

Impact of Precipitation Assimilation on Soil Moisture in the Coupled Land-Atmosphere FSU/COAPS Model

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During the past decade, soil moisture has been increasingly recognized as a key variable in numerous environmental studies including, hydrology, agriculture, meteorology and climatology. Soil moisture controls the repartition into latent and sensible heat fluxes which strongly influence the planetary boundary layer characteristics. Besides, soil moisture has a memory longer than most of the atmospheric variables. A soil moisture anomaly can persist and have a significant impact on the climate system. Thus, the soil moisture plays an important role in improving the accuracy of seasonal forecasting and extremes events (summer droughts, flood and heatwaves). However, because of its high spatial heterogeneity and a lack of reliable global observational network, many disparities exist amongst the reanalyses themselves and also with in-situ observations.

The goal of this study is to improve the temporal and spatial soil moisture variability into the coupled land-atmosphere Florida State University/Center of Ocean and Atmosphere Prediction Studies (FSU/COAPS) model by directly assimilating precipitation using a Precipitation Assimilation Reanalysis (PAR) method (Krishnamurti et al. 1981; Nunes and Cocke 2004). Precipitation is the main source of soil moisture and has a great impact on its temporal and spatial variability. While most of the reanalyses do not directly assimilate the precipitation, the PAR method does it by modifying the vertical humidity profile along with its associated heating. For this, the model precipitation is nudged toward 3-hourly merged Tropical Rainfall Measuring Mission (TRMM) precipitation and the prognostic variables (surface pressure, virtual temperature, divergence and the vorticity) are nudged toward the 6-hourly NCEP2. The nudging is performed for a long assimilation period of several years to spinup the land surface. The land portion of the coupled FSU/COAPS model is the advanced Community Land Model (CLM2) with 10 layers for the prognostic soil moisture variable. Using the in-situ soil moisture dataset provided by the Global Soil Moisture Data Bank, we examine the impact of the precipitation assimilation on the model soil moisture. We will show that the assimilated soil moisture anomaly better correlates with the in-situ observed anomaly than the non-assimilated soil moisture anomaly.

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