

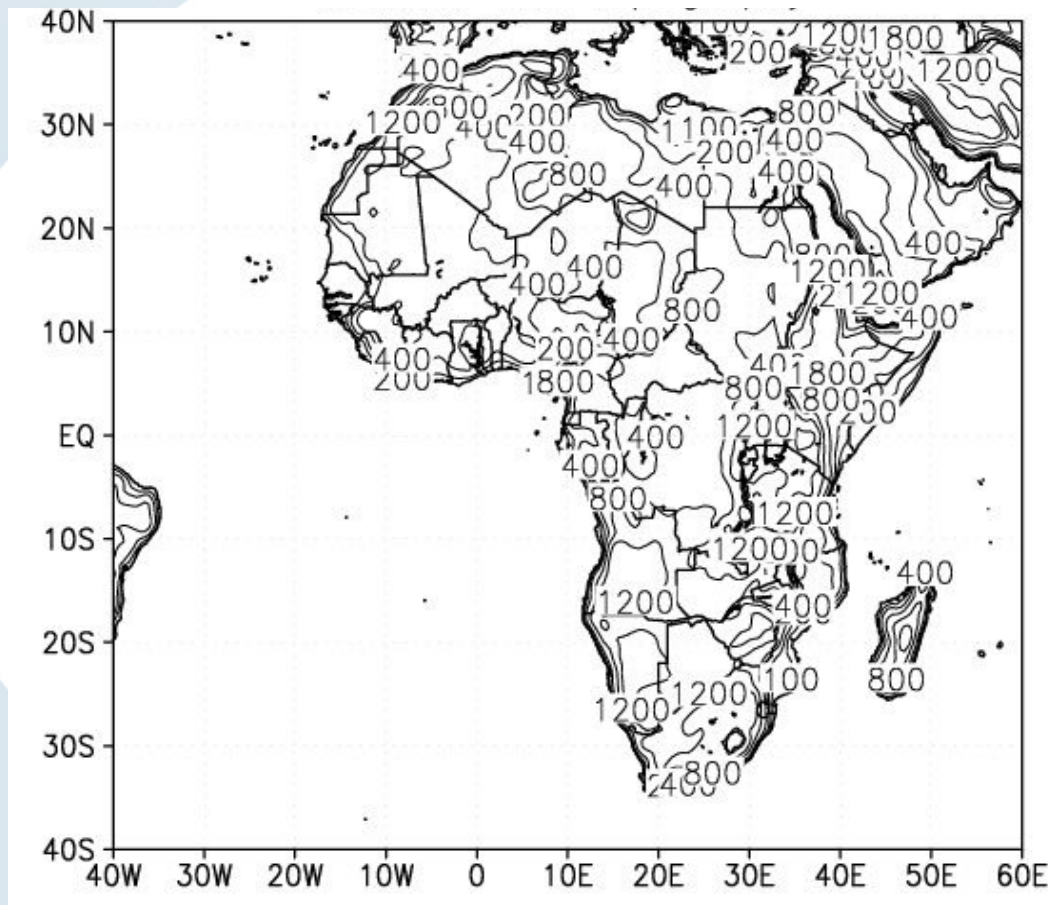
**Seventh ICTP Workshop on
the Theory and Use of Regional Climate Models
Trieste - Italy, 12-23 May 2014**

**Seasonal and intraseasonal changes of
African monsoon climates in 21st century
CORDEX projections**

L. Mariotti, I. Diallo, E. Coppola and F. Giorgi
mariotti@ictp.it

- **Simulation configuration**
- **Assessment of the reference period**
- **Change signal in monsoon patterns**
- **Conclusions**

- **Simulation configuration**
- Assessment of the reference period
- Change signal in monsoon patterns
- Conclusions



X grid 240 ; Y grid 250

**spatial resolution of 50
km**

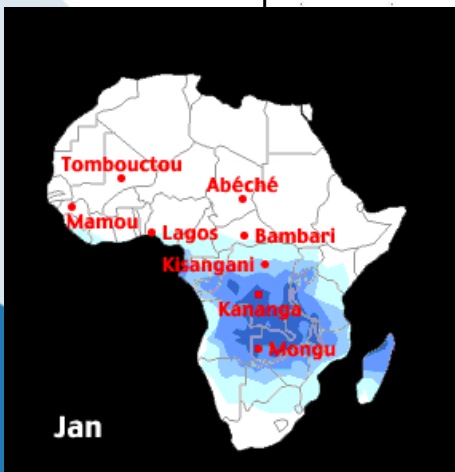
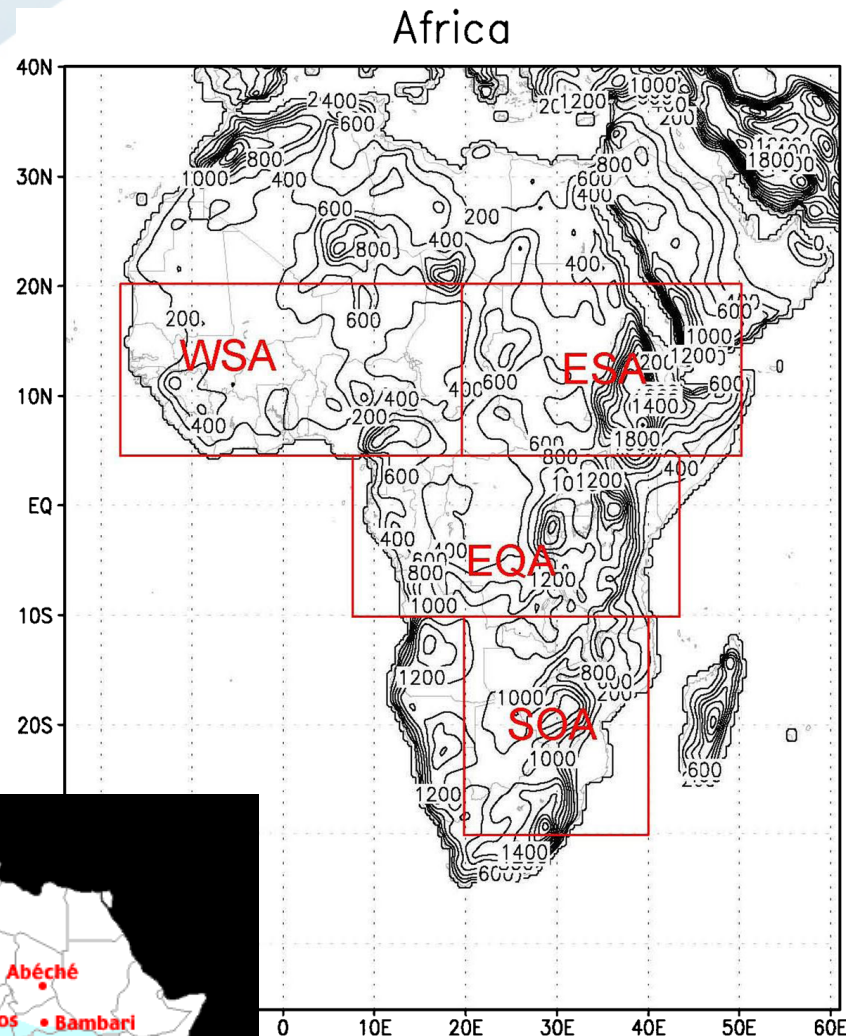
**3 scenario simulations
from 1970 up to 2100**

- ▶ **MPI-GCM RCP8.5**
- ▶ **Hadgem-GCM RCP4.5**
- ▶ **Hadgem-GCM RCP8.5**

Reference period
(1976-2005)

2 RCMs (CLM, BATS,

- Simulation configuration
- **Assessment of the reference period**
- Change signal in monsoon patterns
- Conclusions



**spatial resolution of 50
km**

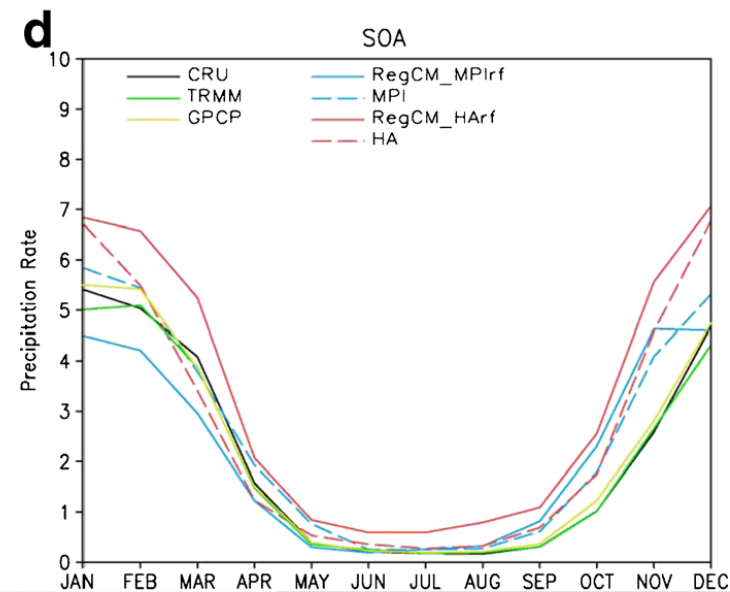
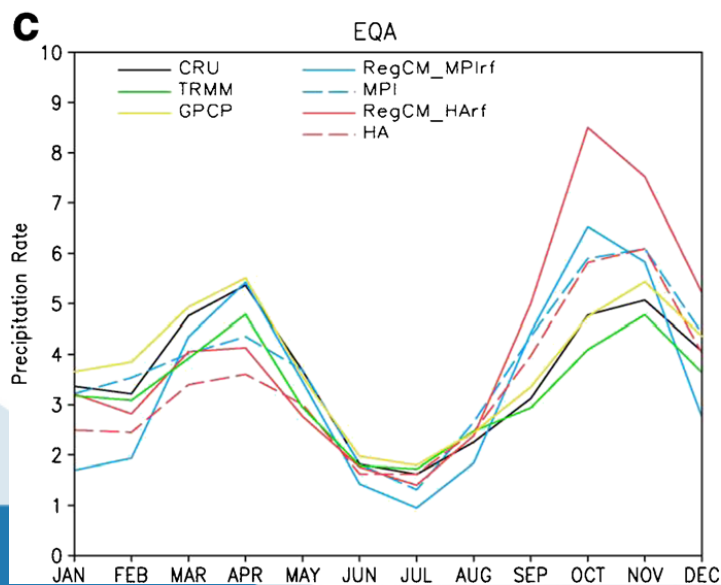
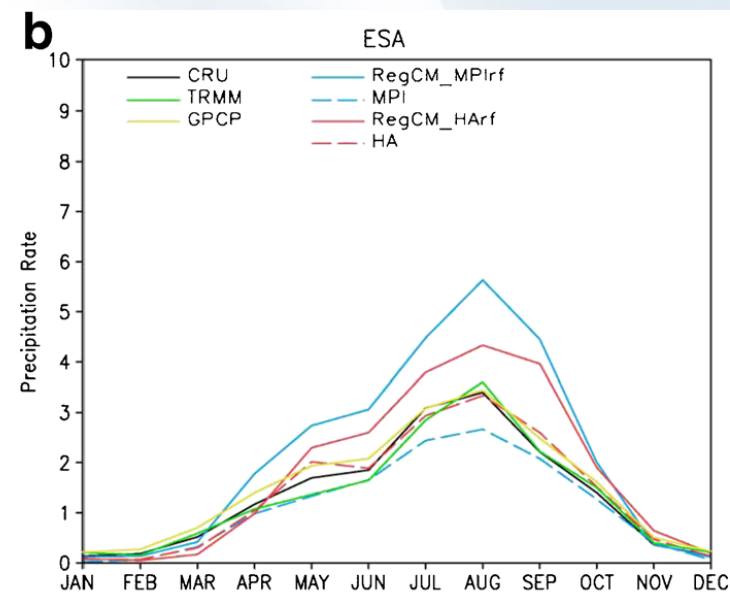
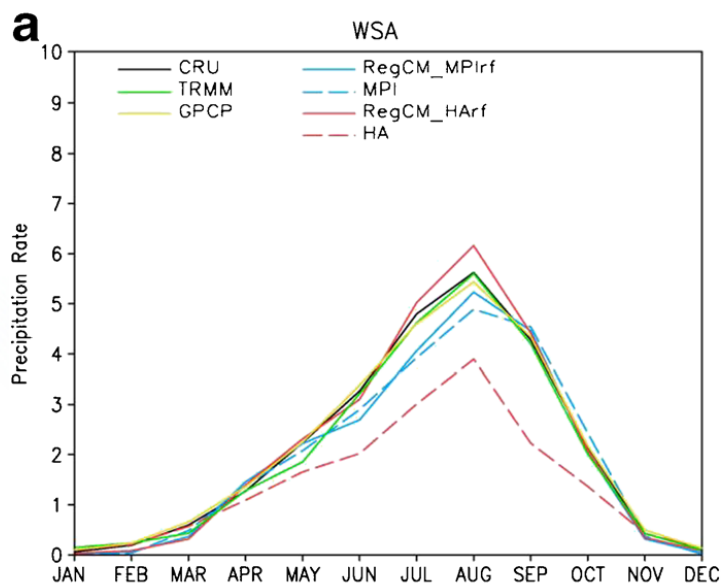
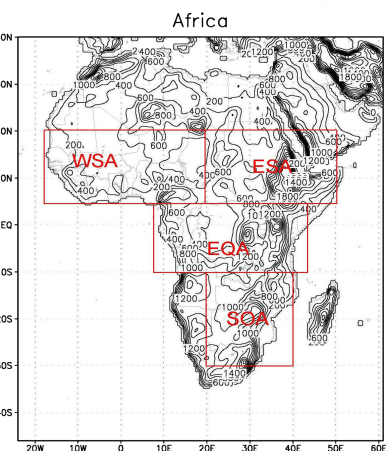
**3 scenario simulations
from 1970 up to 2100**

- ▶ **MPI-GCM RCP8.5**
- ▶ **Hadgem-GCM RCP4.5**
- ▶ **Hadgem-GCM RCP8.5**

Reference period
(1976-2005)

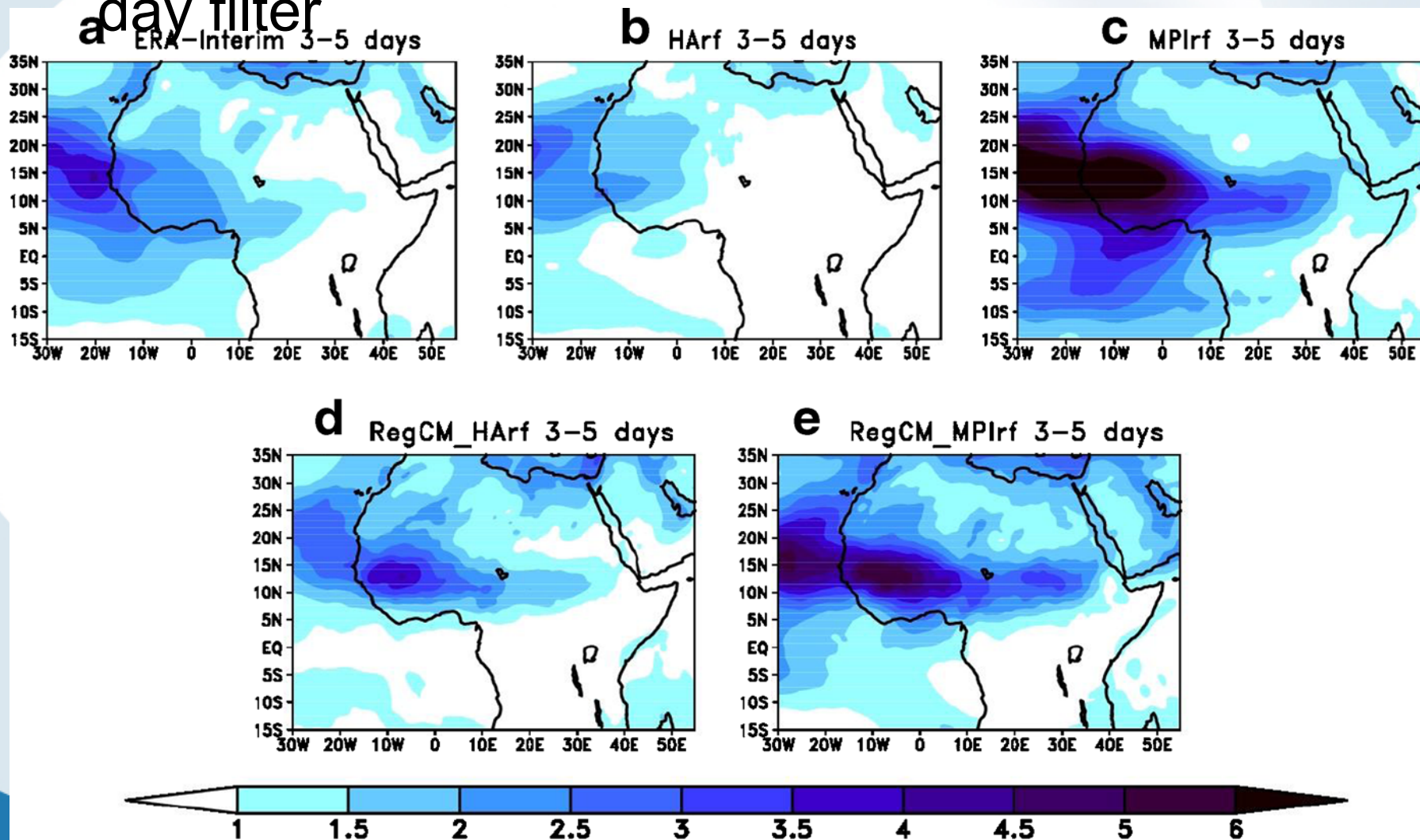
2 RCMs (CLM, BATS,

Precipitation annual cycle (Ref: 1070-0007)



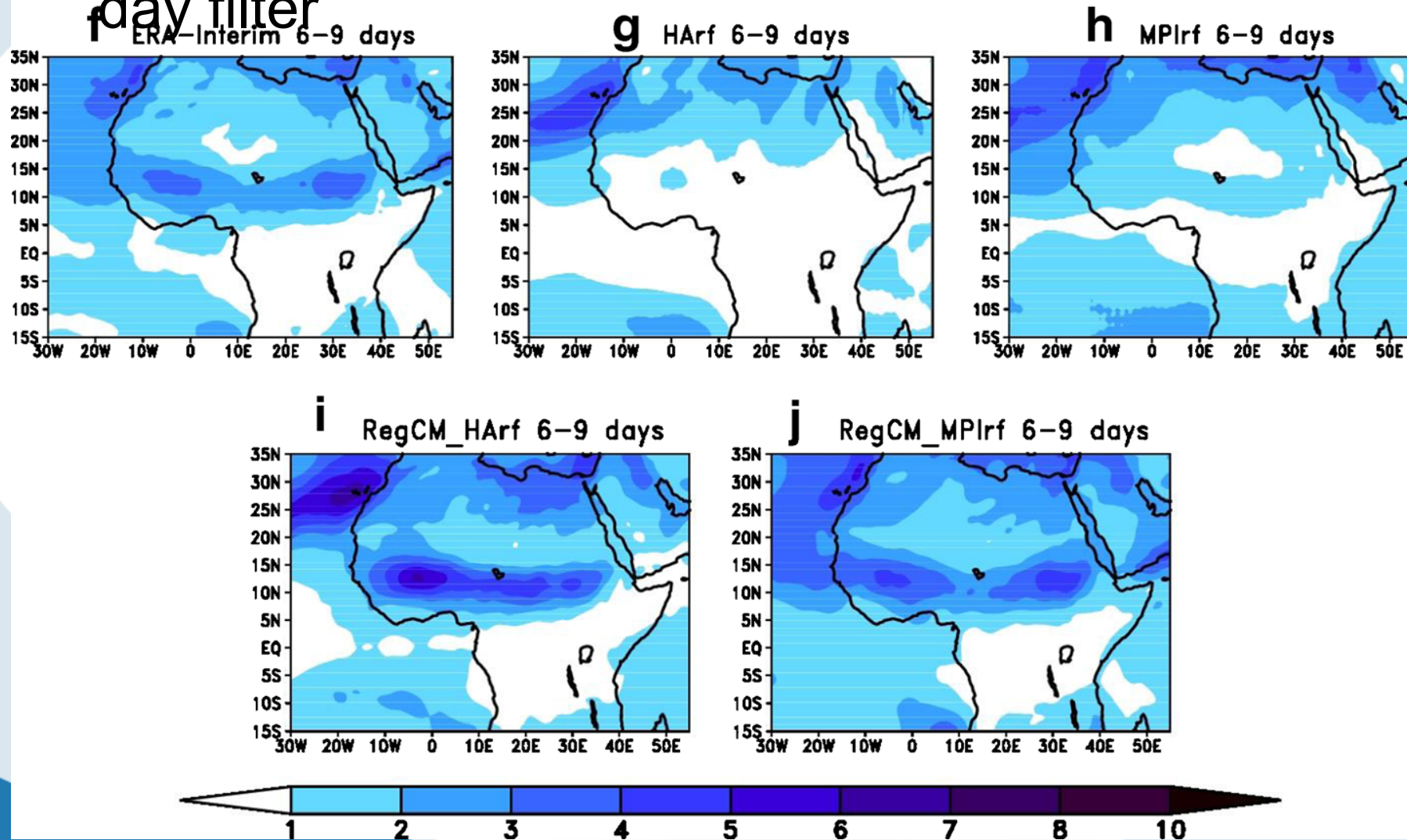
Variance in 700hPa meridional wind, JJA, 3-5

day filter



Variance in 700hPa meridional wind, JJA, 6-9

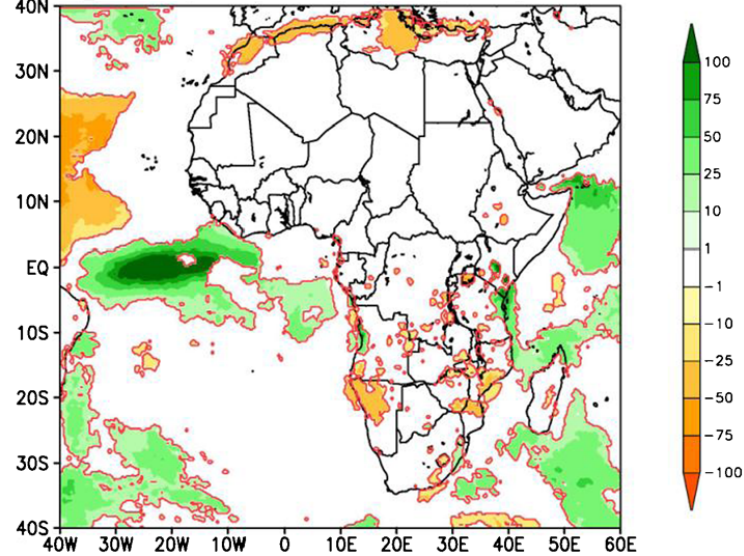
day filter



- Simulation configuration
- Assessment of the reference period
- **Change signal in monsoon patterns**
- Conclusions

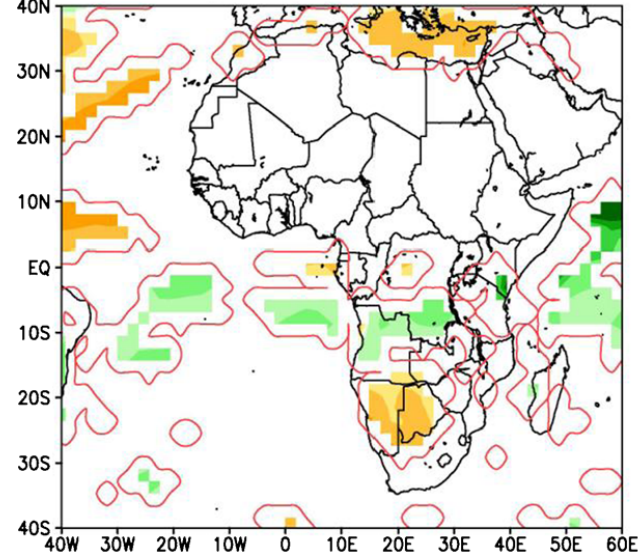
Precipitation change DJF

RegCM_MPI85 (2070/2099)-(1976/2005) DJF PRE %



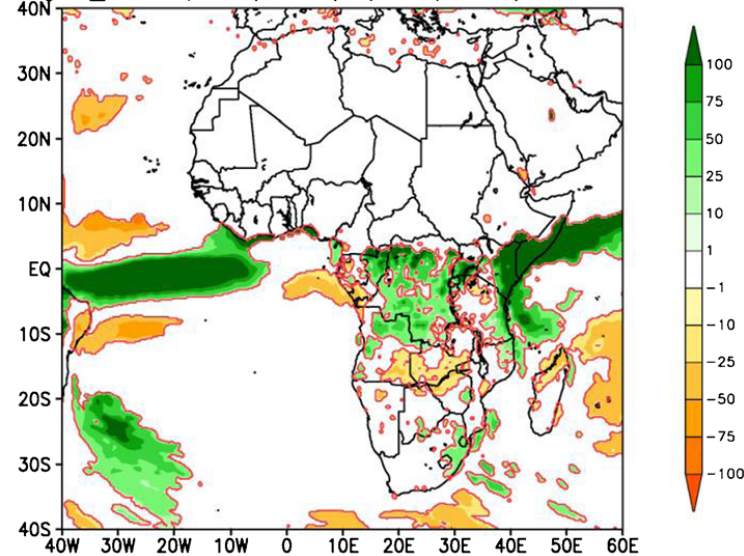
a

MPI85 (2070/2099)-(1976/2005) DJF PRE %



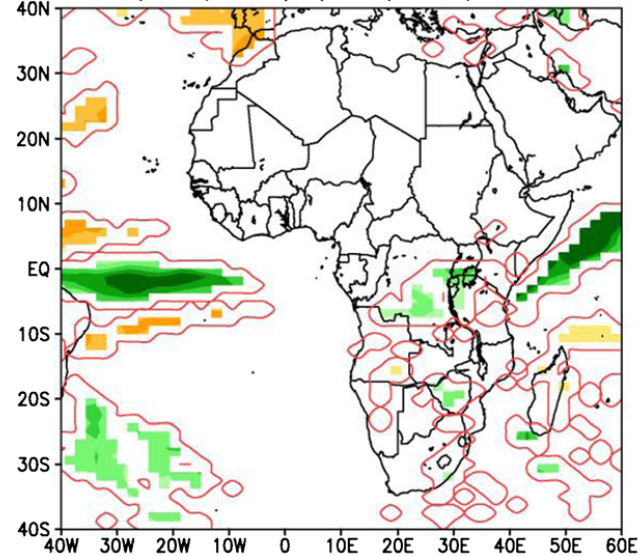
b

RegCM_HA85 (2070/2099)-(1976/2005) DJF PRE %



c

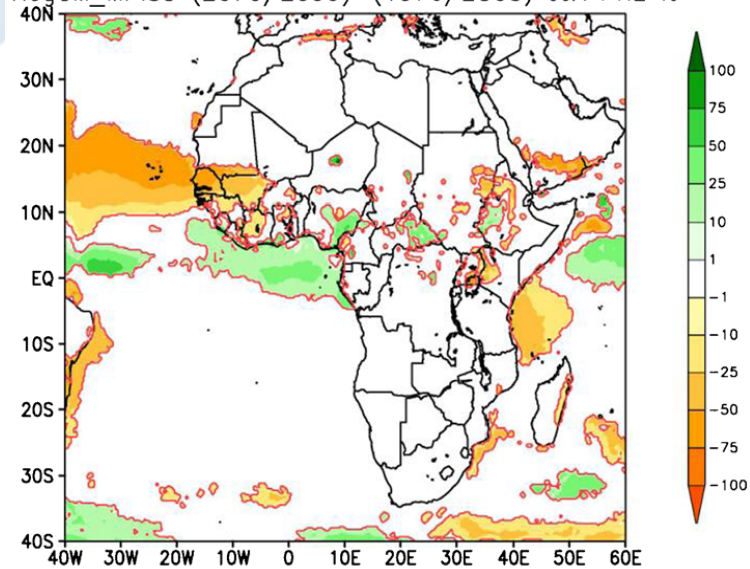
HA85 (2070/2099)-(1976/2005) DJF PRE %



d

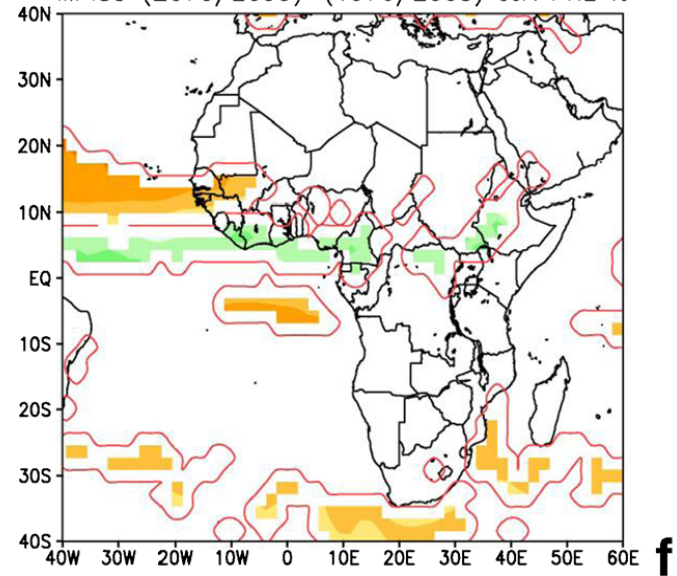
Precipitation change JJA

RegCM_MPI85 (2070/2099)-(1976/2005) JJA PRE %



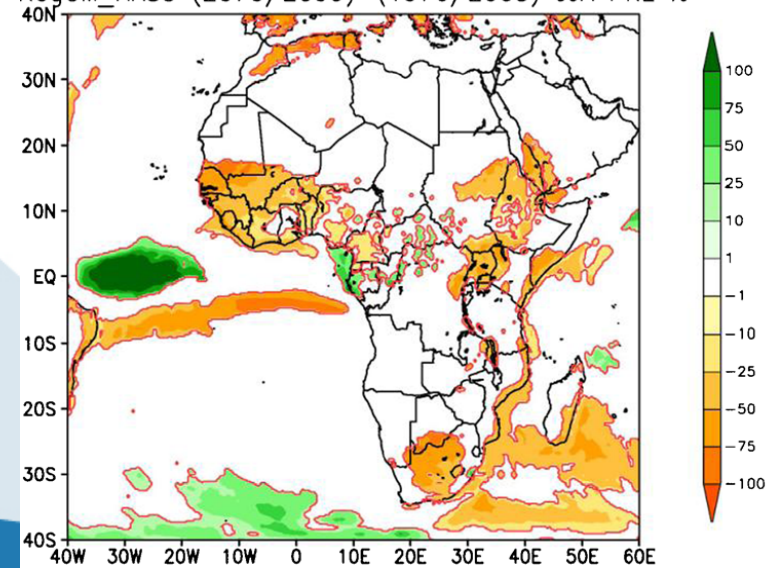
e

MPI85 (2070/2099)-(1976/2005) JJA PRE %



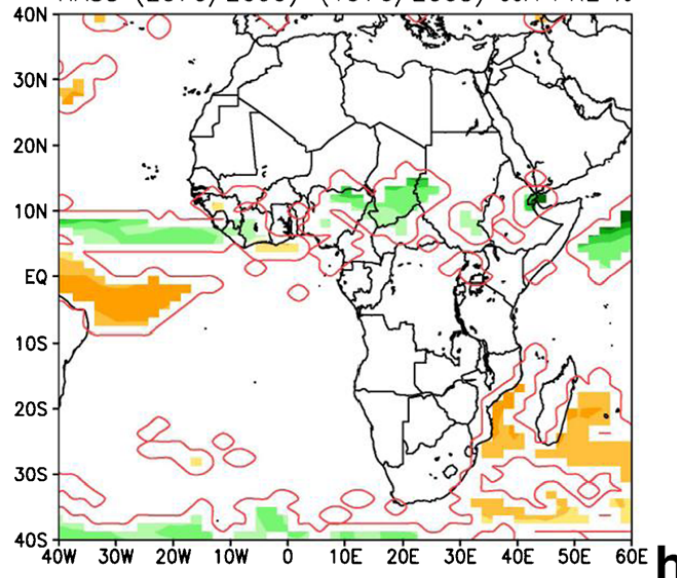
f

RegCM_HA85 (2070/2099)-(1976/2005) JJA PRE %



g

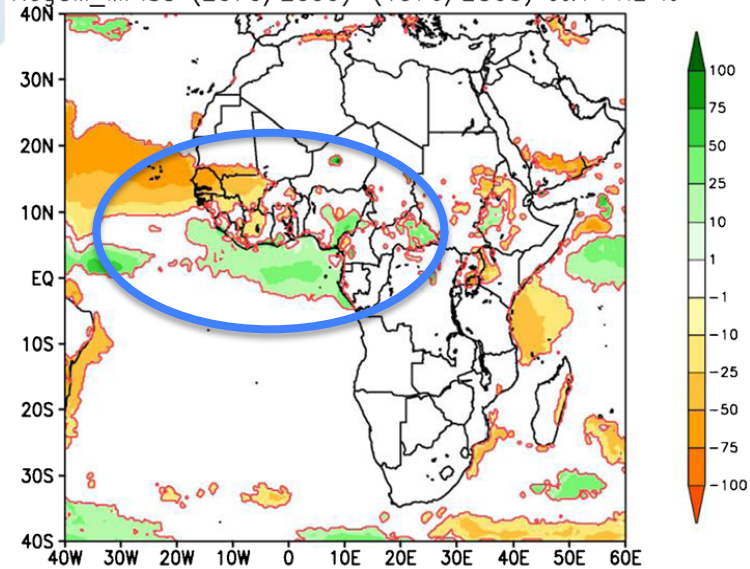
HA85 (2070/2099)-(1976/2005) JJA PRE %



h

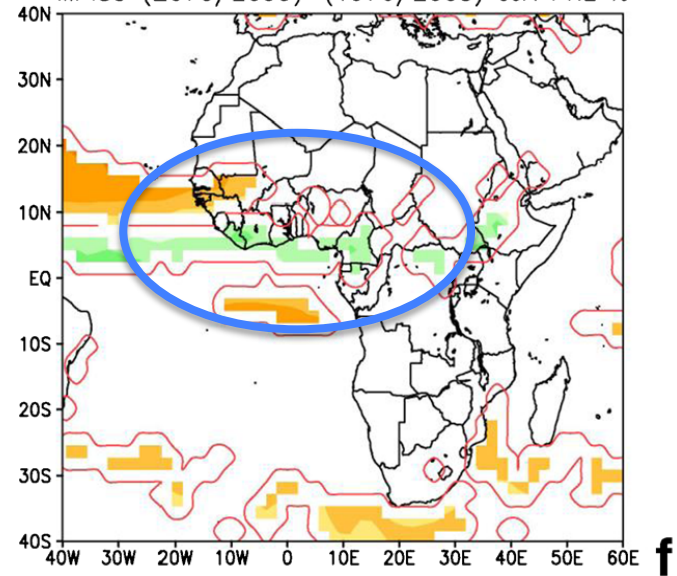
Precipitation change JJA

RegCM_MPI85 (2070/2099)-(1976/2005) JJA PRE %



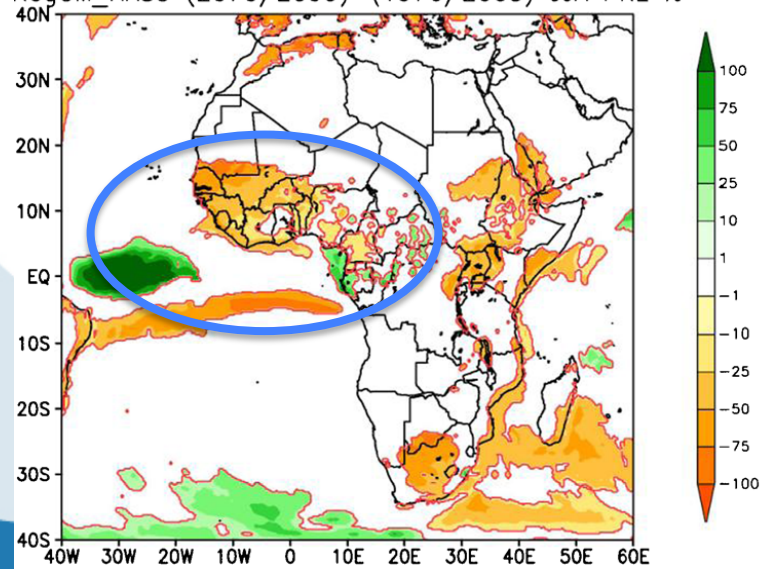
e

MPI85 (2070/2099)-(1976/2005) JJA PRE %



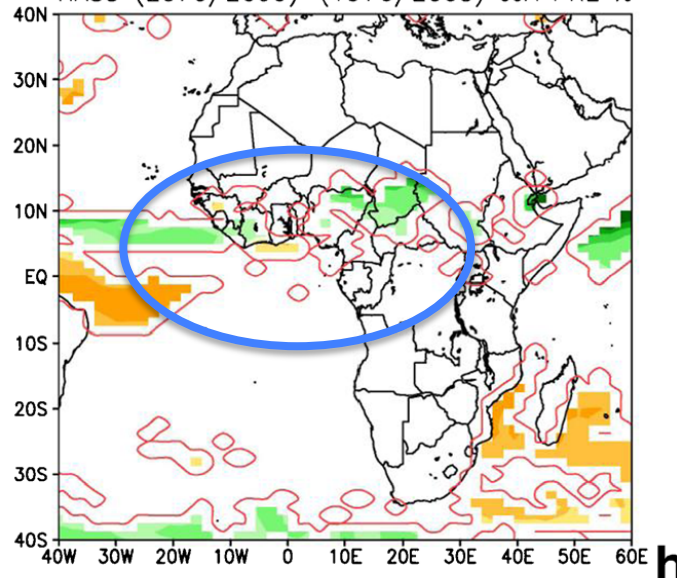
f

RegCM_HA85 (2070/2099)-(1976/2005) JJA PRE %



g

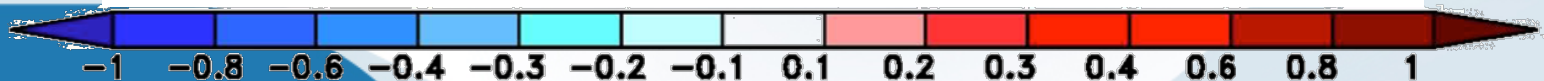
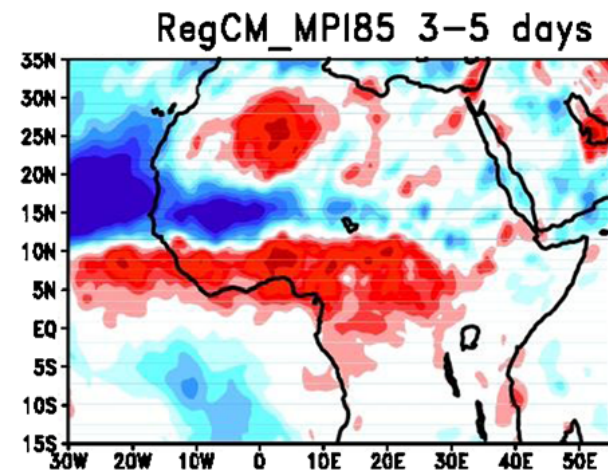
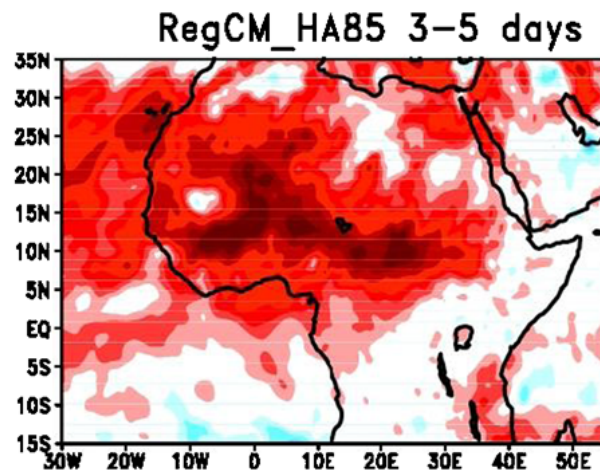
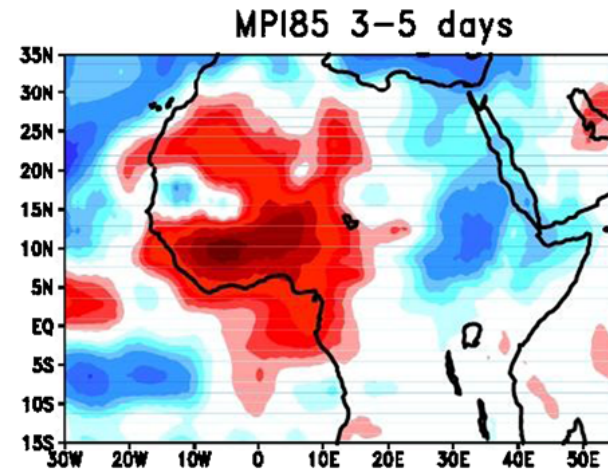
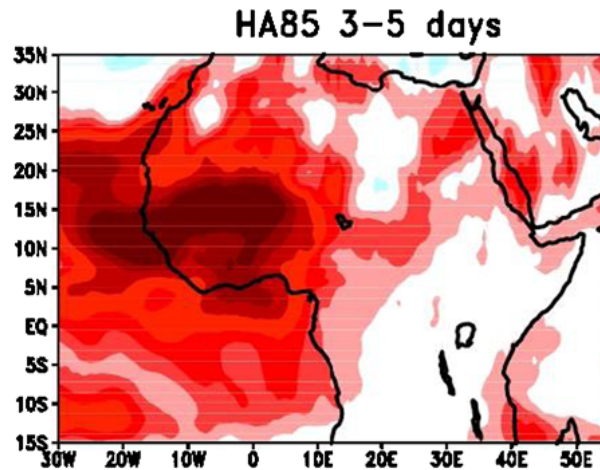
HA85 (2070/2099)-(1976/2005) JJA PRE %



h

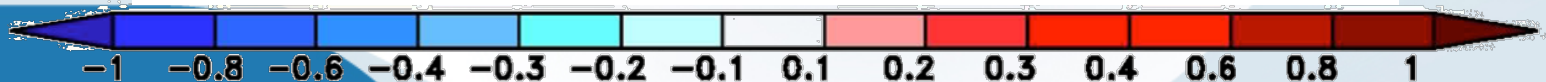
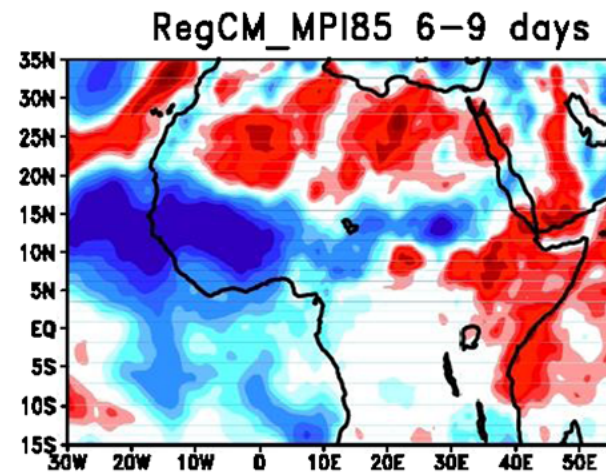
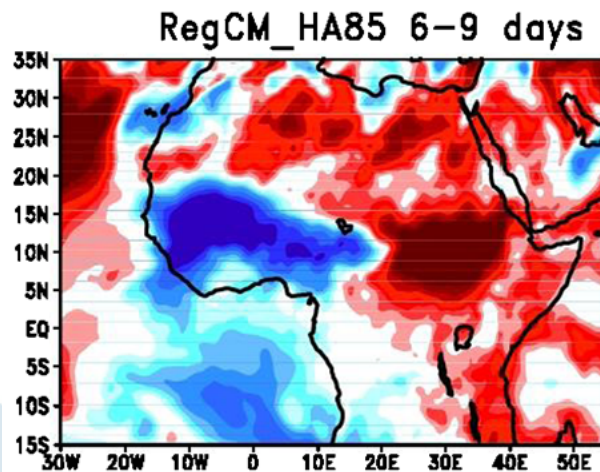
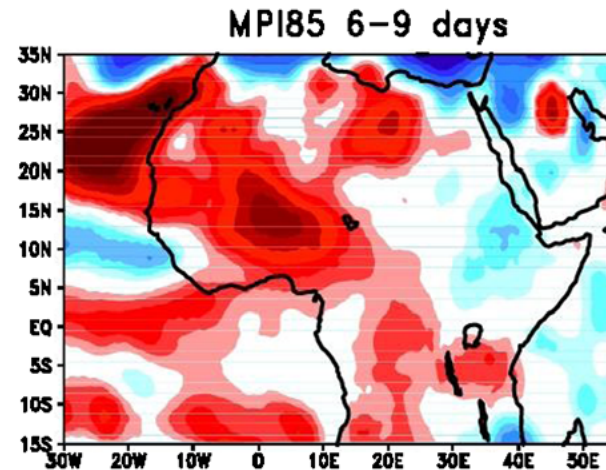
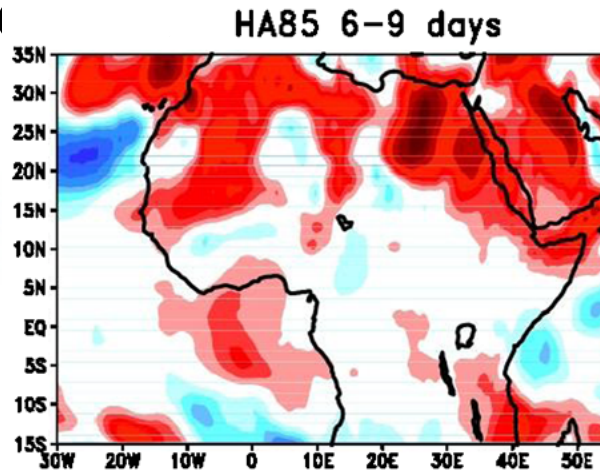
Change AEWs activity

Variance in 700hPa meridional wind, JJA, 3-5 day fil



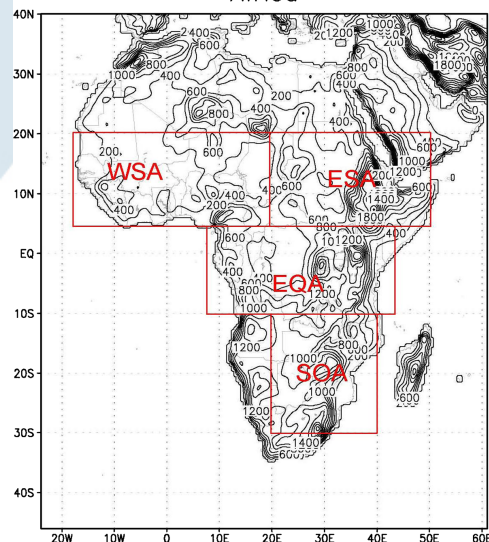
Change AEWs activity

Variance in 700hPa meridional wind, JJA, 6-7 day filter

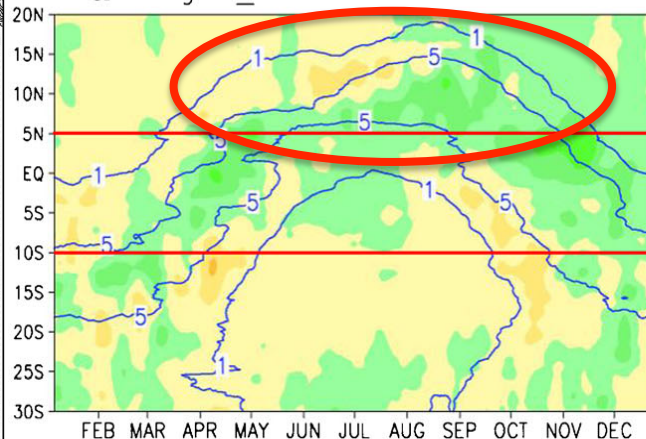


Hovmöller diagram

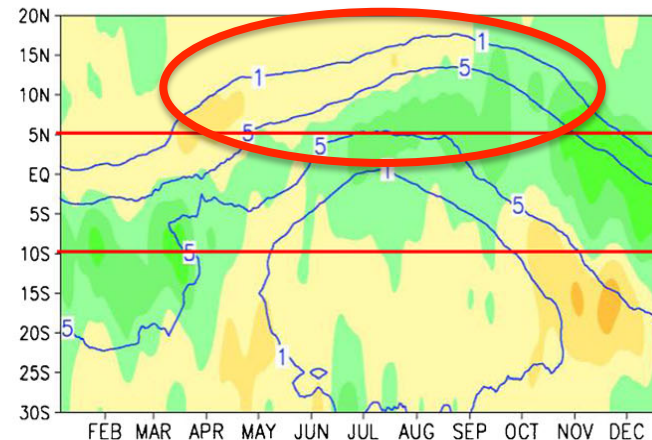
Africa



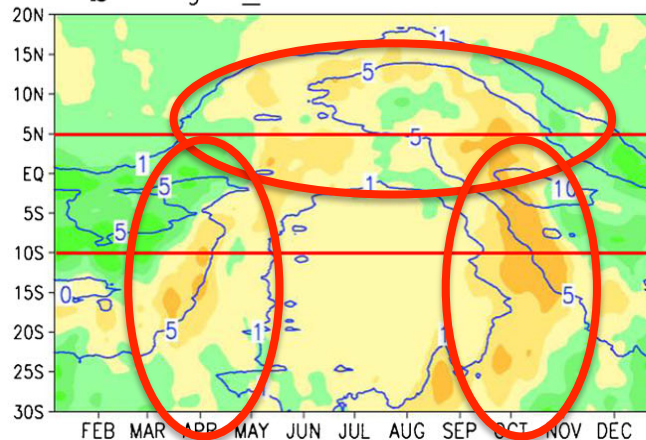
a RegCM_MPI85 Africa 2070–2099



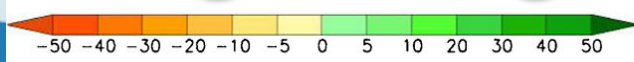
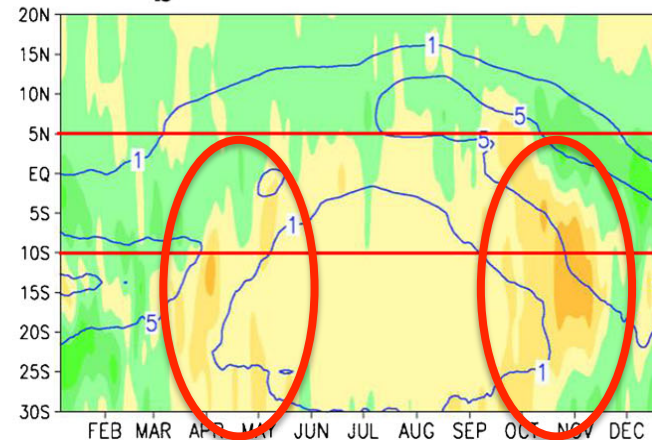
a MPI85 Africa 2070–2099



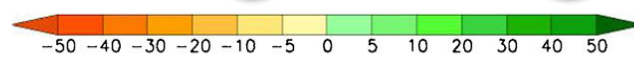
b RegCM_HA85 Africa 2070–2099



b HA85 Africa 2070–2099



a



b

- A set of 21st century projections has been conducted over the Africa CORDEX domain driven by the HadGEM and MPI GCMs for the RCP8.5 and RCP4.5 GHG concentration scenario.
- The models simulate realistic monsoon seasonal evolution and patterns of wave activity associated with monsoon rain, with the regional model improving considerably the pattern of AEWs activity compared to the driving GCMs.
- Over West Africa and the Sahel the MPI GCM simulates a forward shift of the monsoon season, while the HadGEM has a more mixed change signal.

The nested RegCM4 also simulates this shift (when driven by MPI) but also projects a more widespread decrease in precipitation throughout the monsoon season mostly associated with a reduction of AEWs activity in the 6–9 days regime and to the soil-precipitation feedback discussed by Mariotti et al. (2011).

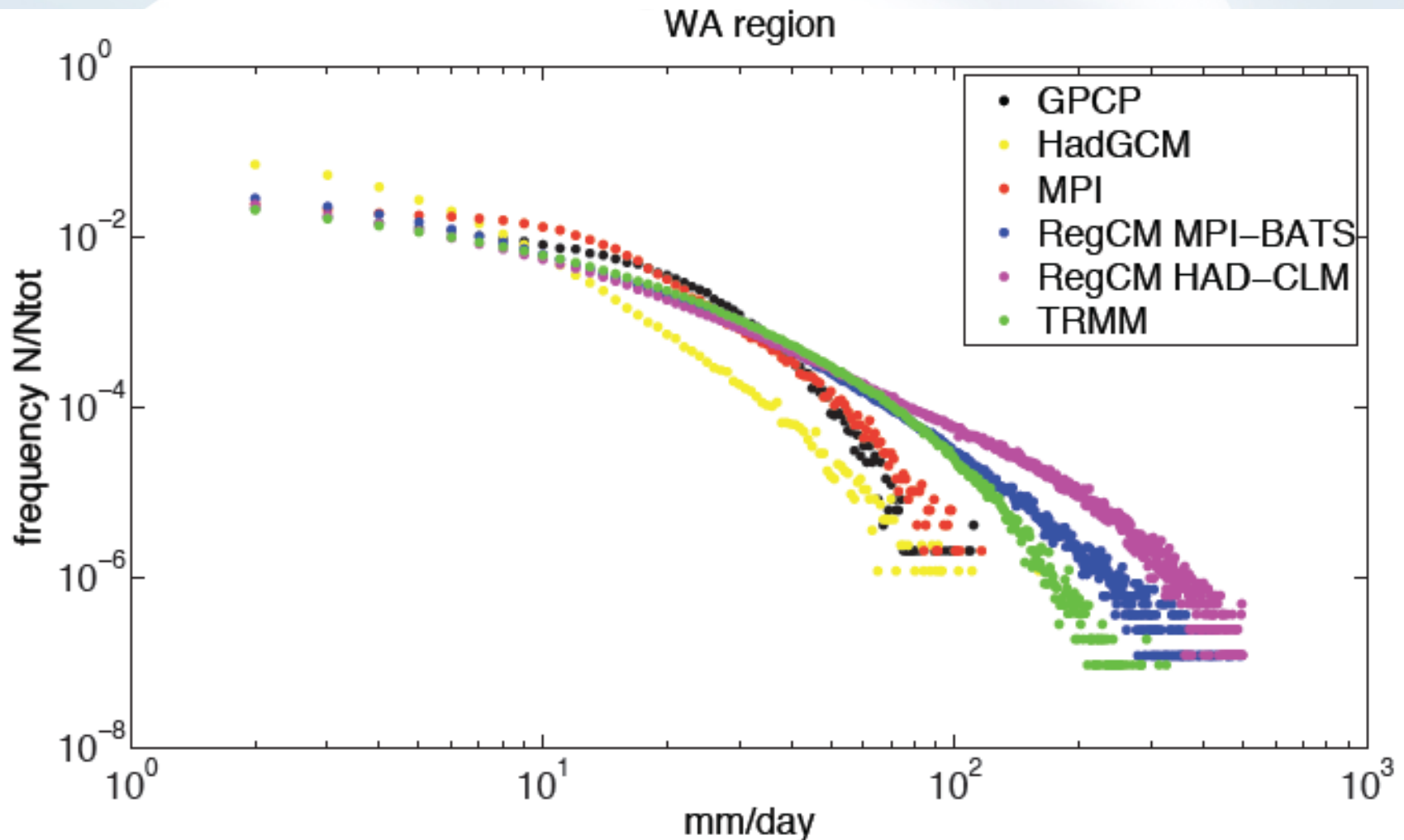
- South of the equator the most pronounced signal is a tendency for an extension of the dry season associated with a narrowing and strengthening of the ITCZ precipitation band in the equatorial and

Thank you
for your Attention

Issue II: Added value

- Added value is not necessarily found at the regionally averaged scale, mean biases in GCMs and RCMs are often of similar magnitude and depend mostly on the quality of the model rather than the downscaling exercise itself
- Added value is probably best found for higher order moments, regional circulations, local topographical detail etc.
- Looking for added value can provide important information to assess the model performance.
- We need to evaluate our models on more process-based grounds

Added value is an important issue: It has been suggested to have a specific task group to investigate it



**The GCM is close to the coarse resolution data,
the RCMs to the high resolution data
This is what we expect from a downscaling
exercise**