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Improving Global Soil Moisture Retrievals from AMSR-E through Enhanced Radiative Transfer Modeling and Parameter Calibration

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Accurate retrieval of soil moisture from satellites is always a challenge. A soil moisture retrieval product has been produced at Princeton University for last a few years from various passive microwave sensors (e. g. Advanced Microwave Scanning Radiometer – Earth Observing System: AMSR-E; TRMM Microwave Imager: TMI) by inverting a single-channel single-polarization (10 GHz Horizontal polarization) forward model (Land Surface Microwave Emission Model: LSMEM). Various characteristics are noticed in this product, such as regions of zero or saturation soil moisture retrievals, indicating an under-performing forward model. Additionally, an analysis of the data set reveals a number of problems related to the vegetation optical depth (VOD) parameter and some soil parameters.

To improve the VOD estimation, the previous monthly vegetation parameter (previously static from year to year) is replaced with a dynamic VOD estimation module developed at University of Montana, which derives VOD from multiple microwave channels available on AMSR-E or TRMM. To improve the soil parameters, the surface roughness and soil texture parameters are calibrated to match the forward model predicted brightness temperature against the satellite observations, using one year of surface soil moisture from the VIC LSM. The new improved retrieval system that now utilizes multiple microwave channels significantly reduces the forward model bias and produces much more reasonable soil moisture estimates. Areas of active rainfall, snow cover, thick vegetation, and RFI are screened out using the microwave observations from the same platform. The new retrievals are compared to the uncalibrated LSMEM retrievals and are also assessed using soil moisture data from the NRCS SCAN and NCDC soil moisture networks.