Fifth Symposium on Prediction of the Madden-Julian Oscillation: Processes, Prediction, and Impact
97th Annual Meeting of the AMS, Seattle, WA

355

The MJO and Rainfall Variability Over the Congo Rainforest

Ajay Raghavendra*, Liming Zhou, Nicholas J. Schiraldi and Paul E. Roundy
University at Albany, SUNY
Albany, New York

MOTIVATION

The Congo Rainforest

1. *Second largest rainforest in the world*
2. *Most convective regions in the world*
3. *Strong influence on weather and global climate*
4. *Influences tropical weather*
5. *Regulates the global climate by acting as a major carbon sink*

Negative rainfall anomaly and decline in vegetation have been observed over the Congo rainforest for over 35 years. Therefore, understanding the cause and implication of rainfall variability over this region is critical to accurately determine the future state of the climate.

DATA

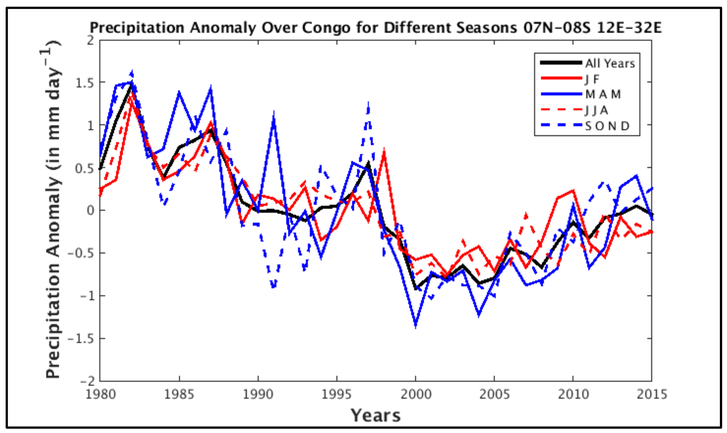
- NCEP/NCAR Reanalysis–2 (Kanamitsu et al. 2002) | NASA's MERRA–2 Reanalysis (Precipitation Only)
- Outgoing Longwave Radiation (OLR) data (Liebmann and Smith 1996)
- The daily MJO index data (Bureau of Meteorology, Australia)

METHOD

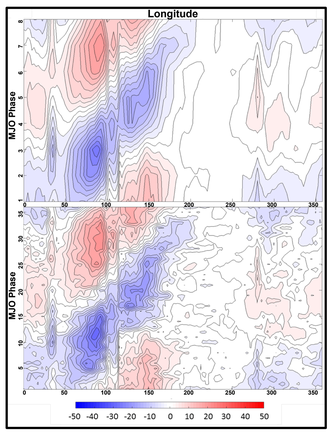
- Constructed a 36 Phase MJO Index using RMM1 and RMM2 (Wheeler and Hendon, 2004)
- Determine precipitation enhancing/ suppressing phases of the MJO over Congo Africa
- Use composite and statistical analysis to study rainfall patterns under different ENSO states

RESULTS

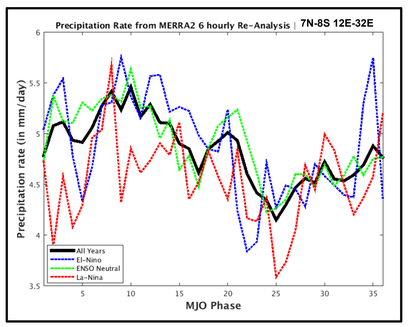
- A decline in precipitation over Congo Africa was observed in both NCEP/NCAR-2 and NASA's MERRA2 reanalysis data. This result is consistent with other studies such as Zhou et al. (2014).
- The MJO modulates daily precipitation trends over Congo Africa
  (Phases 1–9 enhances precipitation | Phases 21–30 suppresses precipitation)
- The ENSO state appears to impact the strength of the precipitation across the different phases of the MJO and it appears that an ENSO neutral state is most favorable for anomalously high precipitation over the study region.



Precipitation data from NASA's MERRA–2 Reanalysis showing a decline in precipitation over the Congo from 1980–2015 for both the ***Wet (Sep–Dec)*** *and* ***Dry (Jan–Feb and Jun–Aug)*** *seasons. Data from other model/reanalysis and satellite date show a similar trend.*



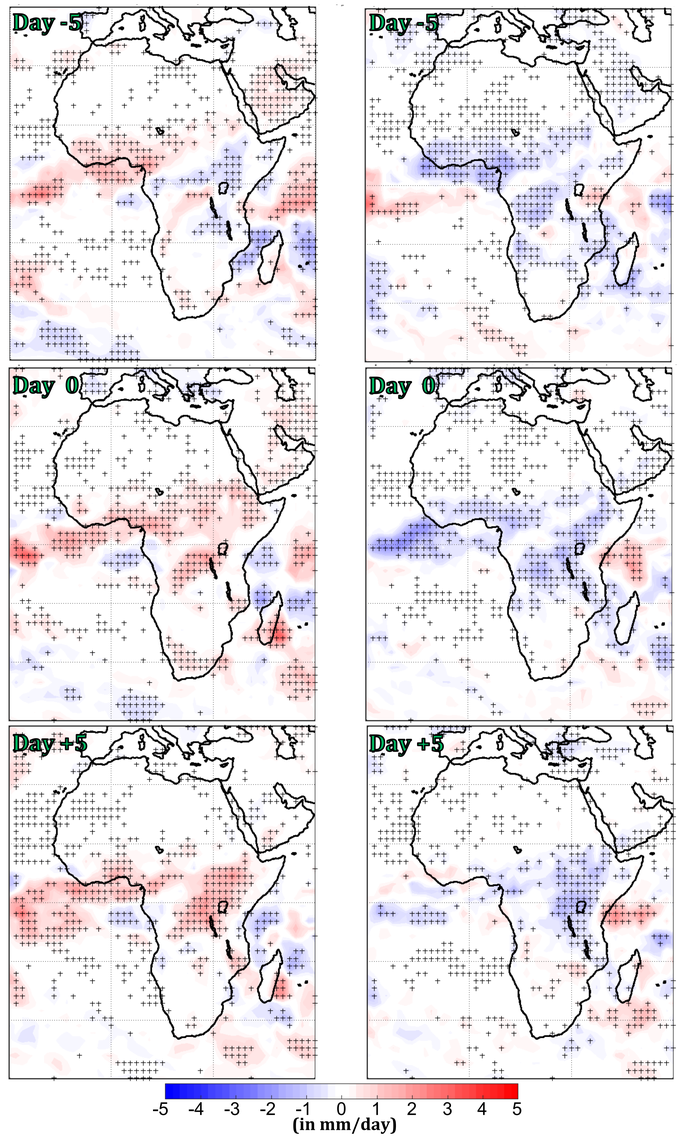
A comparison between the commonly used 8 MJO phases and the 36 MJO phases constructed for this project.



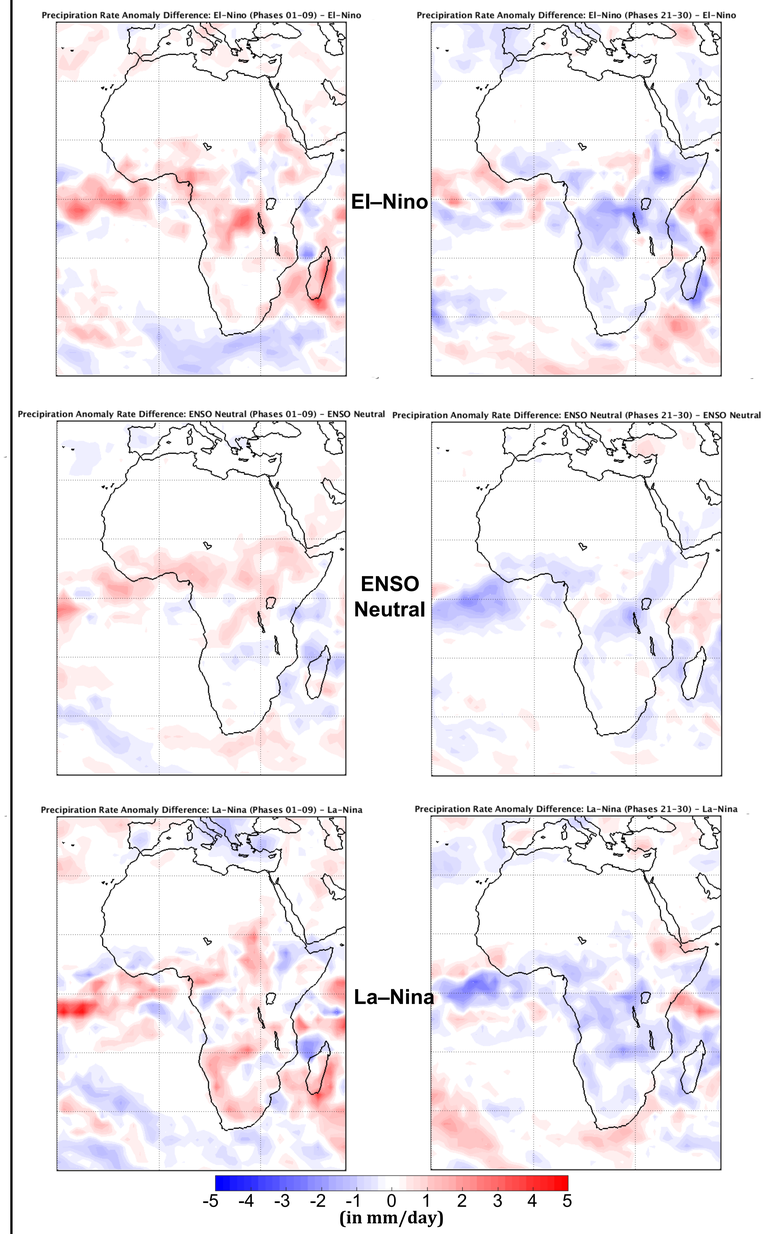
Average precipitation distribution across the different phases of the MJO.

- A decline in precipitation amounts was noticed in all seasons of the year from 1980–2015 over the Congo rainforest.
- The analysis of the number of dry/wet days in a year using multiple thresholds also resulted in a drying trend over the Congo.
- The MJO analyzed with 36 phases provides a finer spatial structure of the propagating wave.
- OLR anomaly suggests that the convective (suppressed) phases of the MJO over the Congo include Phases 1–9 (21–30).
- The average precipitation over the Congo is dependent on the MJO phase and ENSO state.

Composite analysis of precipitation rate for favorable MJO phases (left) and unfavorable MJO phases (right)
"+" indicates grids that are statistically significant at the 95th percentile.



Composite analysis factoring both the ENSO state and the MJO phase



REFERENCES

- Kanamitsu, M., and Coauthors, 2002: NCEP–DOE AMIP-II Reanalysis (R-2). *Bull. Amer. Meteor. Soc.*, **83**, 1631–1643.
- Liebmann, B and C. A. Smith, 1996: Discription of a Complete (Intropolated) Outgoing Lonfwave Radiation Dataset. *Bull. Amer. Meteor. Soc.*, **77**, 1275–1277.
- Washington R, R. James, H. Pearce, W. M. Pokam and W. Moufouma-Okia, 2013: Congo Basin rainfall climatology: can we believe the climate models? *Phil Trans R Soc B.*, **368**, 20120296.
- Wheeler, M. C., and H. H. Hendon, 2004: An all-season real-time multivariate MJO index: Development of an index for monitoring and prediction. *Mon. Wea. Rev.*, **132**, 1917–1932.
- Zhou, L., and Coauthors, 2014: Widespread decline of Congo rainforest greenness in the past decade. *Nature*, **509**, 86-90.

**** Corresponding author address*:**
Ajay Raghavendra, University at Albany, SUNY
1400 Washington Ave, Albany, NY-12222
E-mail: araghavendra@albany.edu

This study was supported by National Science Foundation (NSF AGS-1535426)