Observed drying and projected wettening in the Greater Horn of Africa area

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Conference on „French-German cooperation in Africa in the field of climate change, food security & water resources"

Session 1: Climate change in sub-Saharan Africa.
The physical basis and challenges

01 - 02 June 2015, French Embassy, Berlin, Germany

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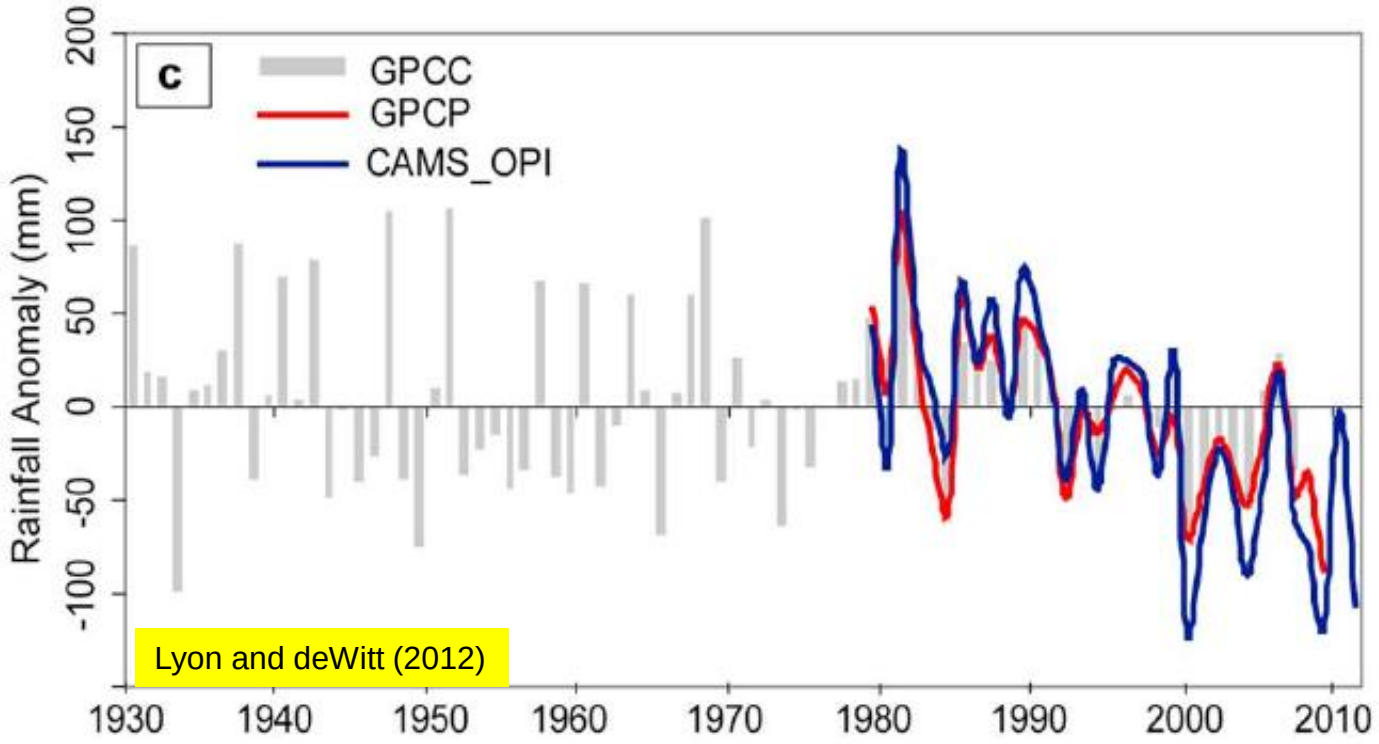
GlobE Wetlands in East Africa

Outline

1. Recent abrupt decline of East African Long Rains
2. How well did models predict/hindcast the decline?
3. The “wet-gets-wetter” paradigm – applicable for equatorial East Africa?
4. How well do we observe regional rainfall trends
5. Future pathways

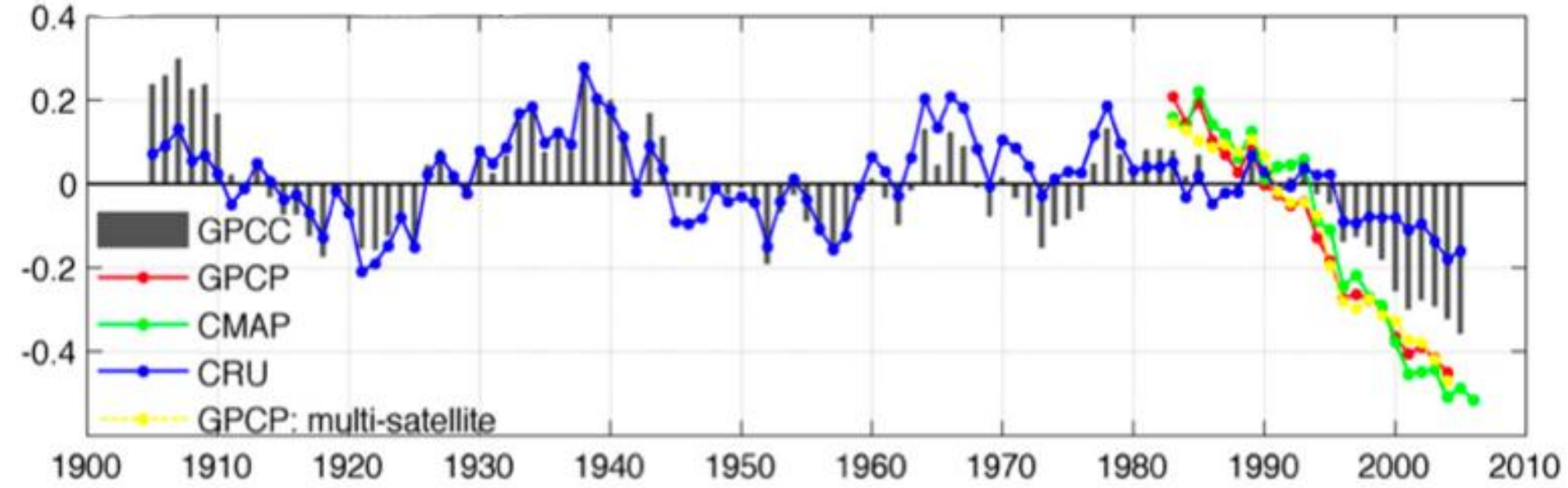
Recent drying trend in Long Rains



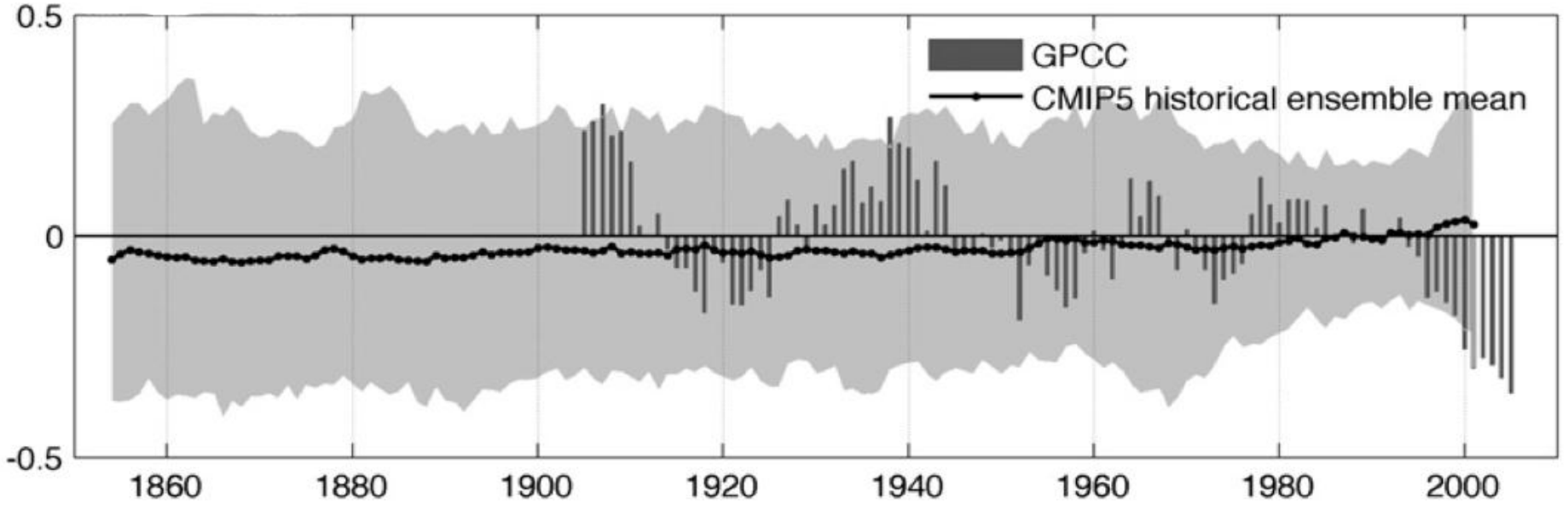
Long Rains: March – October Short Rains: October - December

- The more important Long Rains show a strong decline since the 1980s
- Forecasted La Niña-related failure of Short Rains und unforeseen absence of Long Rains in 2010-2011 caused a humanitarian crisis

Observed & simulated trends in Long Rains

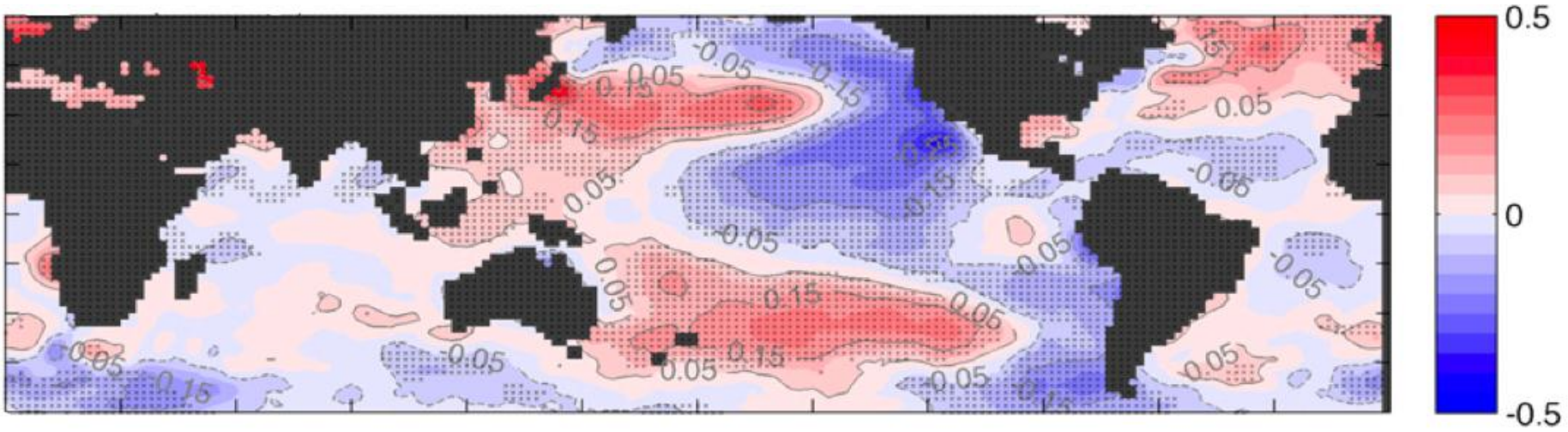


Yang et al. (2014)



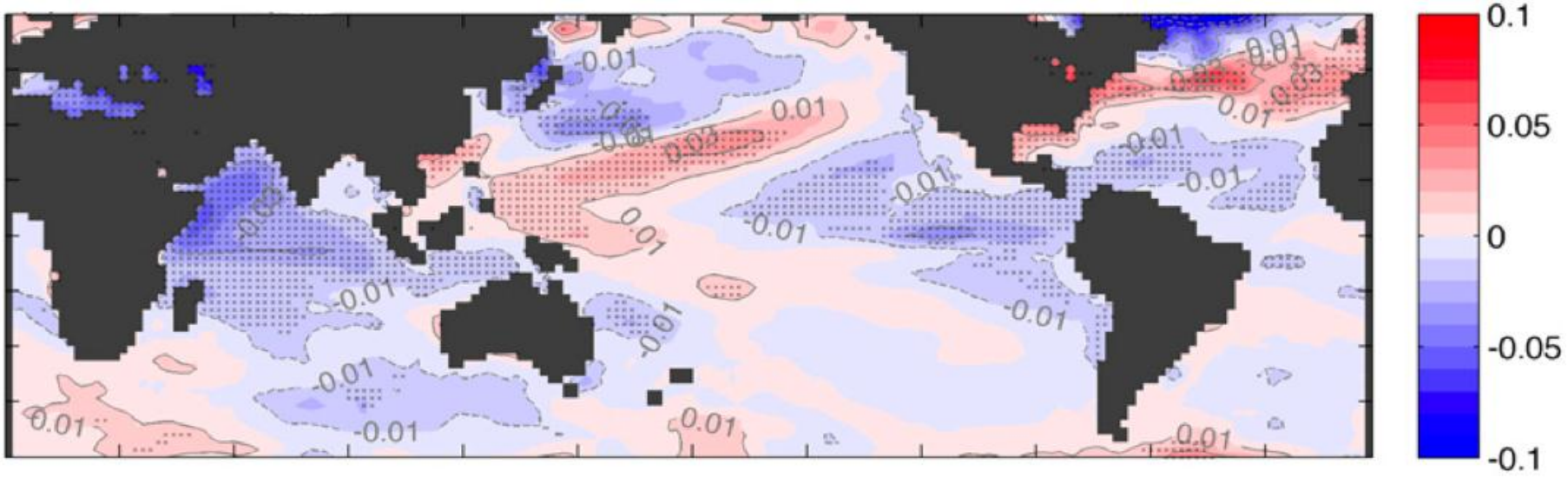
Observ.& simulated ocean temperatures for dry LR

Observed

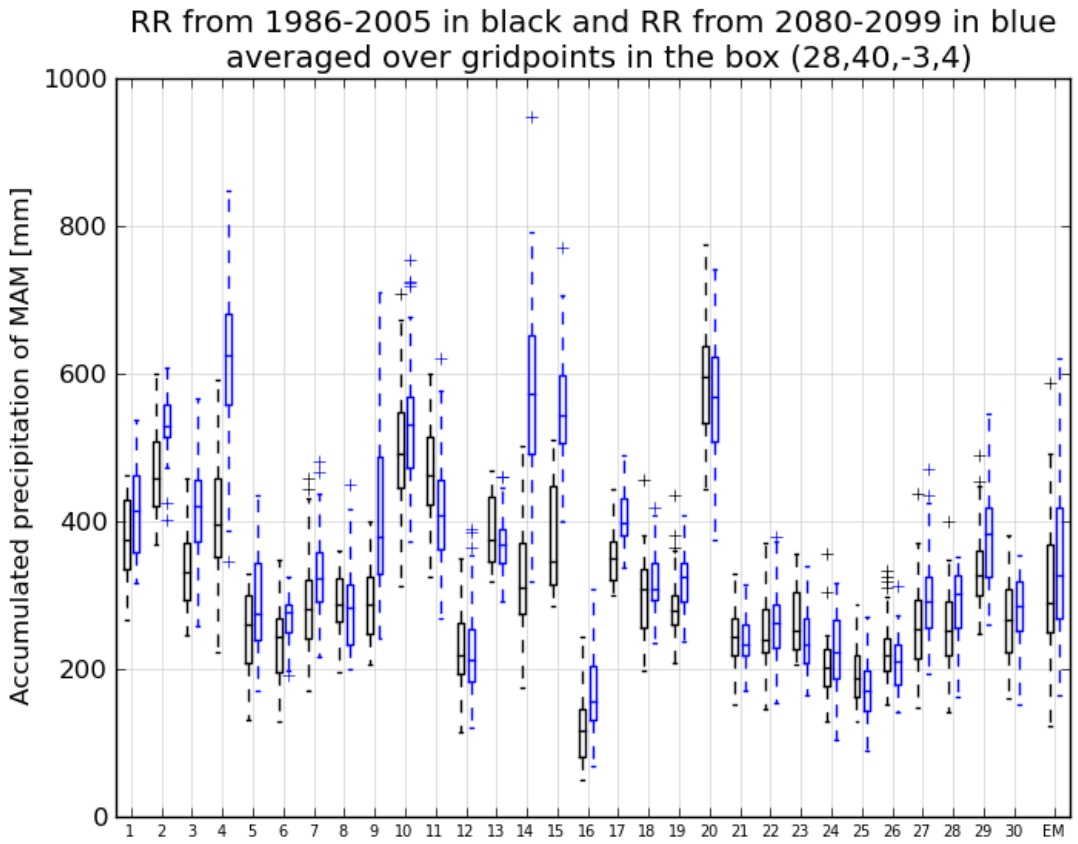


CMIP5 fully coupled

Yang et al. (2014)



The “wet-gets-wetter” paradigm, CMIP5 Long Rains



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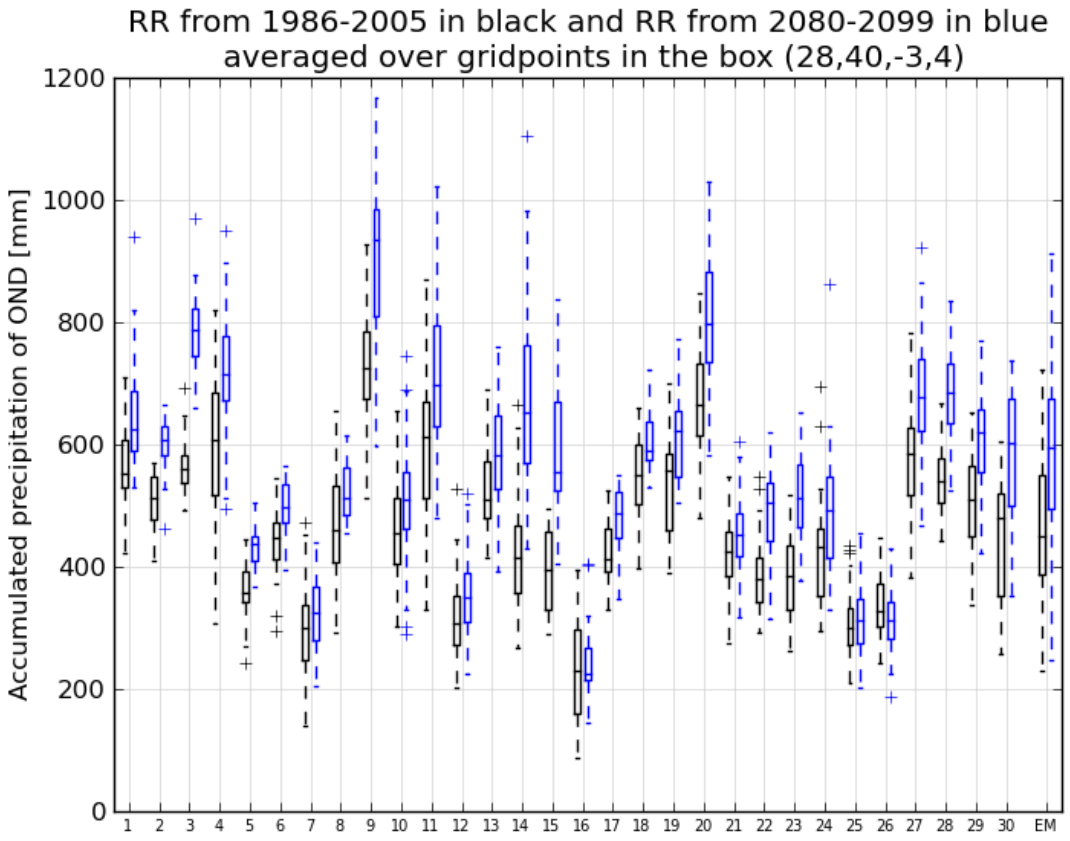
- Large inter-model variations in total rainfall -> bias correction mandatory
- Ensemble-mean shows slight wettening at the end of this century

The “wet gets wetter” paradigm, CMIP5 Short Rains



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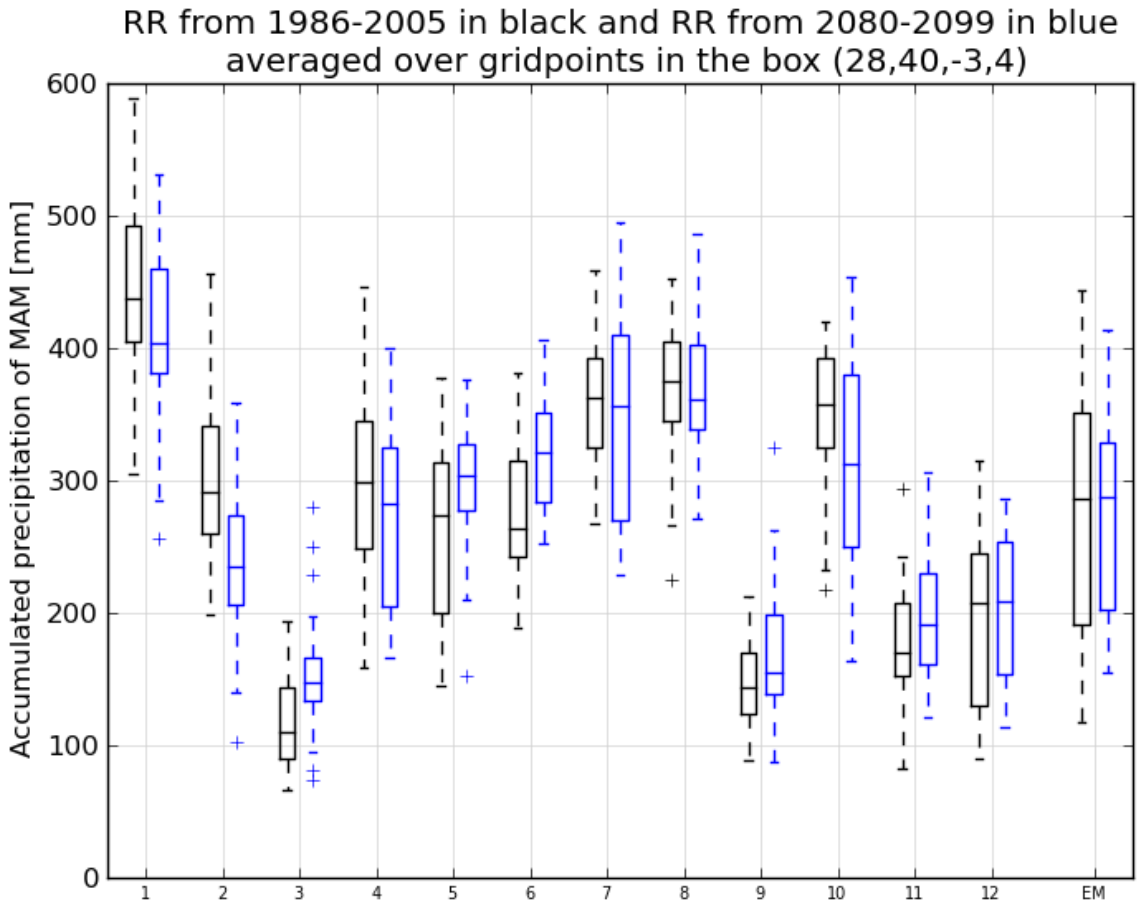
- Ensemble-mean shows wettening until the end of this century
- Wettening well-understood from simulated changes in water temperatures of the Indian Ocean

The “wet gets wetter” paradigm, CORDEX Long Rains



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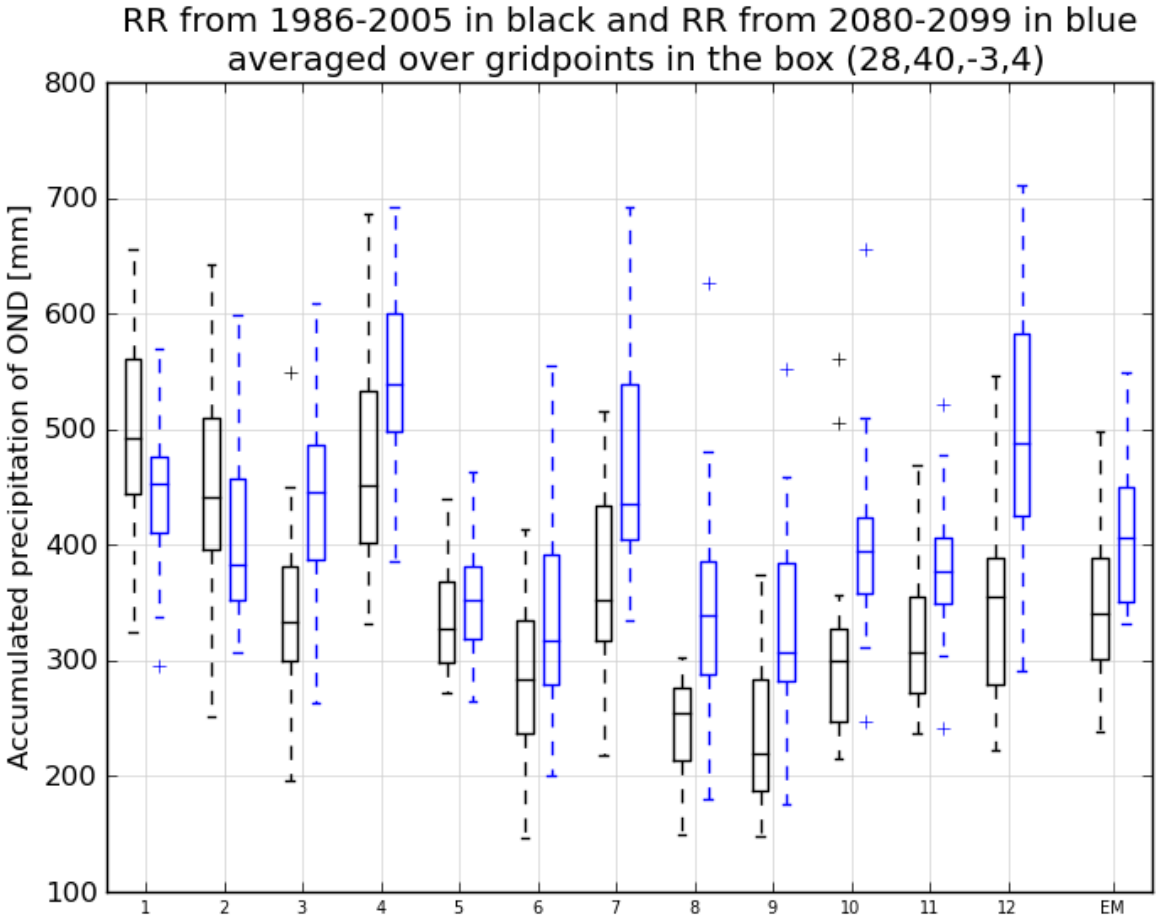
- Regional Climate Models do not show wetter Long Rains
- Several realizations event show a drying

The “wet gets wetter” paradigm, CORDEX Short rains



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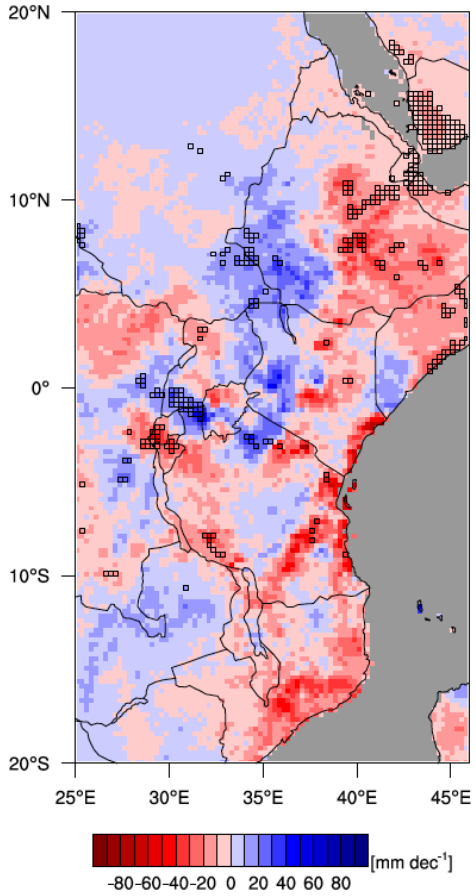
- Regional Climate Models do show wetter Short Rains
- But some realizations event show a drying

Consequences of CMIP5 + CORDEX results

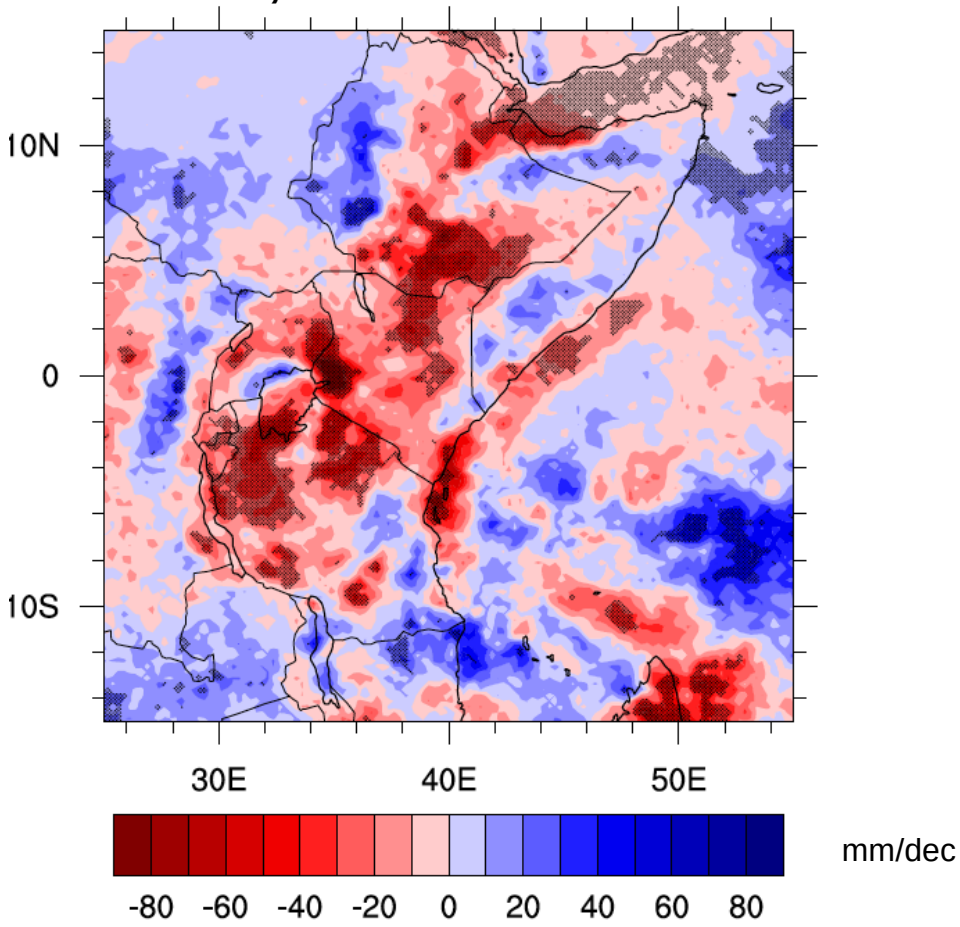
Impact studies must consider both wetter and drier futures, definitely for the long rains.

The observational uncertainty, Long Rains

CHIRP/S data set trend, 1983-2014



Persiann CDR data set trend, 1983-2014



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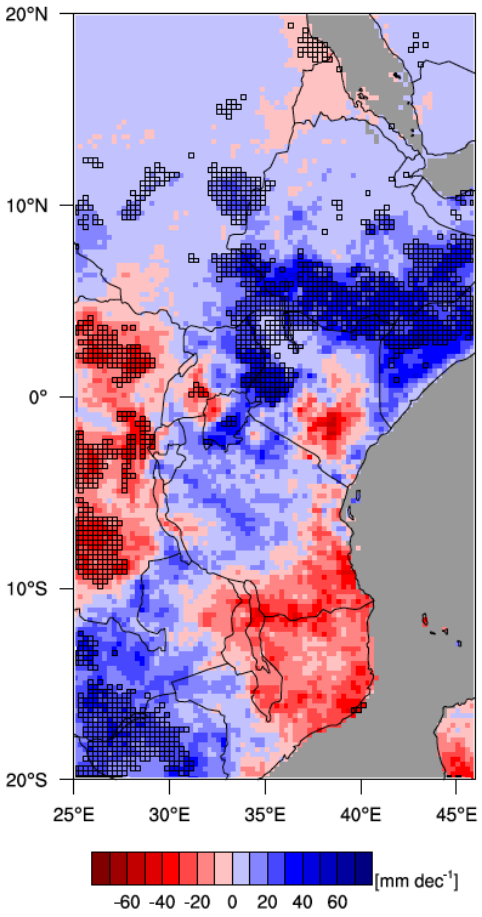
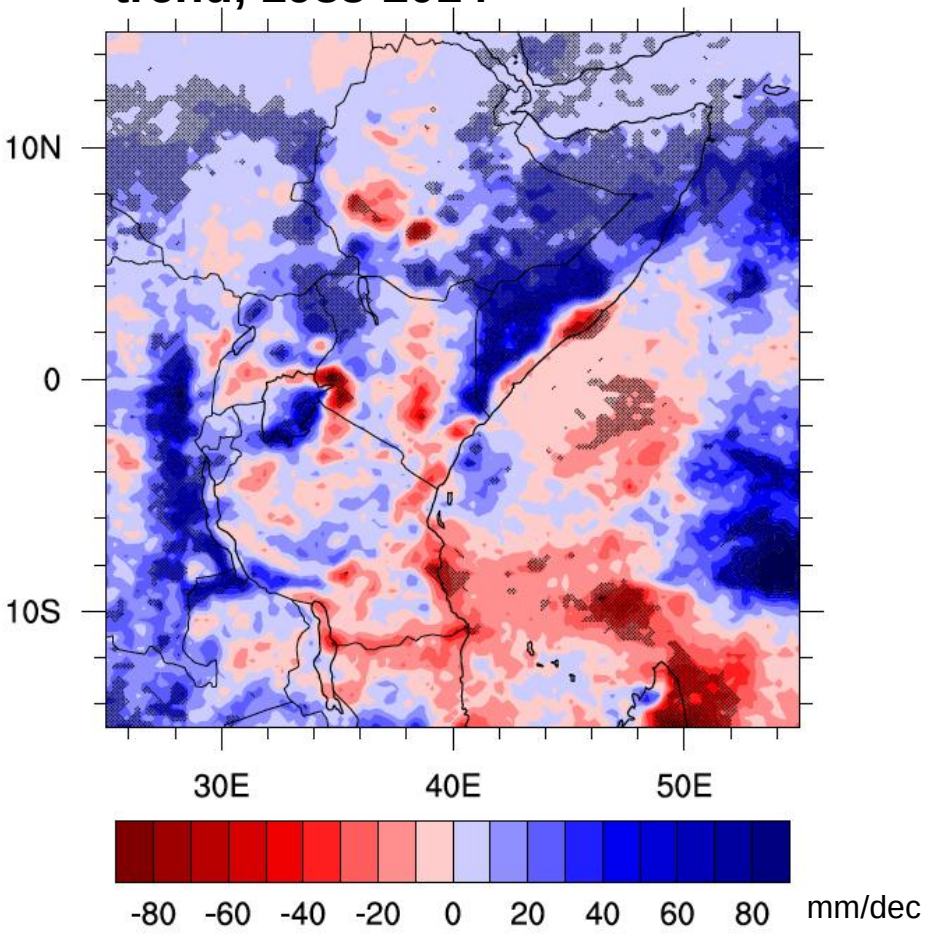
The observational uncertainty, Short Rains

CHIRP/S data set trend, 1983-2014



Persiann CDR data set trend, 1983-2014



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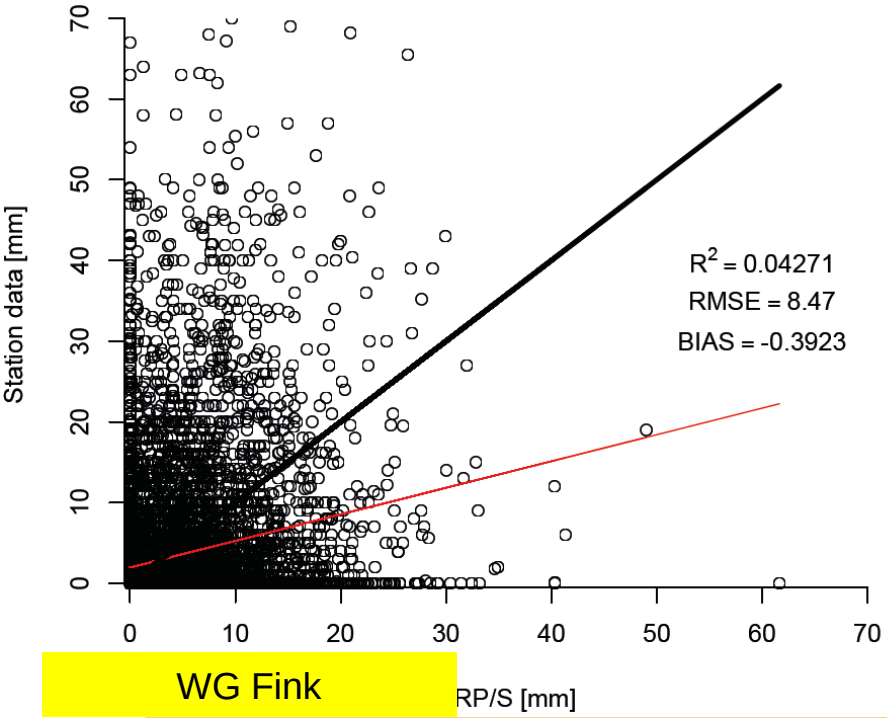
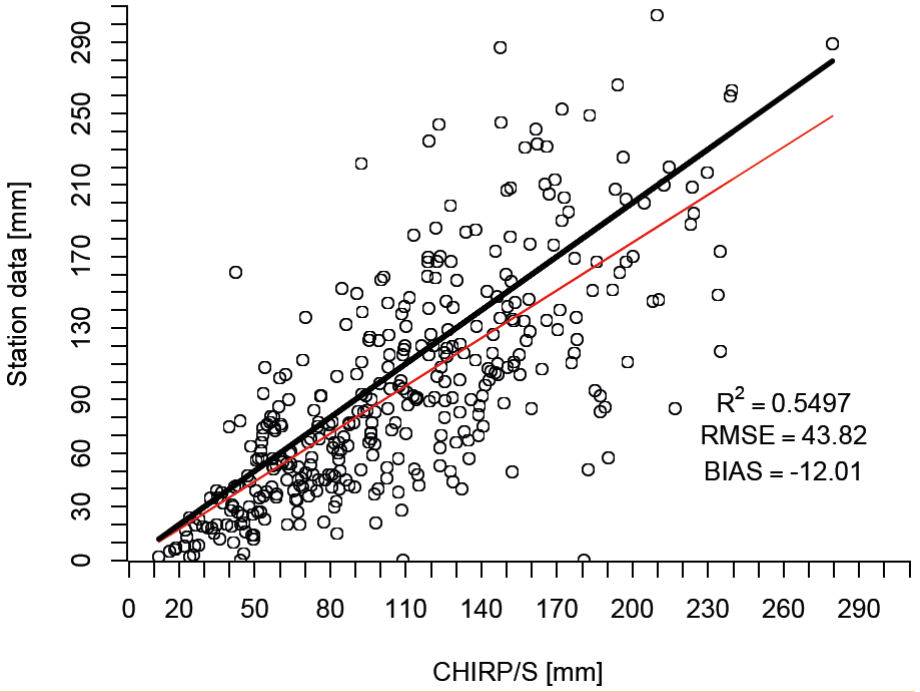
Station rainfall at Namulonge (Uganda) vs. CHIRP/S

Daily, 1983-2014



Monthly, 1983-2014



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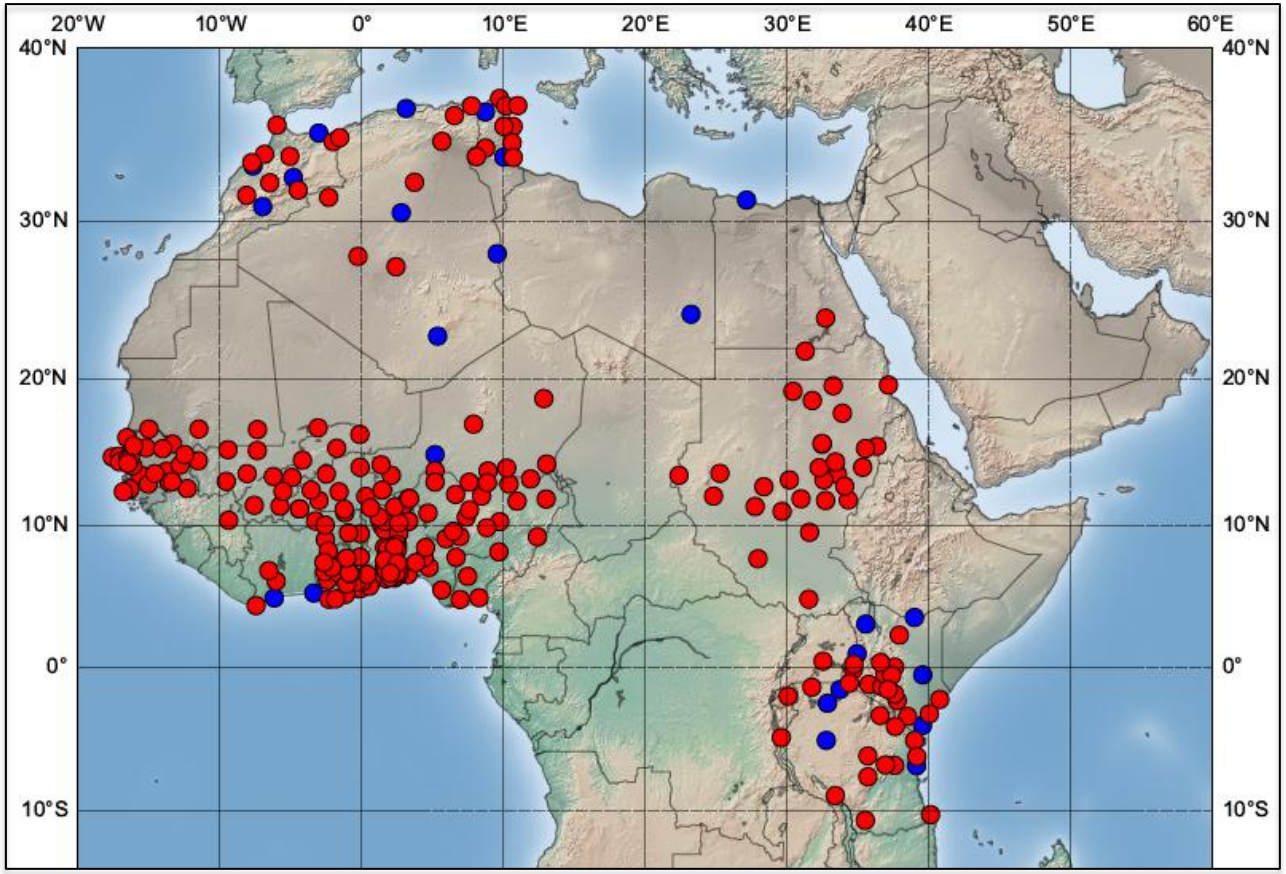
- Irrespective of the problem of comparing a point measurement with an 28x28 km2 grid: Daily extreme events are smoothed out in almost all satellite-only or blended gridded rainfall data sets

Observational uncertainty, 1980-2012



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- **Red dots**: > 80% daily rainfall data availability in KIT data base
- **Blue dots**: GHCN daily data base based on reports in the worldwide network

Data rescue efforts and degrading station network

Future pathways

1. Efforts into data rescue, into the establishment of an African data centre & sustainable observation network.

   -> SASSCAL/WASCAL is partly doing this, not for East Africa

2. Enhance process-understanding based on a more solid ground and upper-air database.

3. Use adaptive high-resolution grid models (Arpege, ICON) to allow for convection-permitting modelling.

4. Challenge models with observed processes known to be pertinent to rainfall.

   -> the UK Impala project is currently paving the way