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Intraseasonal variability of precipitable water in West Africa

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The objective of this study is to improve the understanding of the mechanisms involved in the intraseasonal variability of the West African Monsoon. We focus here on the precipitable water (PRW), which is a key variable for convective processes. To characterize the PRW variability, four datasets are used and compared: the two reanalyses ECMWF/ERA-Interim and NCEP/DOE AMIP-II, the ECMWF operational analysis, and the PRW retrieved from GPS observations during the AMMA field campaign. These datasets give very consistent results in terms of climatology and intraseasonal variability: PRW has a meridional structure marked by a strong North-South gradient, maximum in the Sahelian zone. Several cores of variance are located along this gradient. The consistency between the datasets allows us to focus subsequently on the ERA-Interim reanalysis, which presents a good compromise between spatial and temporal resolutions (0.75°/day) and a large covered period (1997-2007). The intraseasonal variance represents 65% of the total PRW variability in the Sahelian belt with a predominant variability at scales lower than 10 days in the West and a comparable weight of all scales in the East.

We then focus on the 3-10-day timescale variability. A strong and robust westward propagating mode is identified with dynamical characteristics reminding those of African Easterly Waves (AEWs - Periodicity $\sim$ 6 days, wavelength $\sim$ 3000 km and propagating speed $\sim$ 8m/s). Nevertheless, there are some differences with AEWs traditionally identified using vorticity or the meridional wind. Indeed, this mode has a longer period and a larger spatial and temporal footprint than AEWs and shows different phase-lag relationships between precipitation, PRW and wind fields. The composite analysis of this PRW mode reveals a strong link with convective activity (OLR and GPCP rainfall). PRW and wind anomalies can also be tracked from the Eastern Sahel to the middle Atlantic during almost 10 days. These results suggest a strong source of predictability of convective activity over the Sahel at short and medium ranges.