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MJO-induced land-atmosphere feedbacks across East Africa

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Across East Africa, sub-seasonal rainfall variability predominantly depends on the phase of the Madden Julian Oscillation (MJO). Rainfall is enhanced during MJO phases 2 to 4, and suppressed during phases 6 to 8. Given that MJO-induced anomalous precipitation can persist beyond several days, a surface response is expected. Using earth observations and reanalysis data, in this presentation we will show how MJO-induced precipitation anomalies promote a surface response which feeds back onto local and regional atmospheric conditions.

MJO-induced rainfall suppression across East Africa decreases surface soil moisture across the exit region of the Turkana jet. Reduced soil moisture increases surface sensible heat fluxes and elevates land surface temperatures. The drier and warmer surface reduces surface pressure and leads to an intensification of the Turkana jet. We conclude that on average approximately 11% of the anomalous jet speed is associated with surface-driven pressure fluctuations over the course of a single day. Since the Turkana jet controls moisture transport from low-lying regions of East Africa into Central Africa, we highlight that surface-induced jet variations impact rainfall totals across East Africa. Furthermore, due to the Turkana jet response to spatial variations in surface warming, we also identify that the magnitude of MJO-induced anomalous precipitation is influenced by surface conditions prior an MJO event. For example, when the surface over southern South Sudan is anomalously dry, MJO-induced precipitation suppression is greater. This presentation will highlight that to fully exploit predictability from the MJO, forecast models must correctly represent surface processes and land-atmosphere interactions. Future work evaluating sub-seasonal forecast models and improving the representation of land-atmosphere interactions will enhance the lead-time of early warning systems across East Africa.