

Session D6: Process Based Evaluation of the West African Monsoon in CORDEX Projections

Thursday May 19

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Goal:

Assess components of the West African Monsoon that are both well understood and poorly understood to

- identify knowledge gaps that exist and
 - and propose an experimental framework to address these gaps
1. Recent advances in our understanding of the West African Monsoon system
 2. What don't we know about the West African Monsoon – and why is it important that we find out?
 3. How does understanding the impacts/vulnerability space help atmospheric scientists target their efforts in understanding the WAM?

Process theme (1)

A process-based understanding of the WAM? (Which processes?)

- The role of different features of the west African monsoon:
 - Monsoon flow
 - African easterly jet (need whole vertical profile to properly evaluate but 650hPa essential)
 - the African easterly waves
 - Sahara heat low
 - tropical easterly jet

Meridional temperature gradient

- Main driver of many of the process listed
- Are the models capturing this adequately?

Effect of the E-W zonal land-sea temperature gradient on the WAM?

Process theme (2)

Understanding the moisture footprint of African Easterly Waves (AEWs)

- MCS
- Understanding the interaction between EAW and MCS
- EAW setting up the perturbation
- Role of the AEJ to steer and create organisation do the MCS?
- Deep convection question

GoG cold tongue

- How to account for this in projections that all get this SST too warm

Process theme (3)

How do we evaluate these processes?

The whole vertical profile of U,V,Q would be first prize but...

- Monsoon flow (U, V, Q at 850 and 925)
- African easterly jet

- need zonal wind (whole vertical profile) to properly evaluate but 650hPa essential; U and V would be better
- the African easterly waves
 - need zonal wind (whole vertical profile) to properly evaluate but 650 or 700 hPa essential; daily time scale critical
- Sahara heat low
 - T, MSLP, Q
- tropical easterly jet
 - U200

Process theme (4)

How do we evaluate these processes?

- Understanding the moisture footprint of African Easterly Waves (AEWs)
 - MCS
 - identify - OLR, ppt rates, W
 - some kind of tracking which implies higher time resolution,
 - which models can provide updraft?
 - Understanding the interaction between EAW and MCS
 - EAW setting up the perturbation
 - Role of the AEJ to steer and create organisation do the MCS?
 - Deep convection question
 - How are MCS re-energized over western WA.

Teleconnection theme

- What are the relative contributions of Indian, Pacific and Atlantic Oceans' SSTs to the inter-annual variability of WAM (e.g. to the onset, cessation, and distribution of rainfall produced by WAM)?
- Control of ITCZ by Atlantic Oceans' SSTs
- ENSO effect on the WAM
- Other teleconnective controls? N-S Atlantic gradient.
- Controls of decadal variability
- South Asian monsoon control of WAM (through TEJ and EWs?)

Gulf of Guinea problem

- How does the over-stimulation of rainfall effect regional climate?
- What about observations of rainfall over oceans?
- Control on regional climates
- Warm bias in SST causes cold tongue to disappear -> bad for AEJ!

Aerosol theme

- Control of ITCZ by dust aerosols (60 year cycle)

Control of ITCZ by European sourced aerosols in dry 1960s and 70s?

Land use change theme

- Effect of LUC on local climates as well as regional feedbacks

Inter annual variability theme (IV)

- We don't understand drivers of interannual variability
- Quantify model climatology of IV
- Understanding mega-drought
- In projections does representation of present day IV matter in terms of CC signal

Intra-seasonal variability theme

- Understanding intraseasonal variability of the west African monsoon:
 - West African monsoon intraseasonal variability has important implications for food security and drought early warnings. But little is known about the robustness, consistency, and RCM footprint in simulating the cumulative effect of intraseasonal variability on the mean climate and convective activity.
- How do we assess changes in onset?
 - Approaches to defining onset
- Addressing intraseasonal variability of precipitation over the Sahel
 - mechanisms responsible for the intra-seasonal long dry spells
- Double-peaked rainy season in the Gulf of Guinea:
 - mechanisms responsible for the short break (SSTs, AEJ, ... ?)
 - Intrusion of St Helena high (SST), (dry intrusions)

MJO

Next user perspective

- WAM effect on LUC
- Precipitation and temperature
- Drought/flood cycles
- Extremes

Shrinking of Lake Chad

Migration towards water

Other themes

- How can multiple projects work together to have maximum scientific impact with respect to the WAM (CORDEX, AMMA2050, IMFULA, IMPALA, WASSCAL, CR4D....)?
 - Would be useful to have a list of data available for WAM research
 - Key reference papers and documents