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# Influence of the Madden-Julian Oscillation on Southern African summer rainfall

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Rain-causing mechanisms over Southern Africa (south of 15˚S) involve both tropical and temperate dynamics. Most studies focused on the synoptical timescale, while the intraseasonal (20-120 days) variability has more been neglected to date. This study aims at determining whether the dominant mode of intraseasonal variability in the Tropics, namely the Madden-Julian Oscillation (MJO), has a significant impact on Southern African rainfall and associated atmospheric dynamics.

The examination of outgoing longwave radiation (OLR) over Southern Africa shows indeed significant intraseasonal fluctuations at the 30-60 day timescale, i.e. in the periods that are typically reminiscent of the MJO. In order to confirm the implication of the latter, composite analyses are computed, based on the real-time MJO indices defined in Wheeler and Hendon (2004).

Strong intraseasonal convective signals are particularly recorded over the region during its rainy season (November through March). Large-scale organized convective perturbations are seen to propagate eastwards, mainly between 10˚S and 20˚S, and then northwards, over the Rift Valley and the African Great Lakes. They finally reach the MJO-associated equatorial clusters over Tanzania, which complete their circuit towards the East over the Indian Ocean.

The corresponding response of the rainfall field, obtained through the analysis of daily rain-gauge records in 7665 stations over Southern Africa, presents the alternation, over the intraseasonal cycle, of a dry and a humid phase, which are both significant. The influence of the MJO on the rainfall field is however not homogeneous spatially. While the southern part of the domain (Western Cape Province and surrounding coun-

tries) is very partially influenced, and more closely relates to the mid-latitude dynamics, the tropical parts of the domain (Northern Province of South Africa, Namibia, Botswana and Zimbabwe) logically show stronger dependency to the MJO forcing. Rainfall records exhibit there sharp periodicities in the 30-60 day timescale.

Moisture flux anomalies, derived from the NCEP-DOE II reanalyses, reveal an intraseasonal modulation of the mid-tropospheric easterly flow over the Congo basin at 700hPa; these fluctuations are coupled to northerly anomalies that extend from the tropical to the subtropical austral latitudes. They are hypothesized to convey moisture from the tropical air masses, and hence to favour wet conditions over the region. During the dry phase, southerly anomalies tend on the contrary to prevail, and are hypothesized to convey dryness from the mid-latitude air masses.