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African monsoon variability driven by the Madden-Julian oscillation

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The intraseasonal variability over Africa during northern summer was analyzed, using 25 years of NCEP/NCAR reanalysis and satellite data. The dominant pattern of variability was one of enhanced deep convection over the whole African monsoon region. It appeared to arise at least partly as a remote response to the intraseasonal (Madden-Julian) oscillation over the warm pool sector. Twenty days prior to the maximum in convection over Africa, there was no signal over Africa but convection was reduced over the equatorial warm pool. An equatorial Kelvin wave response to this change in warm pool convection propagated eastward and an equatorial Rossby wave response propagated westward and between them they completed a circuit of the equator and met up twenty days later over Africa, where the negative mid-tropospheric temperature anomalies in the Kelvin and Rossby wave favoured deep convection. Over West Africa, the Kelvin wave component contained lower-tropospheric westerly anomalies which acted to increase the boundary layer monsoon flow and moisture supply. The westerly anomalies also increased the cyclonic shear on the equatorward flank of the African easterly jet, leading to enhanced African easterly wave and transient convective activity, which then contributed to the enhanced convection over Africa on the longer intraseasonal time scale. The implications of this intraseasonal mode for predictability over Africa are discussed.