Disaggregation of SMOS soil moisture over West Africa using the Temperature and Vegetation Dryness Index based on SEVIRI land surface parameters - DTU Orbit (17/12/2018)

The overarching objective of this study was to produce a disaggregated SMOS Soil Moisture (SM) product using land surface parameters from a geostationary satellite in a region covering a diverse range of ecosystem types. SEVIRI data at 15 minute temporal resolution were used to derive the Temperature and Vegetation Dryness Index (TVDI) that served as SM proxy within the disaggregation process. West Africa (3 N, 26 W; 28 N, 26 E) was selected as a case study as it presents both an important North-South climate gradient and a diverse range of ecosystem types. The main challenge was to set up a methodology applicable over a large area that overcomes the constraints of SMOS (low spatial resolution) and TVDI (requires similar atmospheric forcing and triangular shape formed when plotting morning rise temperature versus fraction of vegetation cover) in order to produce a 0.05 degree resolution disaggregated SMOS SM product at sub-continental scale. Consistent cloud cover appeared as one of the main constraints for deriving TVDI, especially during the rainy season and in the southern parts of the region and a large adjustment window (105x105 SEVIRI pixels) was therefore deemed necessary. Both the original and the disaggregated SMOS SM products described well the seasonal dynamics observed at six locations of in situ observations. However, there was an overestimation in both products for sites in the humid southern regions; most likely caused by the presence of forest. Both TVDI and the associated disaggregated SM product was found to be highly sensitive to algorithm input parameters; especially of conditions of high fraction of vegetation cover. Additionally, seasonal dynamics in TVDI did not follow the seasonal patterns of SM. Still, its spatial heterogeneity was found to be a good proxy for disaggregating SMOS SM data; main river networks and spatial patterns of SM extremes (i.e. droughts and floods) not seen in the original SMOS SM product were revealed in the disaggregated SM product for a test case of July-September 2012. The disaggregation methodology thereby successfully increased the spatial resolution of SMOS SM, with potential application for local drought/flood monitoring of importance for the livelihood of the population of West Africa.

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