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Do "Realistic" Subsurface Soil Moistures Contribute to the Reproducibility of the West African Monsoon?

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Accurate simulation of onset for the Sahel Africa is one of the challenging tasks in global models, especially in densely-populated West African countries whose agricultural activities are very sensitive to the timing of the monsoon onset. The critical importance of the Sea Surface Temperatures (SSTs) is well known for the seasonal weather evolution for its long memory. Some previous studies, on the other hand have discussed that subsurface soil moisture which has a long memory, would be another contributor, particularly in semi-arid regions including West Africa. However, onset of the West African Monsoon (WAM) associated with the northward shift of the Intertropical Convergence Zone (ITCZ) has difficulties in AGCMs. Here we show a new evidence that global fields of "realistic" subsurface soil moisture, related to locally and globally scales, is another important driver of the WAM onset in a high-resolved (about 50 km grid scale) AGCM for the Earth Simulator (AFES). Furthermore the ITCZ of May-June (MJ) and its northward shift were also well reproduced. The model simulated better the geographical distribution / strength of the African Wave Disturbance (AWD) and horizontal wind convergence, as quantified by the European Centre for Medium Range Weather Forecast (ECMWF) ERA-40 re-analysis. Without the prescription of surface soil moisture (i.e., relying only on the prescription of SSTs), the ITCZ neither appear over the Gulf of Guinea and nor simulate the northward shift. We also found that a low-resolved (about 300km grid scale) AGCM failed to simulate the ITCZ and its northward shift to West Africa even though the realistic subsurface soil moistures are prescribed. Our findings introduces that initializations of soil moisture

may contribute to prediction skill of the monsoon onset in high-resolved models.