/cordex_archive_specifications_110628.pdf

e.g File naming conventions File names should follow this structure:

*VariableName_Domain_GCModelName_CMIP5ExperimentName_CMIP5Ensemble
Member_RCModelName_RCMVersionID_Frequency_StartTime_EndTime.nc*

Initial Results from 10 RCMs run for 1989-2008 at 50km forced by ERA-interim boundary conditions



RCMs that have/are made the Africa ERA run and **will** make GCM projection runs for Africa

UCT/UK Met. : PRECIS

Santander/Bergen/LMD : WRF

ICTP : RegCM3

UQAM : CRCM5

Meteo France : ARPEGE

KNMI : RACMO

JRC : COSMO-CLM

MPI : REMO

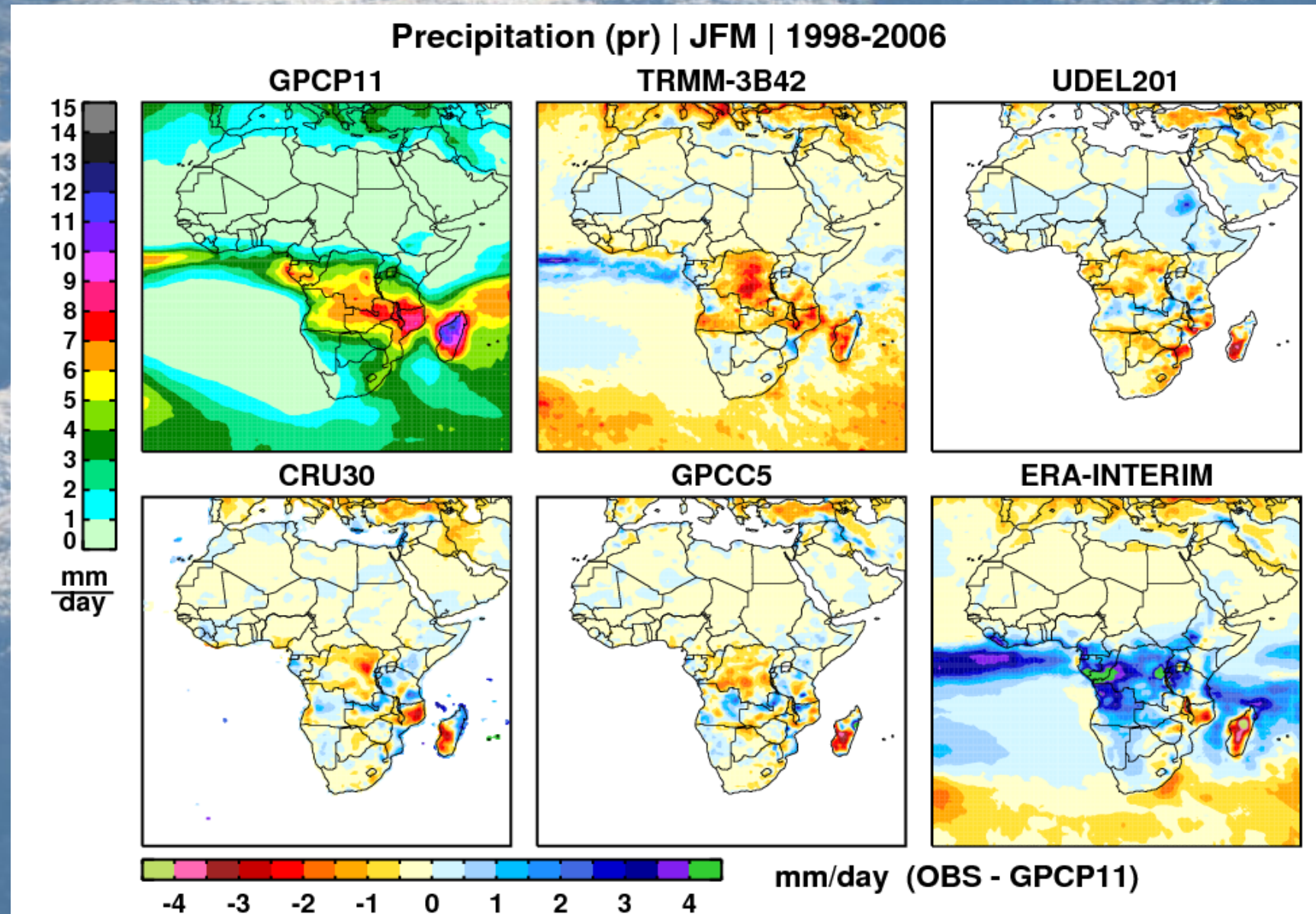
DMI : HIRHAM

SMHI : RCA

All the above have promised (at least 1 GCM forced Africa run)

Africa-CORDEX J.Climate article in review: minor revisions

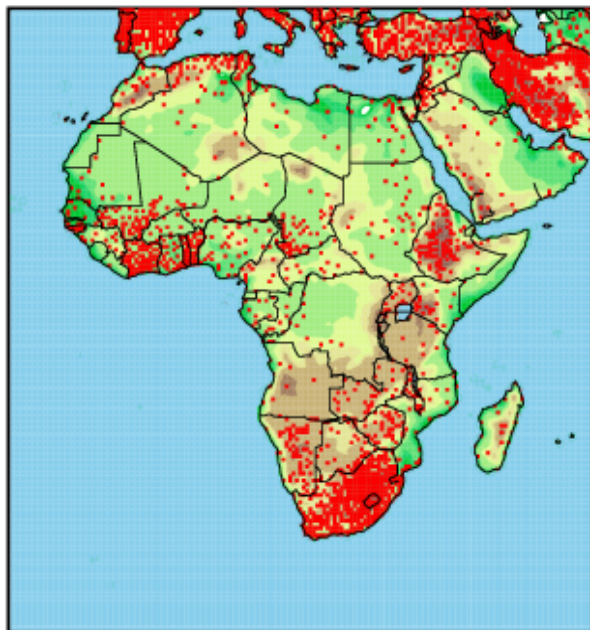
Over Africa it is important to consider observational uncertainty



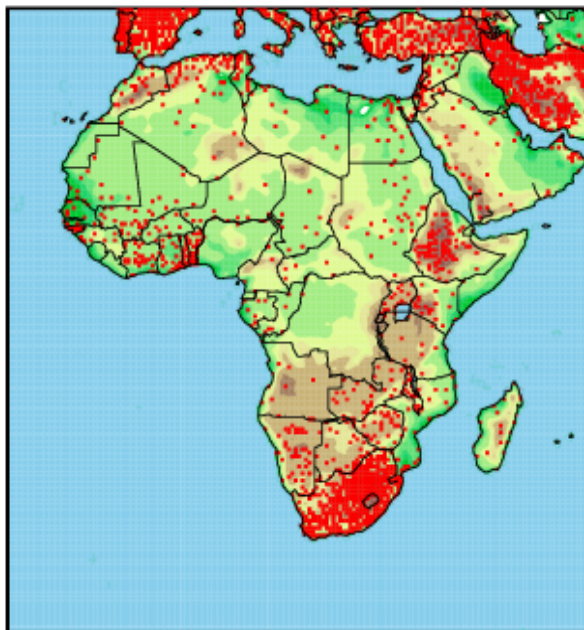
Surface observational coverage is severely limited in some regions

Availability of GPCC gauges | JFM | 1998-2006 (27 months)

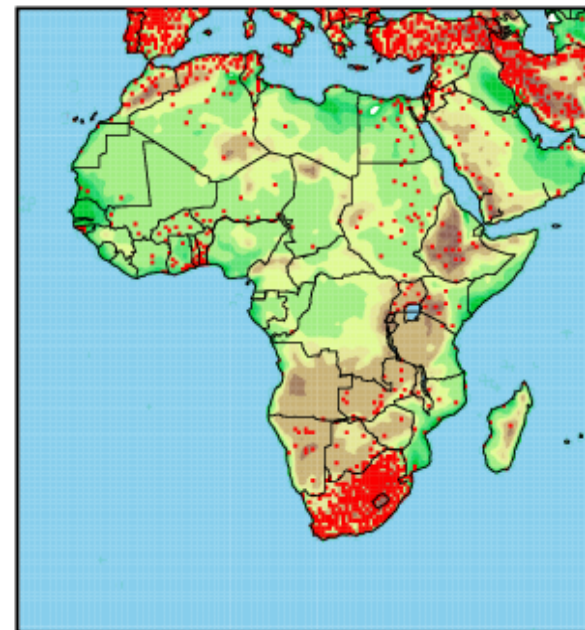
at least 1 month



at least 13 months



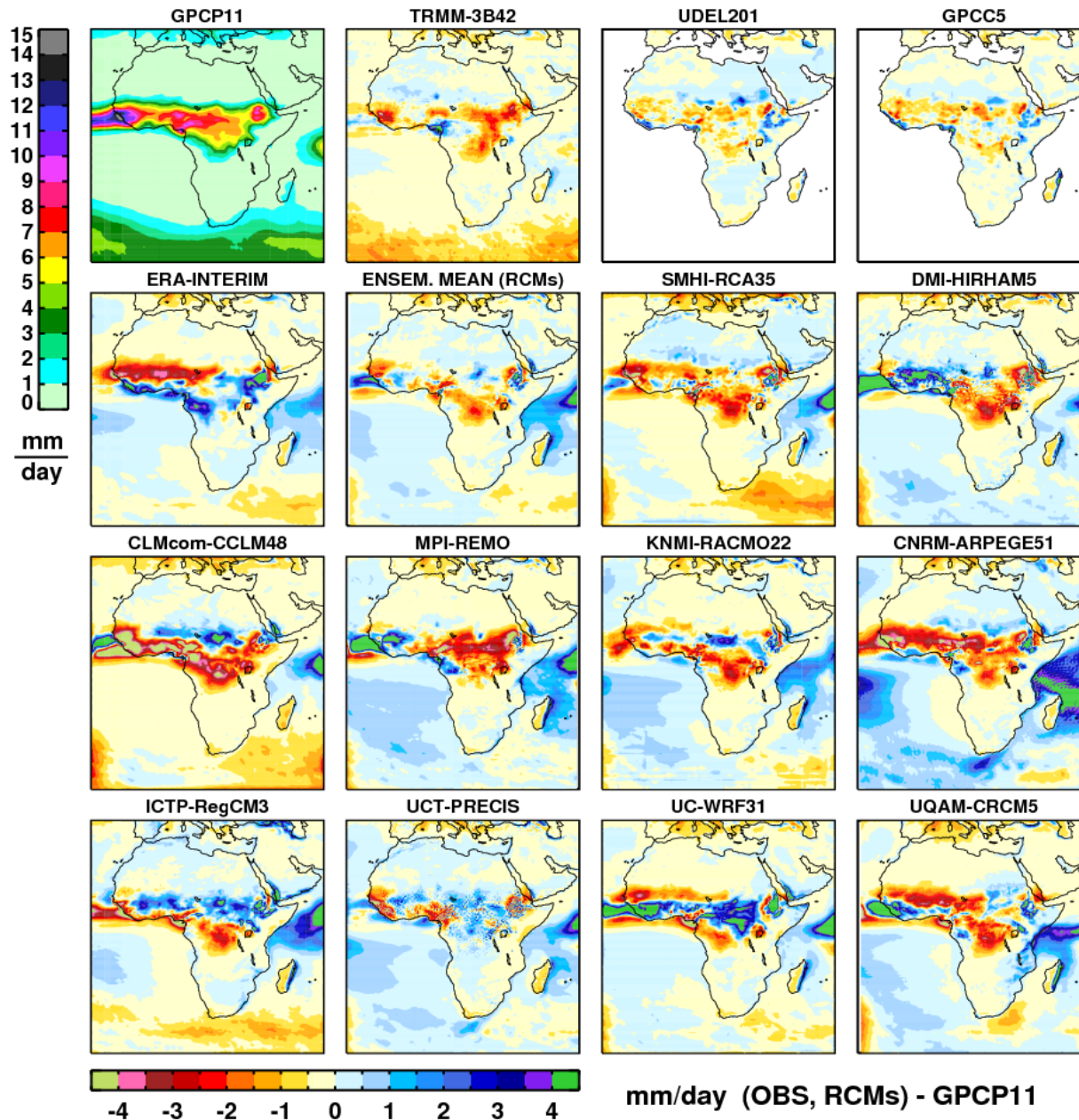
all months



m

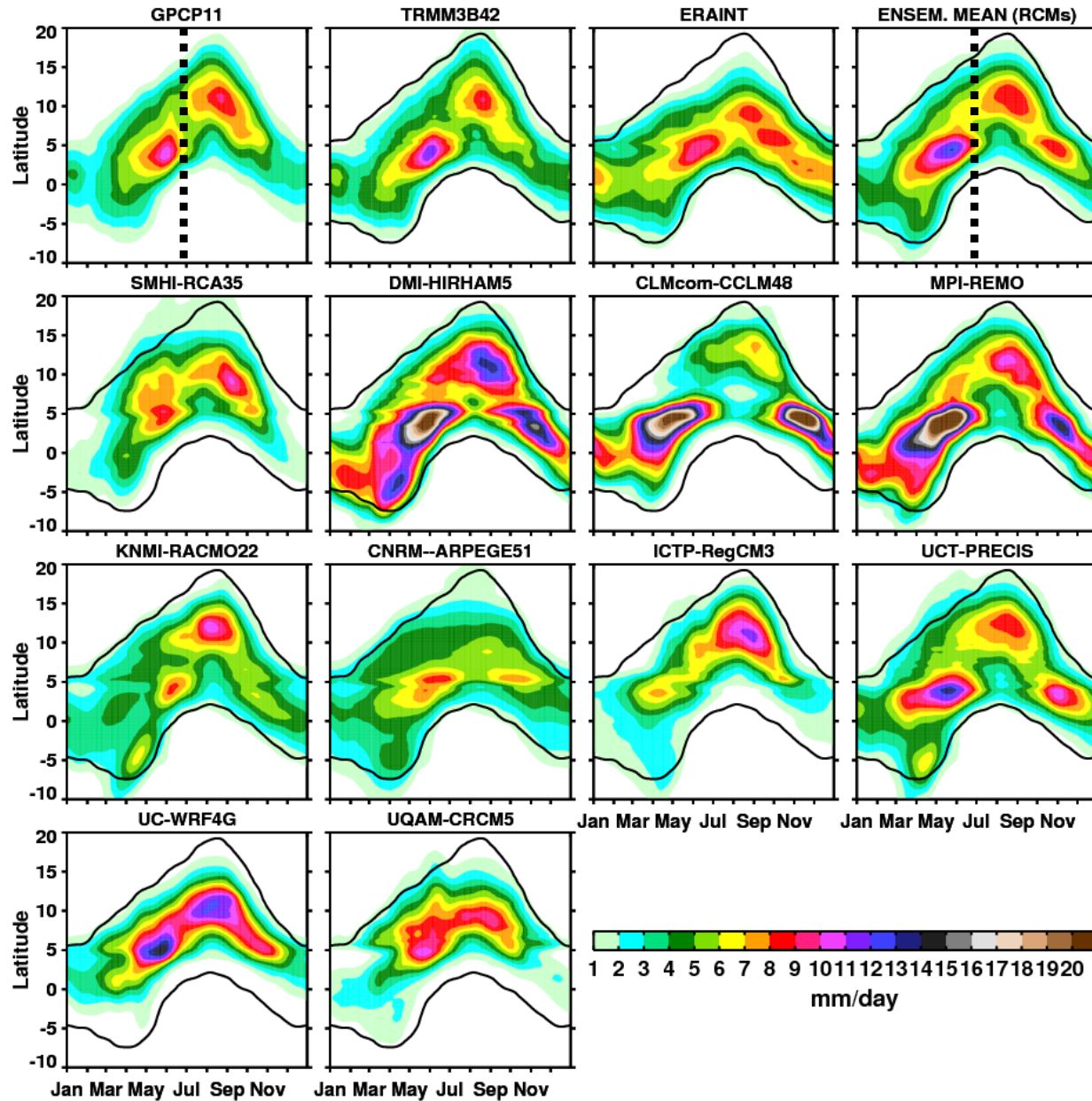
Seasonal Mean Precipitation

Precipitation (pr) | JAS | 1998-2008

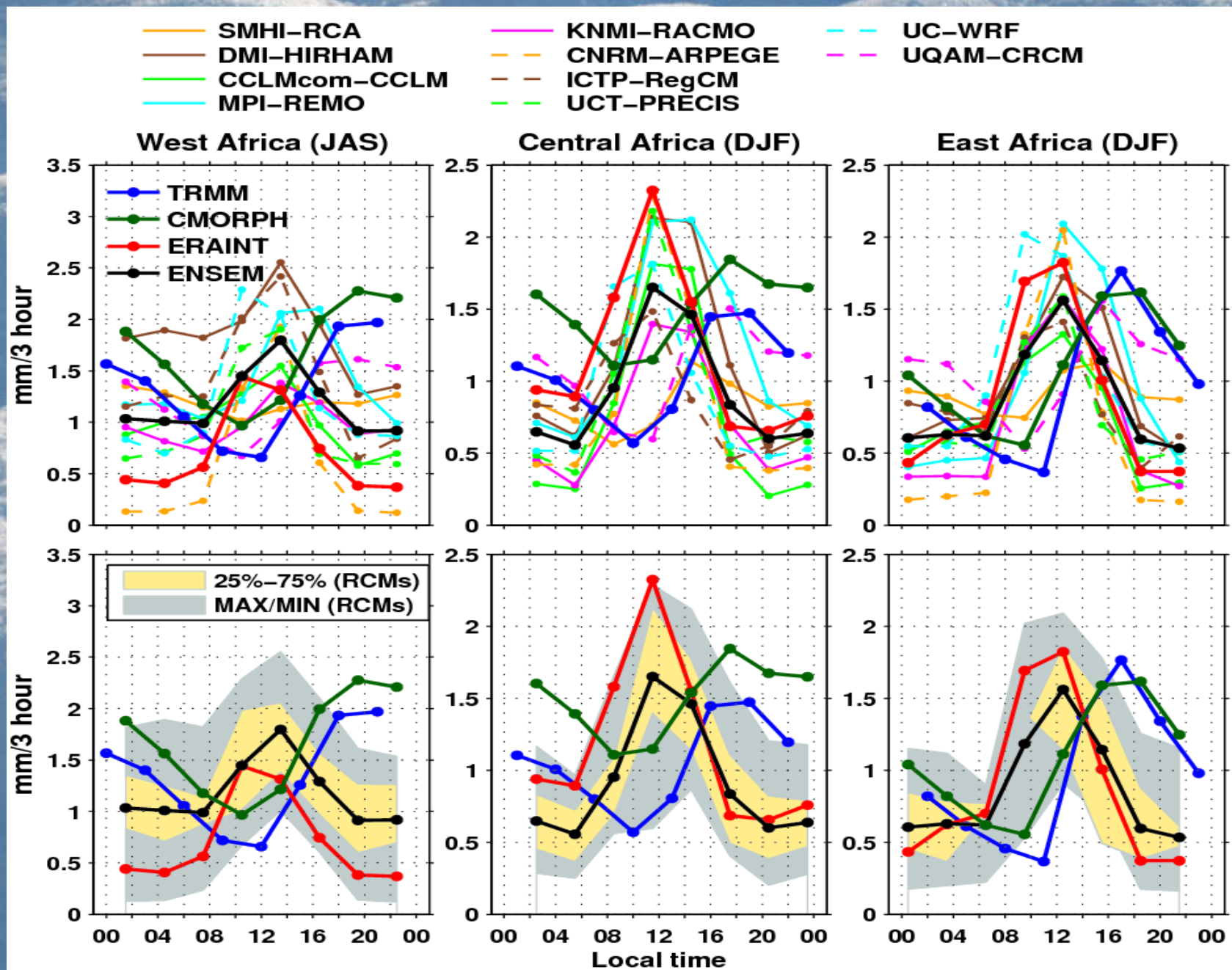


Latitudinal progression of the West African Monsoon

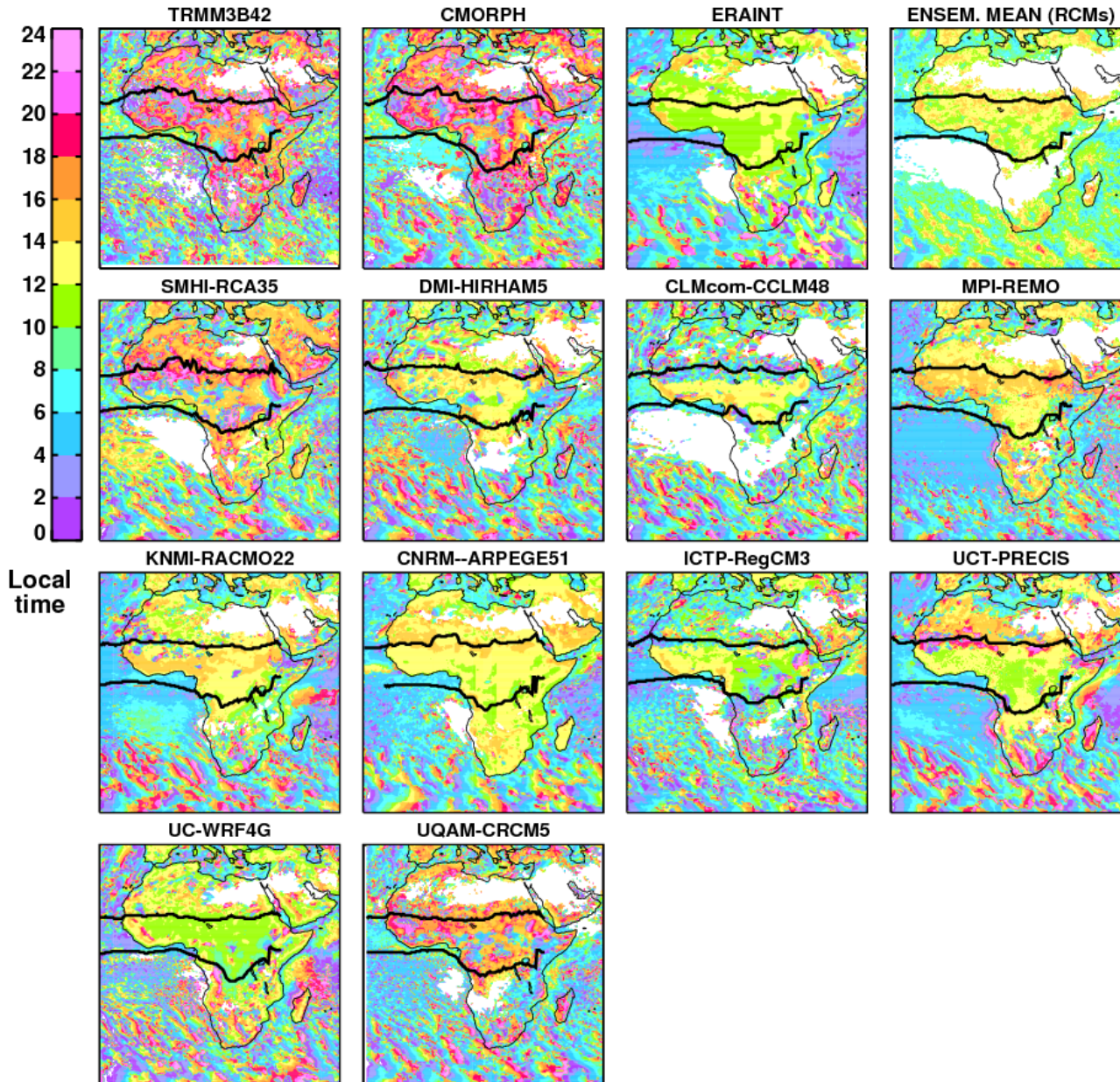
Monthly mean precipitation averaged between 10W-10E



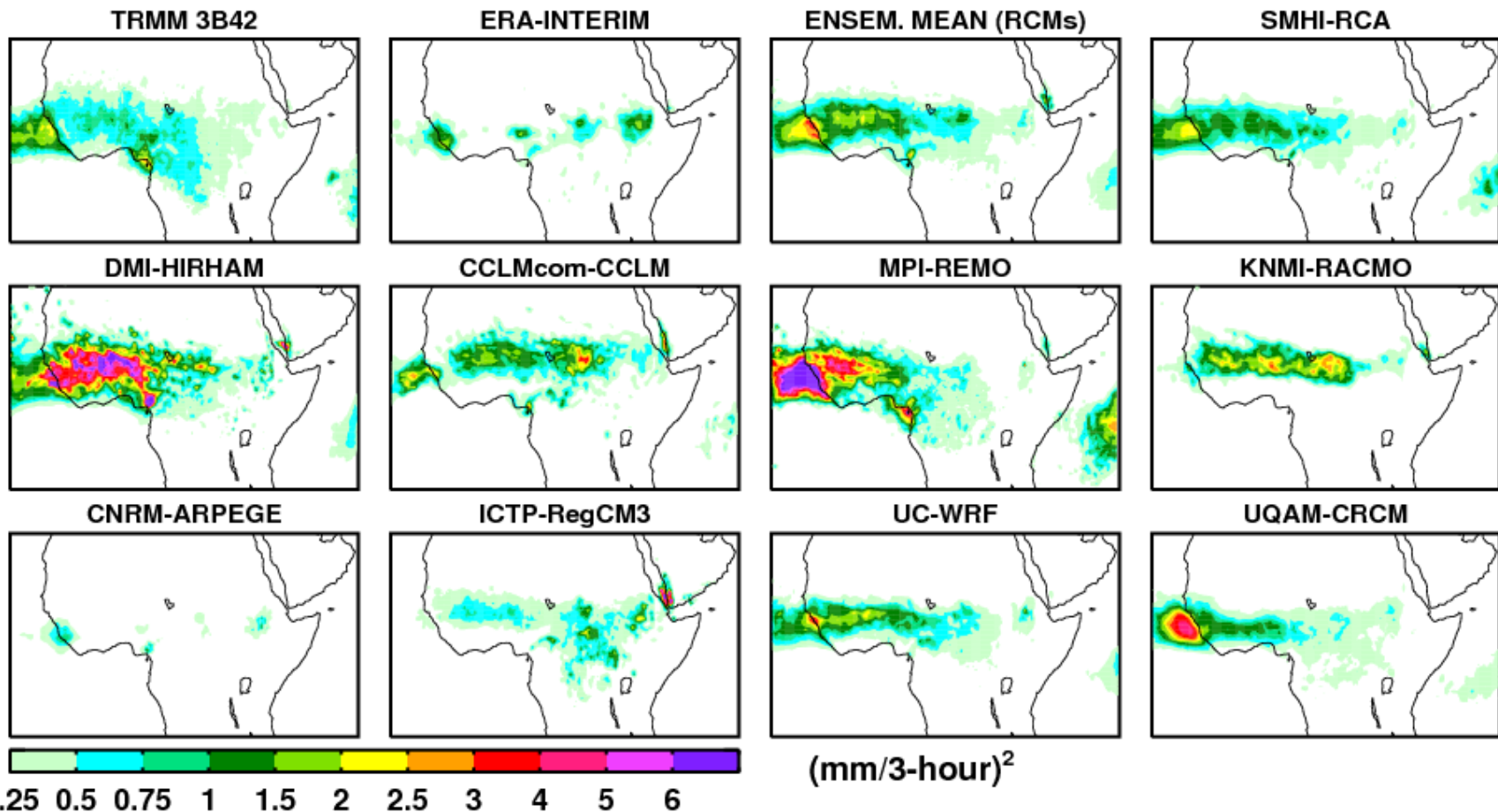
Mean Diurnal Cycle of Precipitation: West Africa JAS



Local Time of maximum rain rate during the day: JAS



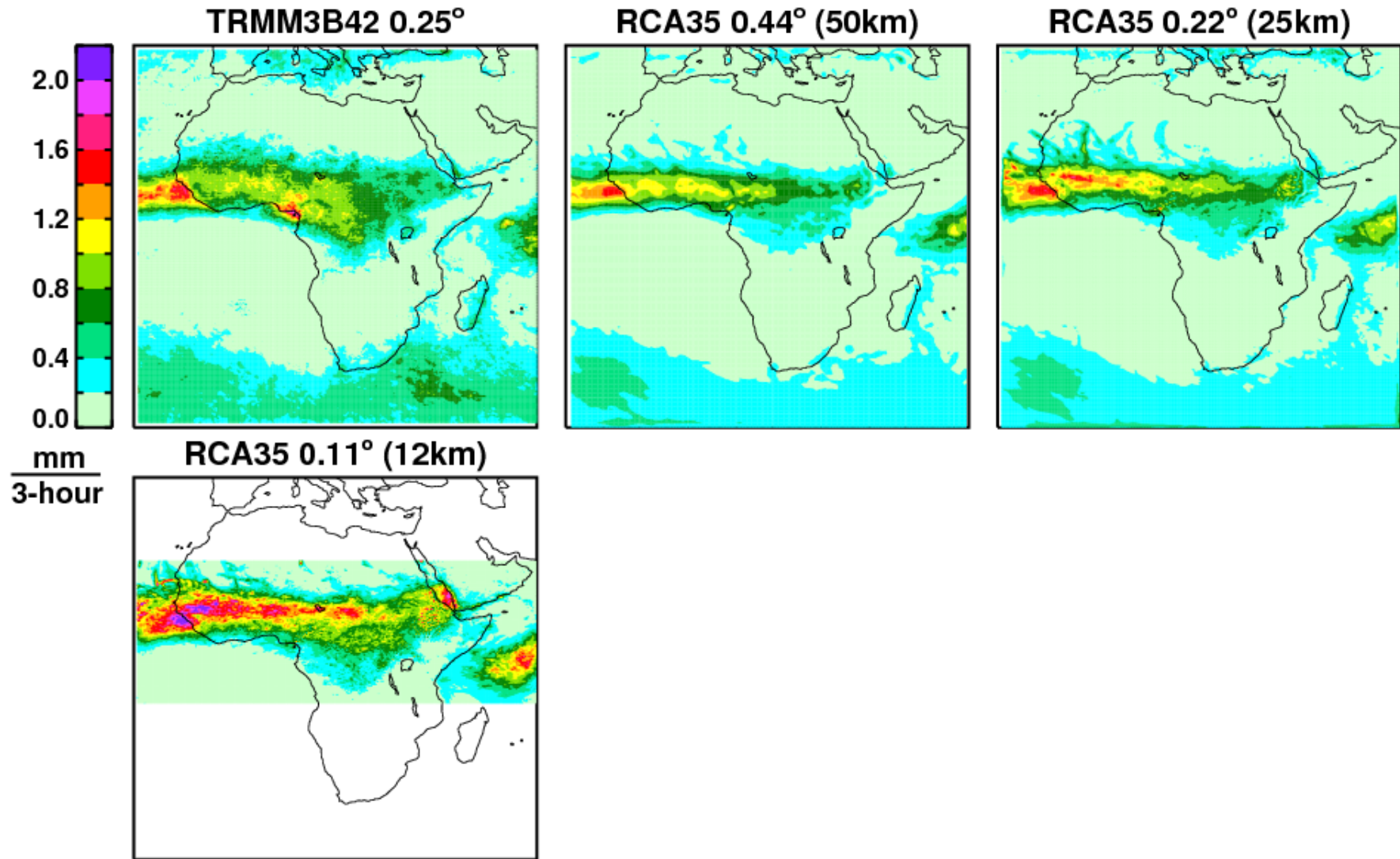
An ensemble can be used to investigate higher order climate variability of importance in impact assessment (e.g. agriculture)



2-6 day band-passed precipitation variance highlights African Easterly Waves that deliver the majority of precipitation in the Sahel region

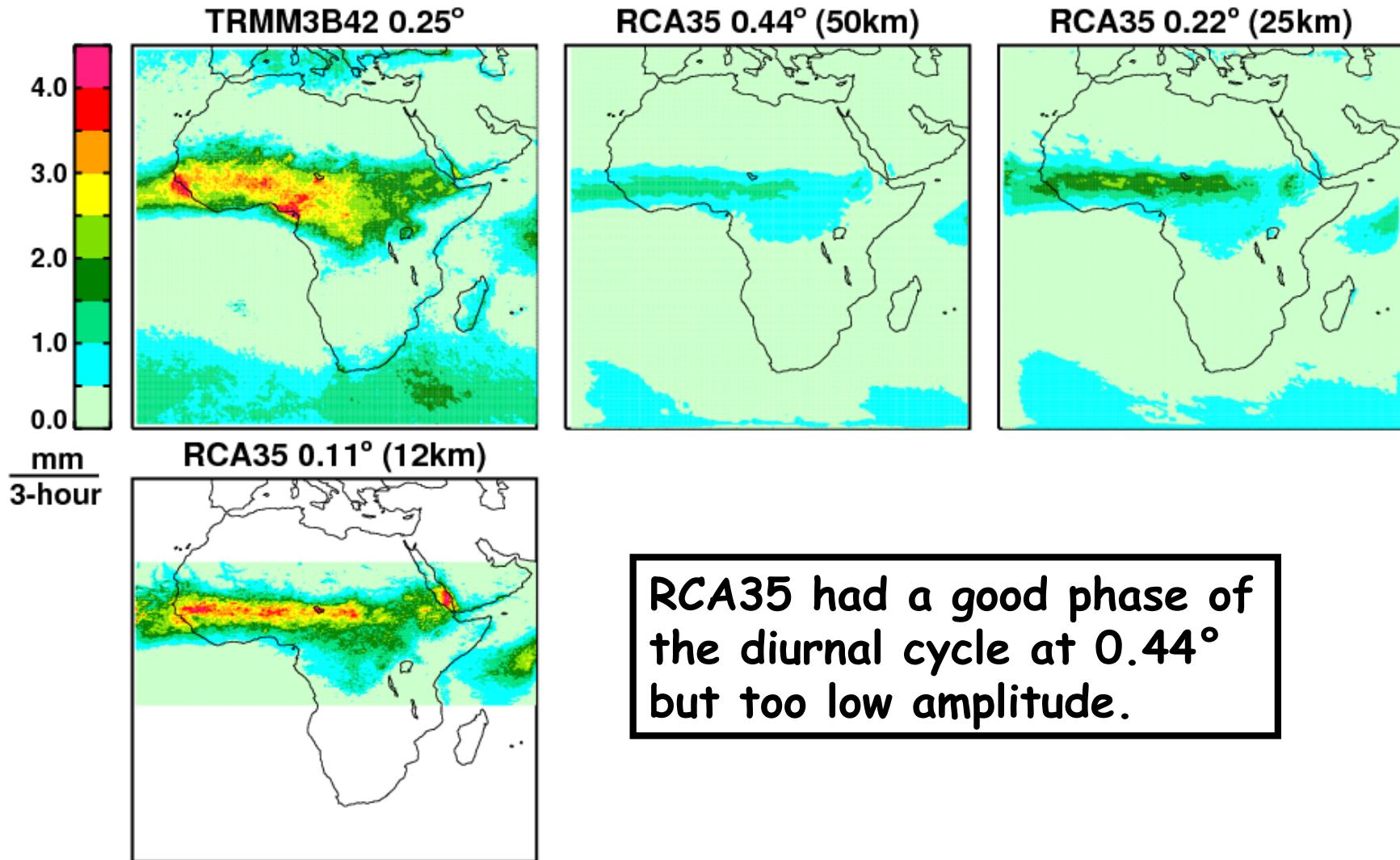
2-6 day band-passed (AEW) Standard deviation of precipitation (JAS)

3-hour precipitation (pr): 2-6 day BP STD | JAS 1998-2008



Standard Deviation of rainfall within the diurnal cycle (diurnal amplitude)

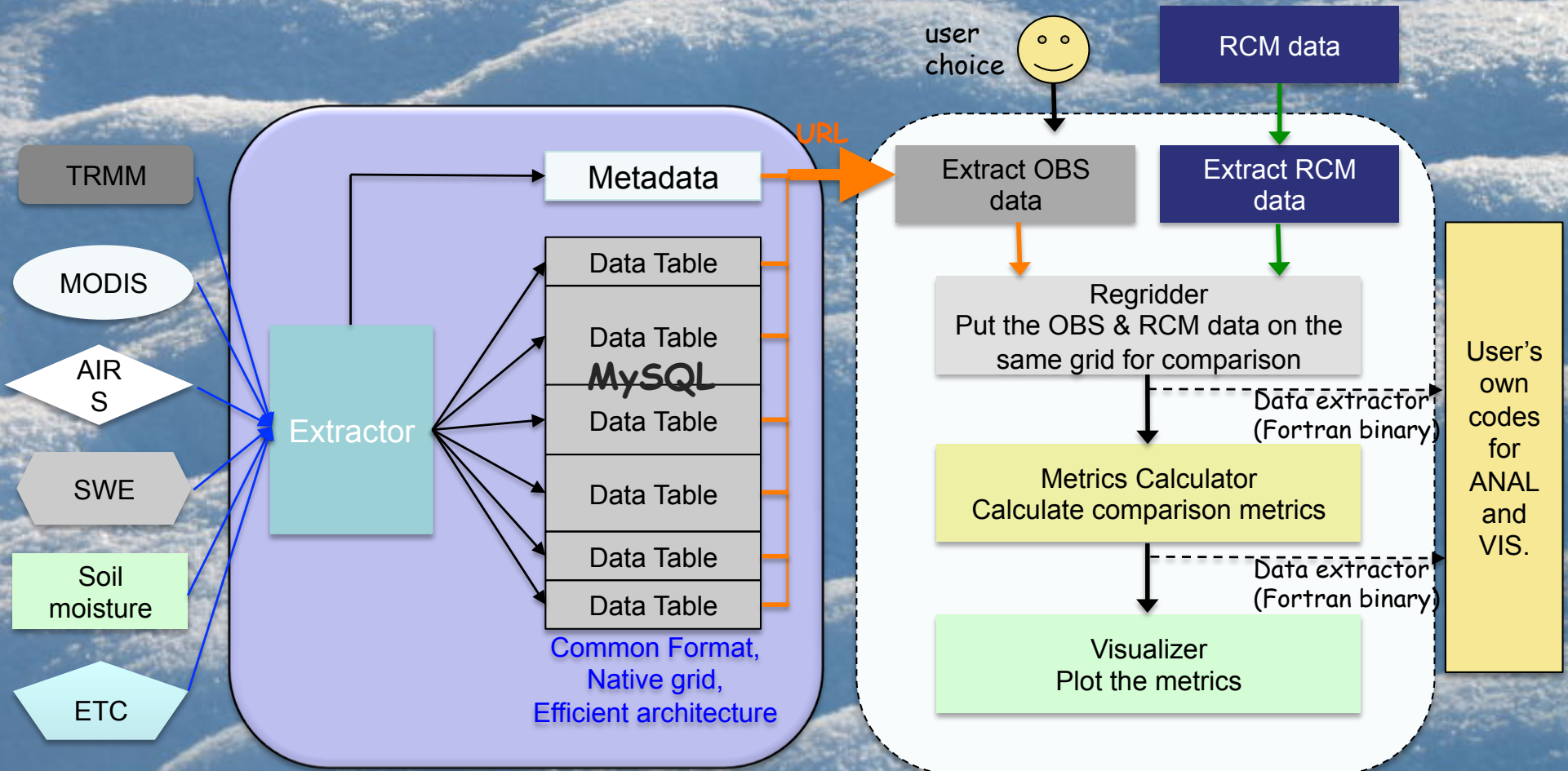
3-hour precipitation (pr): 1.25-day HP STD | JAS 1998-2008



RCA35 had a good phase of the diurnal cycle at 0.44° but too low amplitude.

Regional Climate Model Evaluation System (RCMES)

Application to CORDEX (JPL/UCLA; D. Waliser, J. Kim, C. Mattman, et al.)

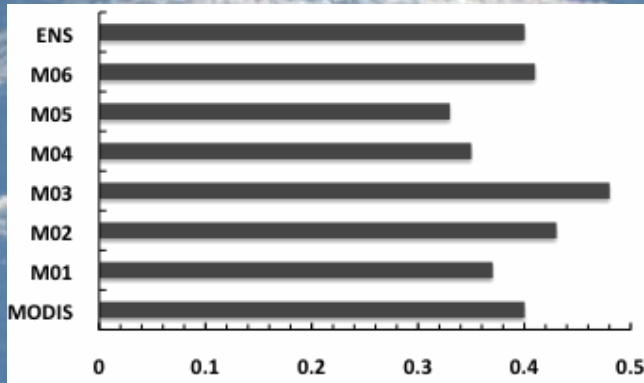


Raw Data:
Various formats,
Resolutions,
Coverage

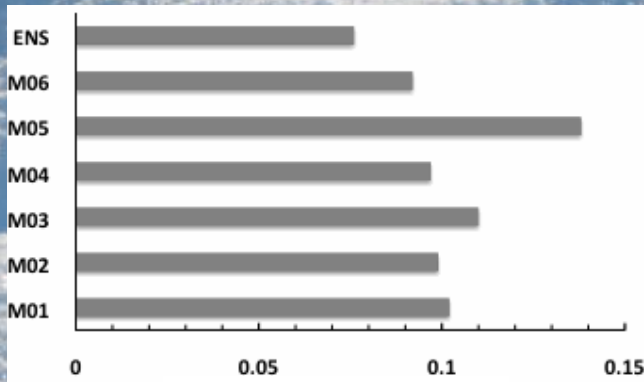
RCMED
(Regional Climate Model Evaluation Database)
A large scalable database to store data from
variety of sources in a common format

RCMET
(Regional Climate Model Evaluation Tool)
A library of codes for extracting data from
RCMED and model and for calculating
evaluation metrics

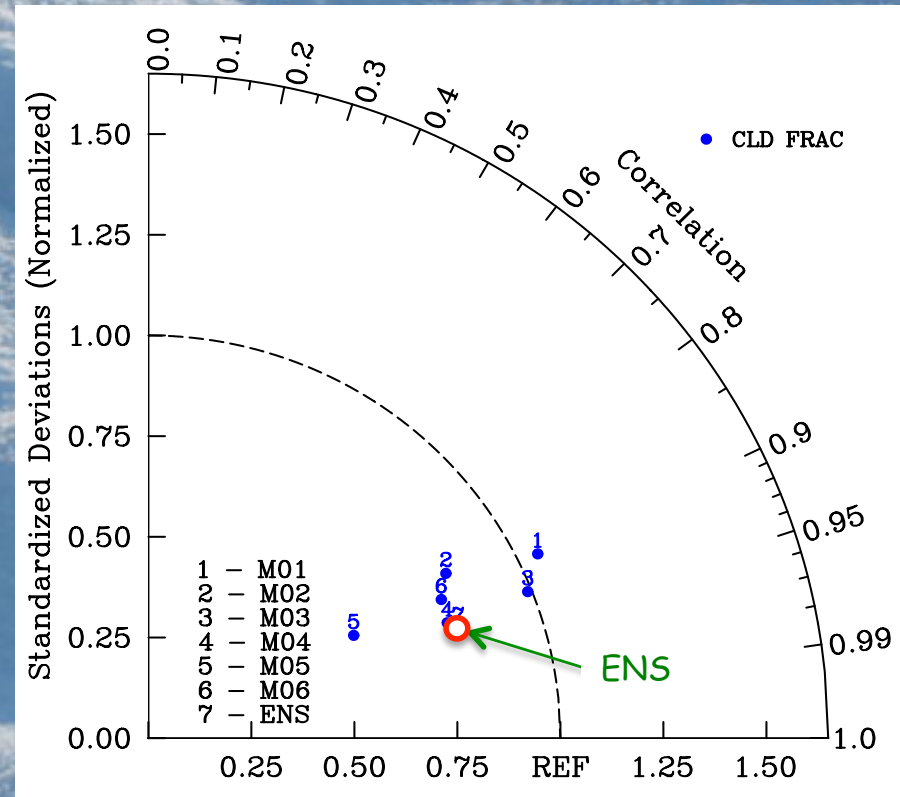
Total Cloud Climatology vs MODIS 2001-2008



Mean (fraction)



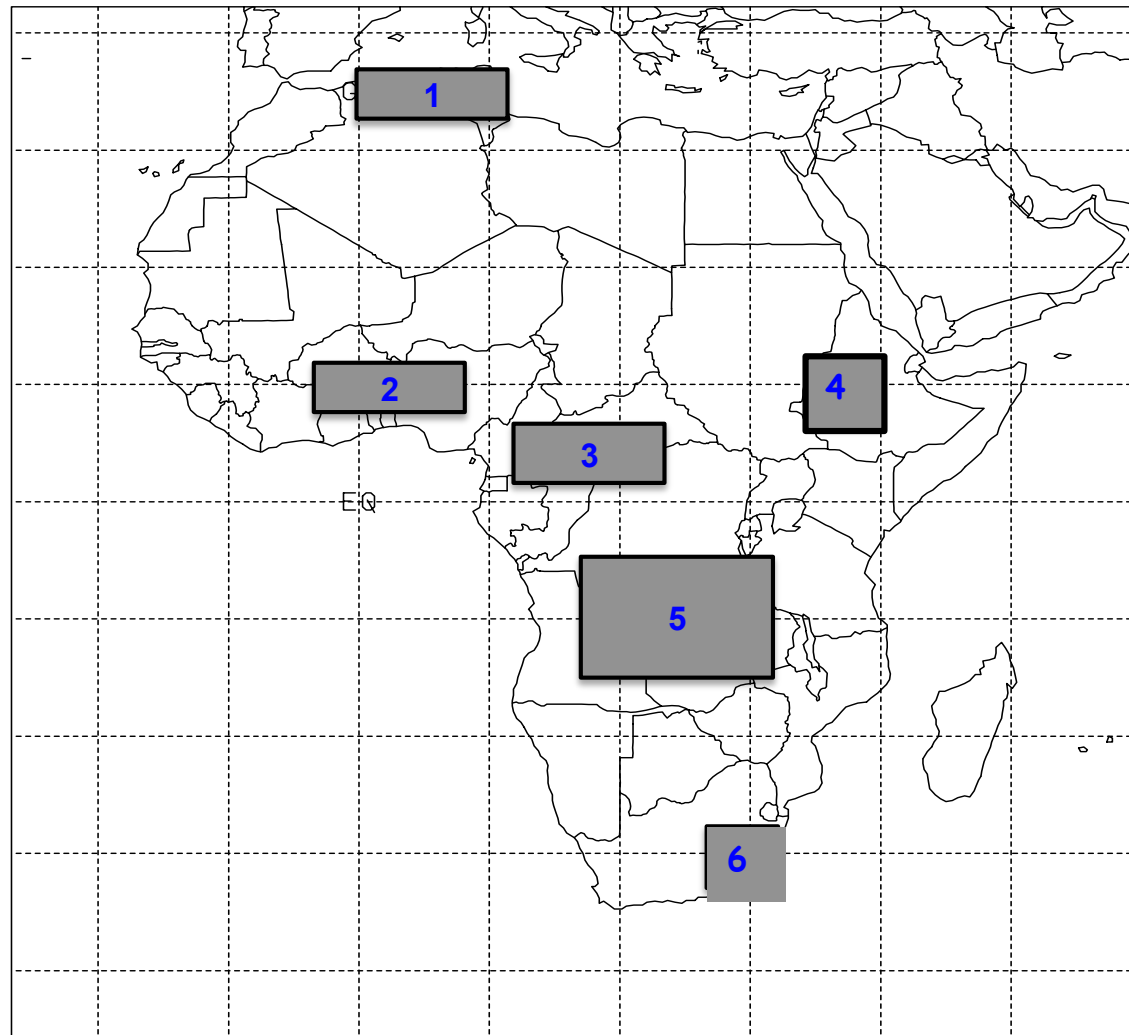
RMSE (fraction)

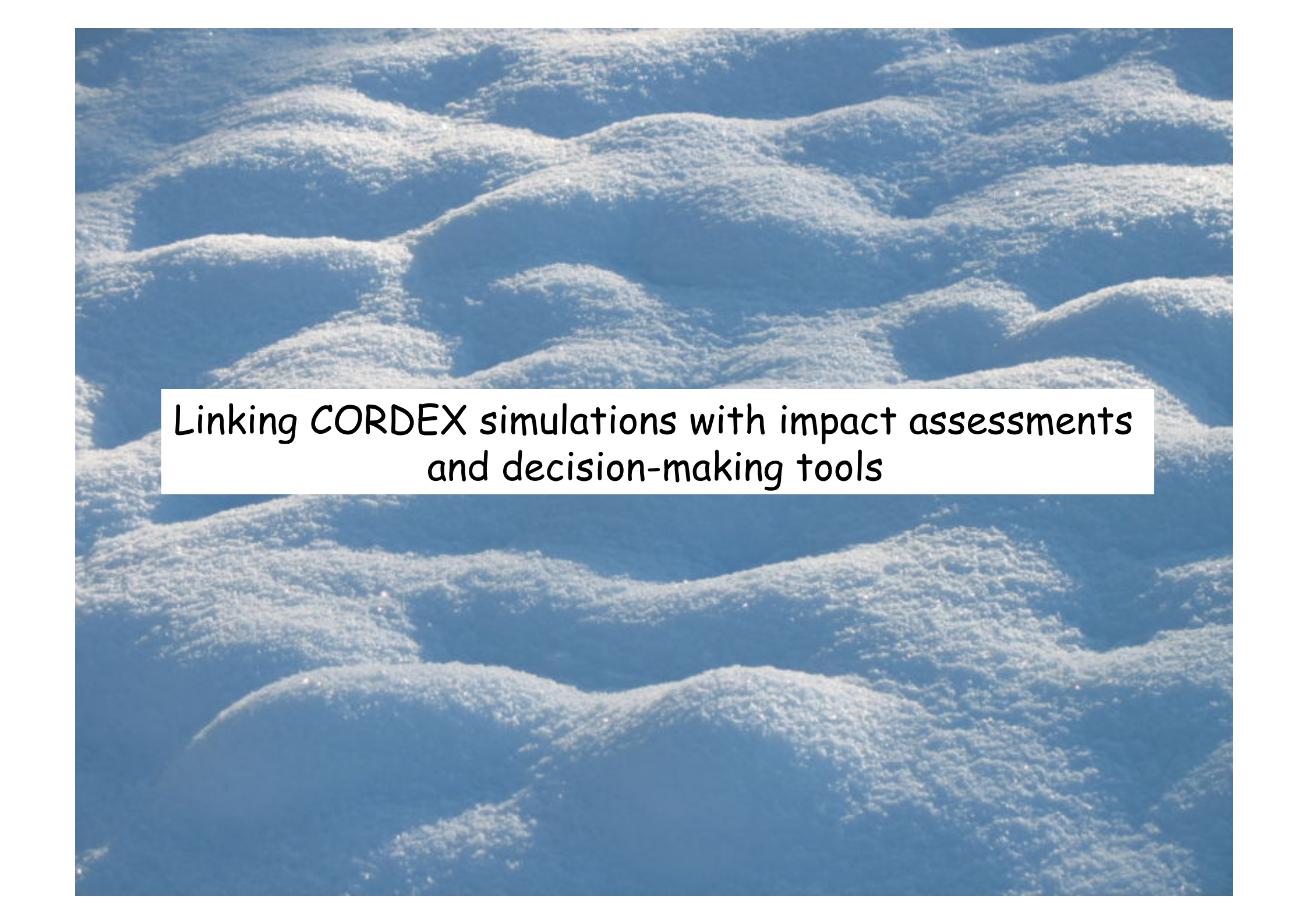


- Model errors range from -17.5% to +20%
- All models generate good spatial pattern (spatial corr. coef. > 0.9 vs. the MODIS data).
- Model ensemble generally agree more closely with the REF data than individual models.
 - the smallest bias and RMSE against the MODIS data.
 - the highest spatial correlation with the MODIS data.
 - Model ensemble does not improve spatial variability.

CORDEX-Africa Hindcast Domain

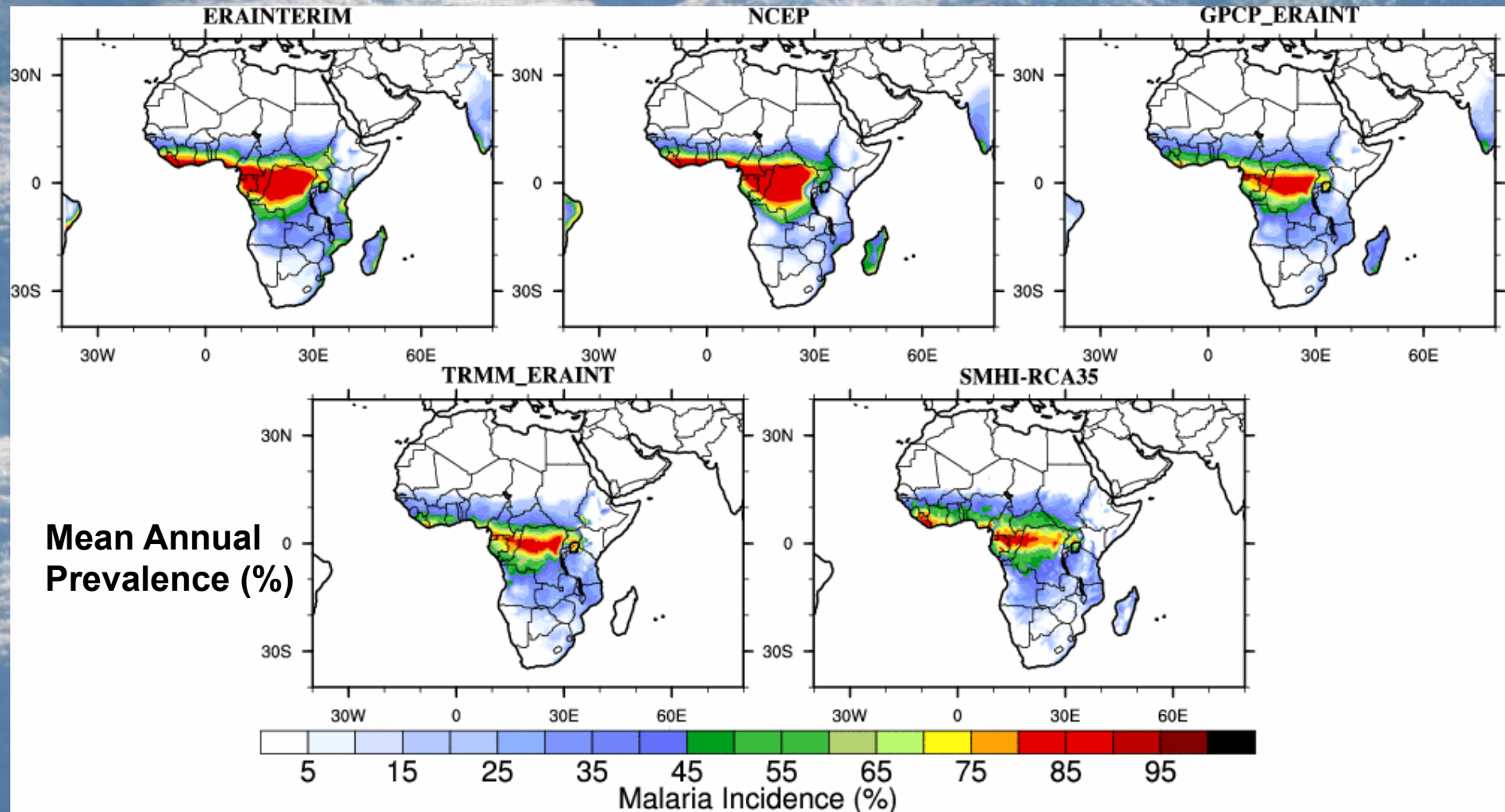
CORDEX-AFRICA DOMAIN: 0.44DEG RE



An aerial photograph of rolling green hills, likely in a rural or agricultural area. The hills are covered in dense vegetation and are arranged in a series of gentle, undulating ridges and valleys. The lighting is bright, creating strong shadows and highlights that emphasize the texture of the terrain. A white rectangular box is superimposed over the center of the image, containing the text.

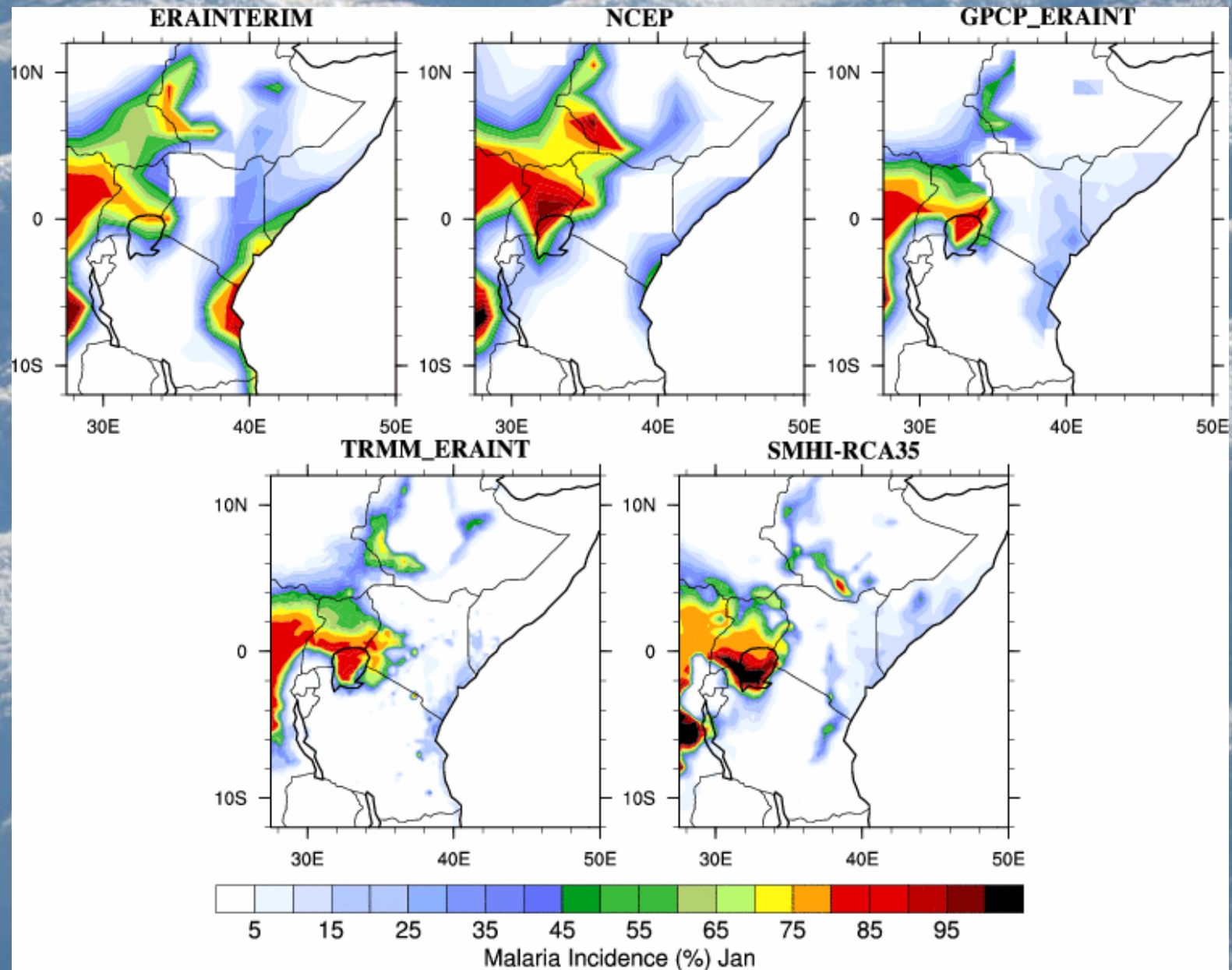
Linking CORDEX simulations with impact assessments
and decision-making tools

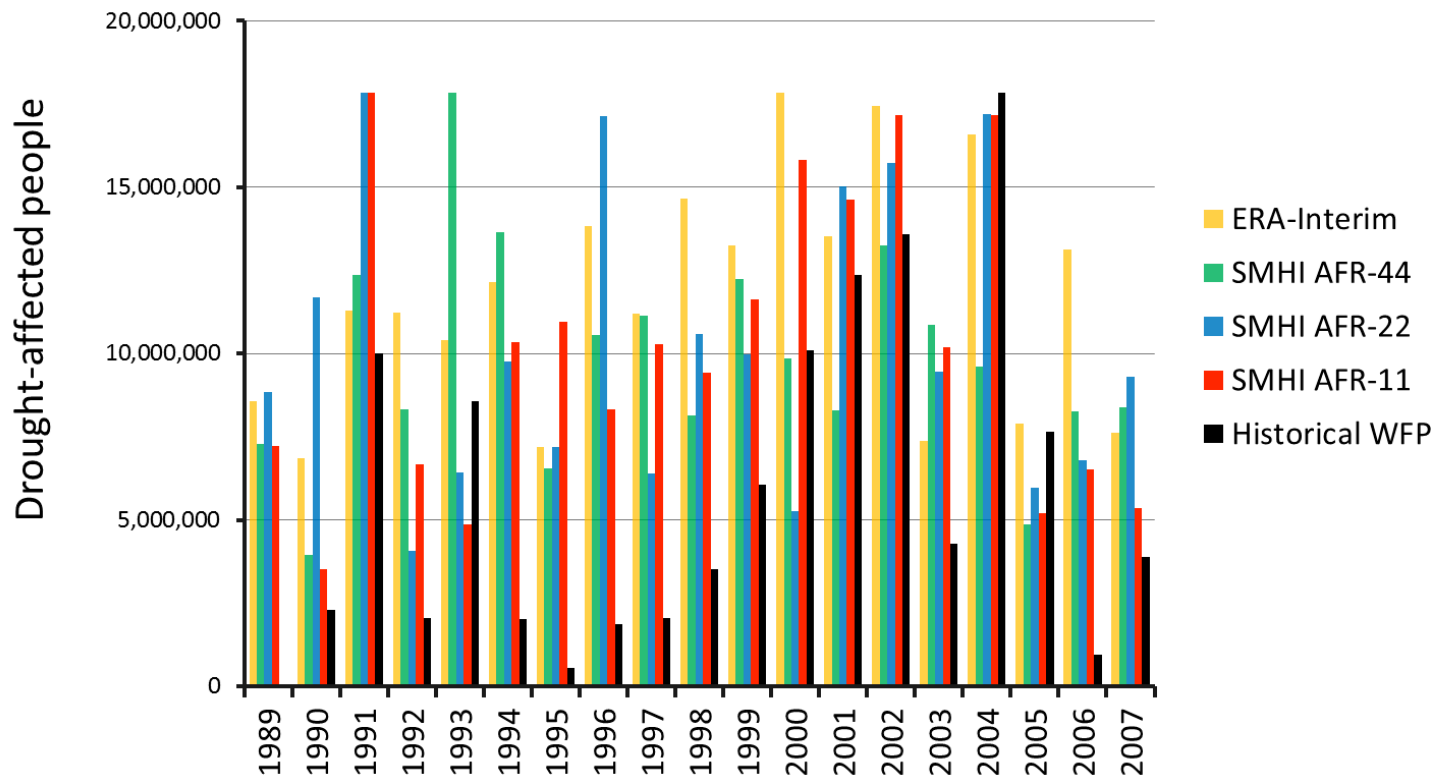
Dynamic Malaria Model driven by climate observations & CORDEX



SMHI (50km²) reproduces well the mean annual malaria incidence pattern with respect to TRMM-ERAINT & GPCP-ERAINT control experiment

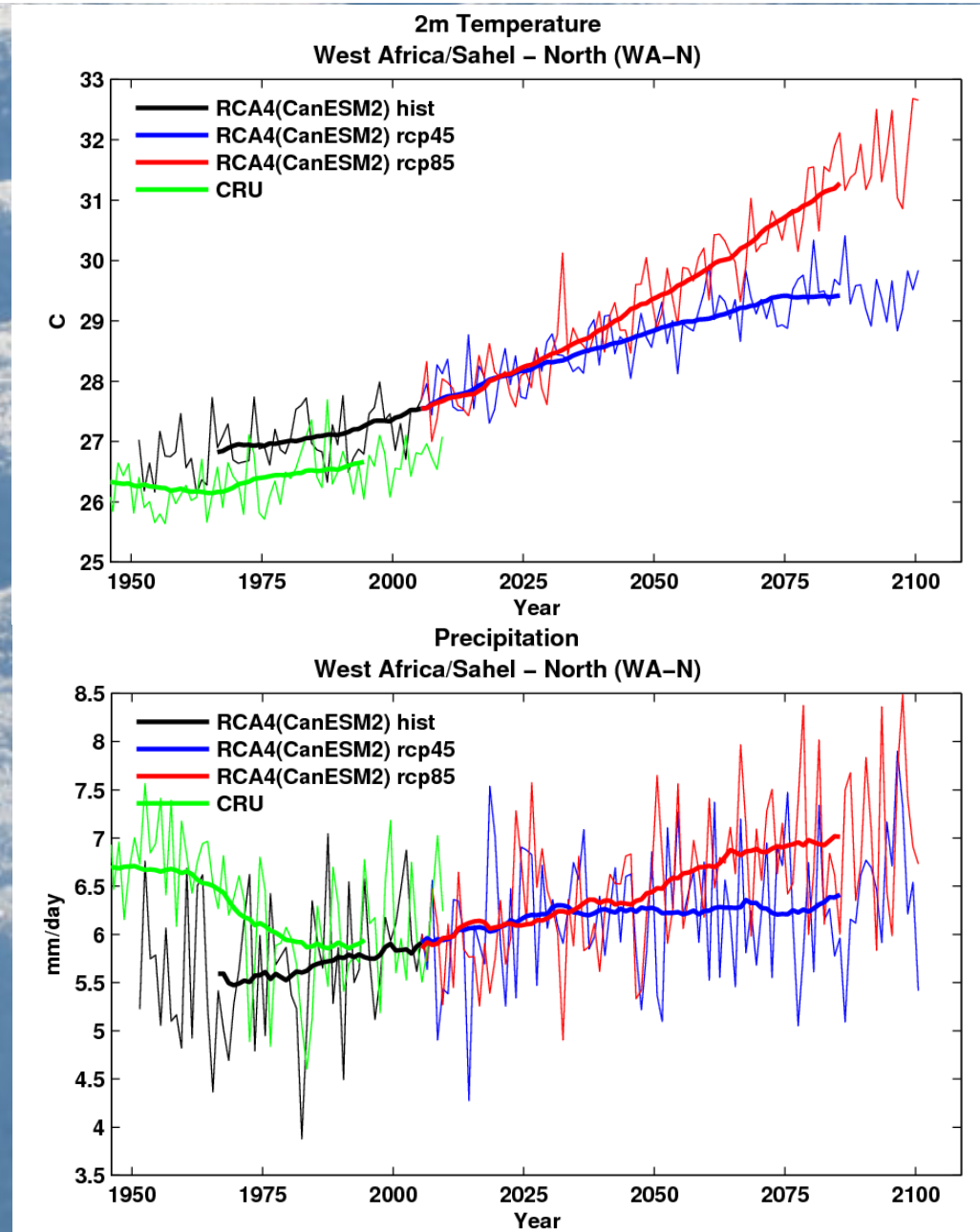
Malaria Incidence mean seasonal cycle animation



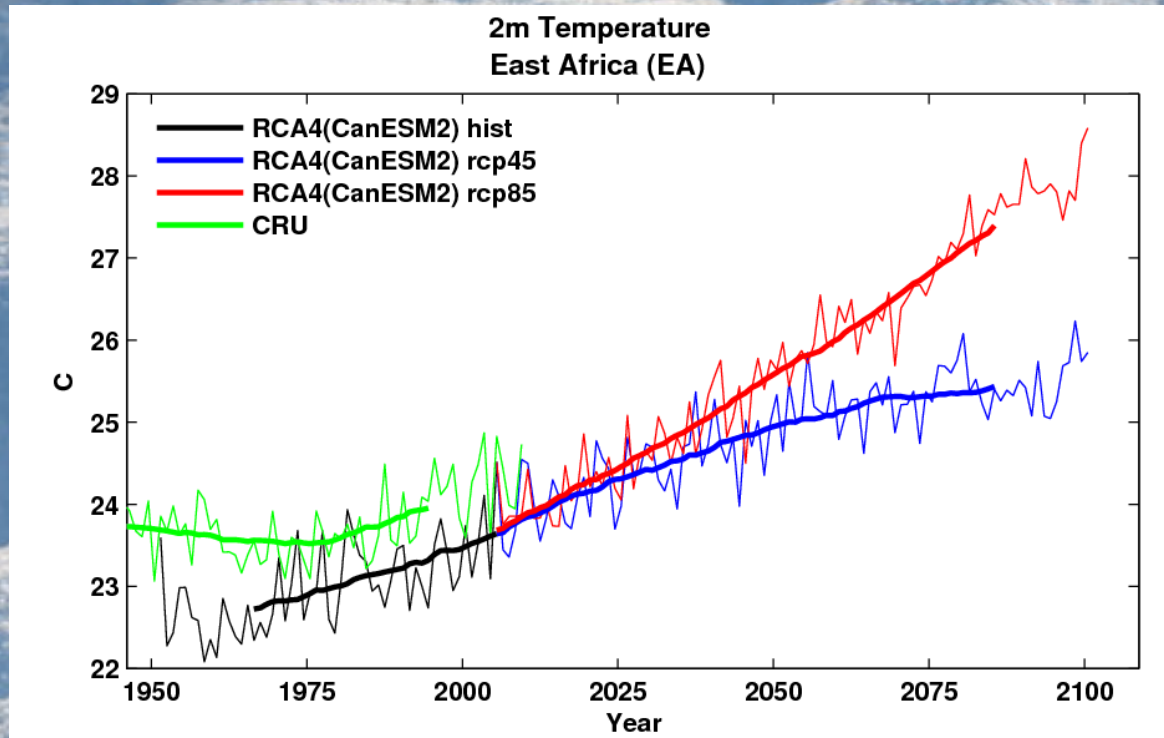


Number of drought-affected people in sub-saharan Africa estimated by WFP Africa RiskView based on rainfall and potential evapotranspiration using: **ERA-Interim** ERA-Interim downscaled by SMHI/RCA at **0.44**, **0.22** & **0.11°**. Black bars are the historical record of WFP emergency operations (EMOP) in response to drought. Note EMOP reflects planned interventions and should be considered a lower bound to the actual drought-affected people.

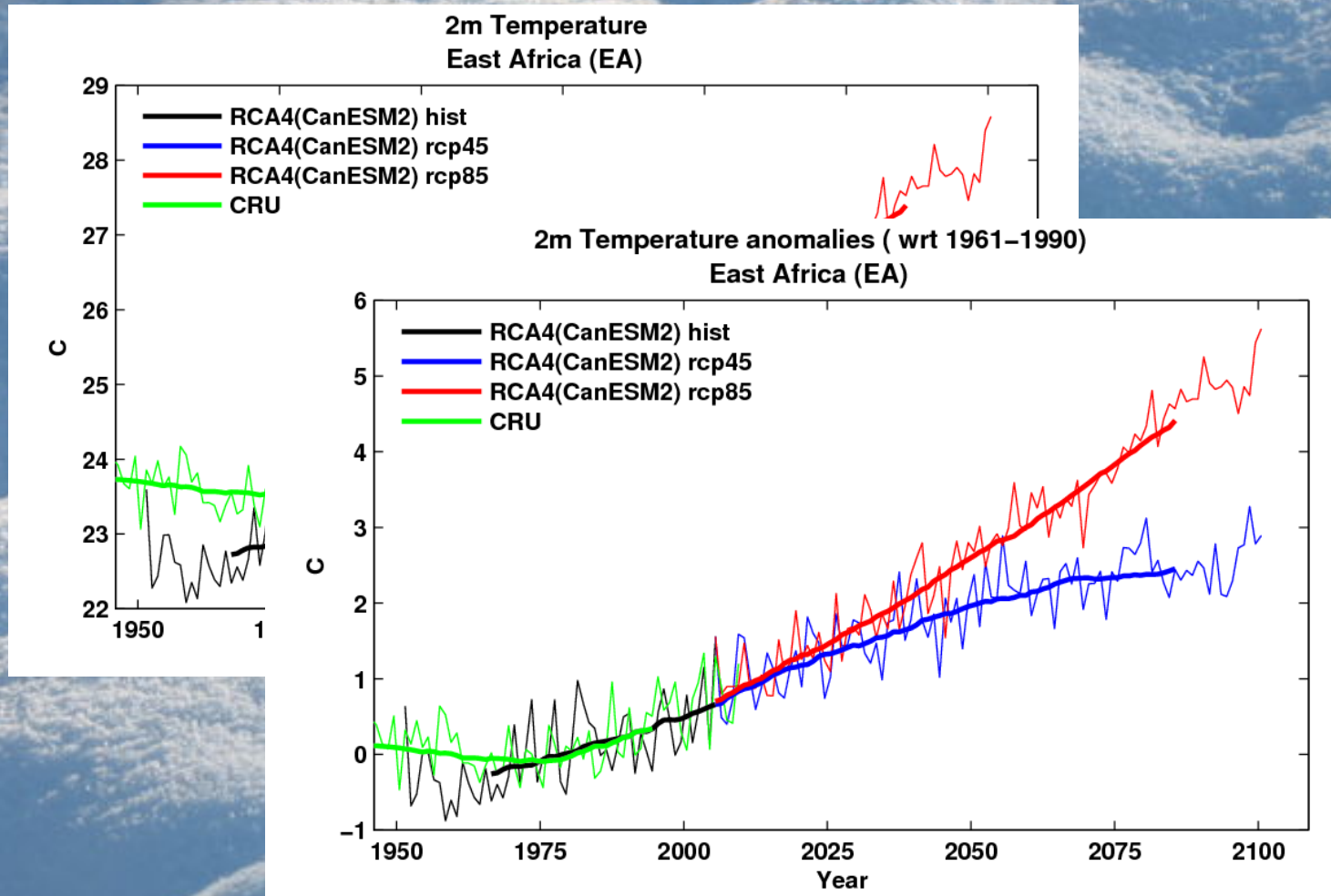
First Africa-CORDEX projections based on CMIP5 RCPs: W.Africa/Sahel JAS seasonal mean 2m temp & precipitation



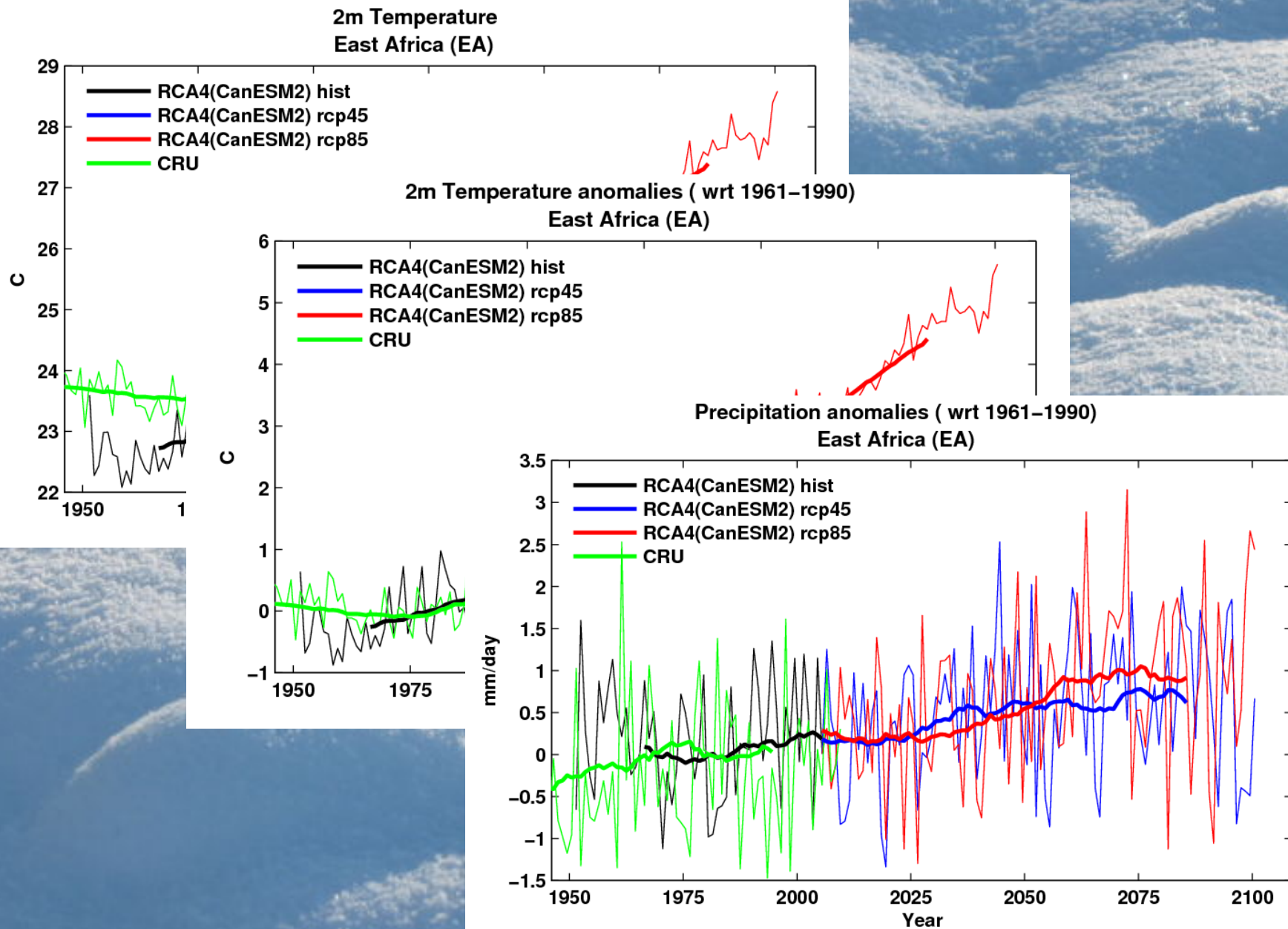
First Africa-CORDEX projections based on CMIP5 RCPs: East Africa



First Africa-CORDEX projections based on CMIP5 RCPs: East Africa

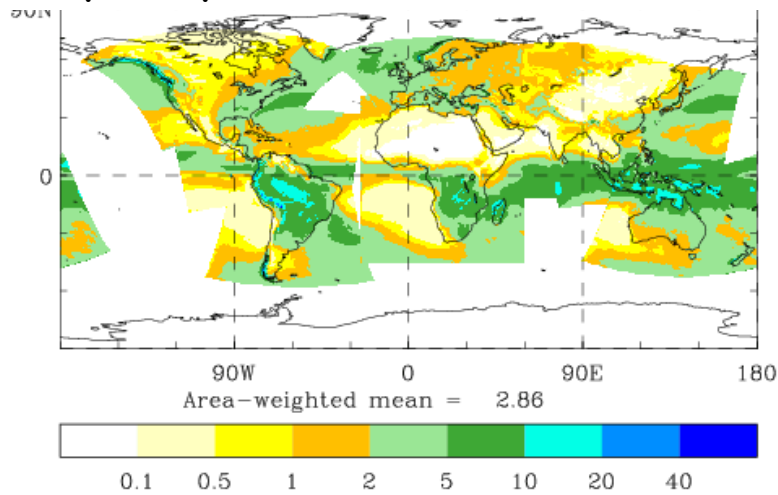


First Africa-CORDEX projections based on CMIP5 RCPs: East Africa

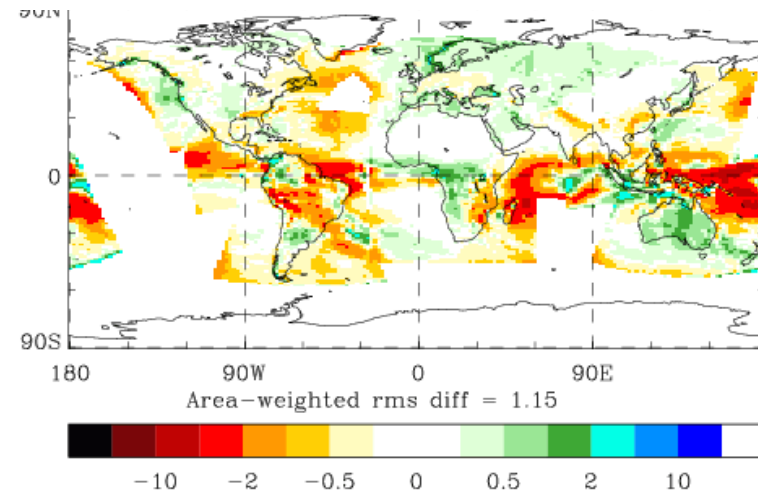


Hadley C. CORDEX simulations used to analyse error Sources (local vs remote) in model development process

DJF precip: 50km HadGEM3 RCM

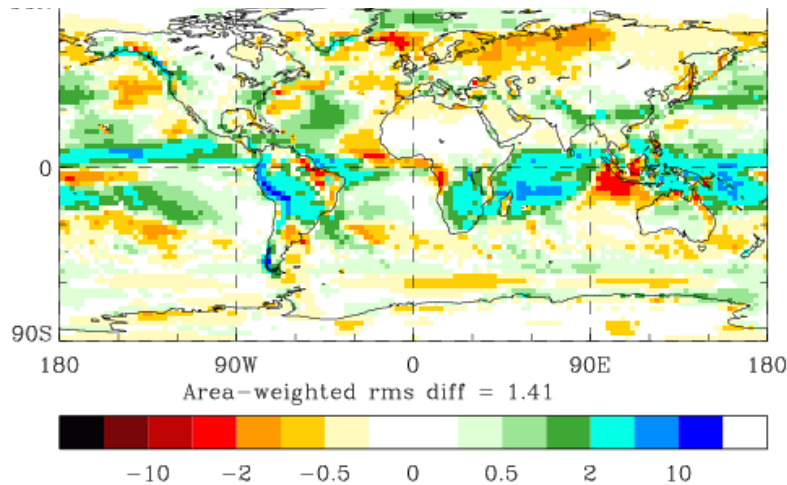


RCM - 60-90km HadGEM3 GCM



Bias v. CMAP:

60-90km HadGEM3 GCM



50km HadGEM3 RCM

