NPOESS Soil Moisture Satellite Data Assimilation: using WindSat Data

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Abstract. A four–dimensional coupled atmospheric/land data assimilation framework is developed using the Regional Atmospheric Mesoscale Data Assimilation System (RAMDAS) to retrieve deep soil moisture profiles. Passive microwave data from CORIOLIS WindSat is used as a surrogate for future National Polar-orbiting Operational Environmental Satellite System (NPOESS) microwave sensors. Current efforts are focused on the use of the system for a case study occurring in September 2003.

The polarization ratio was found to be the most useful function for the observational soil moisture sensitivity analysis. Simple brightness temperature differences indicated radiative transfer model biases on the order of 5-8 K. Additional radiative transfer model debiasing studies are thus needed; however, WindSat polarization ratio results are able to demonstrate a strong soil moisture signal.

The calibration and validation approaches for both the output soil moisture product and related model input data sets were also tested using the WindSat data sets. In particular, model output from the USAF Agricultural Meteorological Model (AGRMET) was analyzed and compared to in situ and satellite data sets. The performance characteristics of AGRMET were determined both temporally and spatially. Objective methods for performing quality control have been developed to assure that the first-guess information used within the satellite data assimilation system is of the highest possible quality.

The outcome of this work will be to extend satellite soil moisture information from the surface to deeper soil levels to more accurately determine its effect upon DoD-related trafficability, off-road mobility, counter-mine operations, and hydrological streamflow estimation.

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