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Characterization of the diurnal cycle of the West African monsoon around the monsoon onset

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This study investigates the diurnal cycle of the West African monsoon and its seasonal modulation with particular focus on the monsoon onset period. A composite analysis around the monsoon onset date is applied to the 1979-2000 NCEP/DOE and ERA40 reanalyzes at 0000, 0600, 1200 and 1800 UTC. This study points out two independent modes describing the space-time variability of the diurnal cycle of low-levels wind and temperature. While the first mode appears to belong to a gradual and seasonal pattern linked with the northward migration of the whole monsoon system, the second mode is characterized by more rapid time variations with a peak of both temperature and wind anomalies around the monsoon onset date. This latter mode is connected with the time pattern of a nocturnal jet reaching its highest values around the onset date.

The diurnal cycle of dry and deep convection is also investigated through the same method. A distinct diurnal cycle of deep convection in the ITCZ is evidenced with a peak at 1200 UTC before the monsoon onset, and at 1800 UTC after the monsoon onset. Strong ascending motions associated with deep convection may generate gravity wave that propagates northward and reaches the Saharan Heat Low region 12 hours later. The diurnal cycle of the dry convection in the Saharan Heat Low is similar during the pre-onset and the post-onset periods with a peak at night (0000 UTC) consistently with the nocturnal jet intensification. This convection is localized at 15˚N and 20˚N before and after the monsoon onset, respectively. Both during the first rainy season in spring and the monsoon season in summer, the nocturnal jet brings moisture in the boundary layer north of the ITCZ favoring humidification and initiation of new convective cells, helping the northward progression of the ITCZ. At the end of the summer the southward return of the ITCZ is associated with the disappearance of the

core of the monsoon jet.

Despite a lot of similarities between the results obtained using NCEP/DOE and ERA40 reanalyzes, giving confidence on the significance of our results, some differences are identified especially in the diurnal cycle of deep convection which limit the interpretation of some of our results and highlights discrepancies in the reanalyzes.