Performance of satellite remotely sensed and modelled soil moisture datasets across Australia and implications for data assimilation

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Abstract:

This study evaluated the performance of ten separate remote sensing and modelled soil moisture products across Australia in a common framework. The performance was based on a correlation analysis between soil moisture products and *in situ* data collated from three separate ground-based networks: CosmOz, OzNet and OzFlux. The interrelationships between the products were also explored using cluster analyses. The products considered in this study include: Soil Moisture Ocean Salinity (SMOS; both Land Parameter Retrieval Model (LPRM) and L-band Microwave Emission of the Biosphere (L-MEB) algorithms), Advanced Microwave Scanning Radiometer 2 (AMSR2; both LPRM and Japan Aerospace Exploration Agency (JAXA) algorithms) and Advanced Scatterometer (ASCAT) satellite-based products, and WaterDyn, Australian Water Resource Assessment Landscape (AWRA-L), Antecedent Precipitation Index (API), Keetch-Bryam Drought Index (KBDI) and Mount's Soil Dryness Index (MSDI) model-based products.

Performance of the satellite and model data sets varied across Australia. SMOS (both algorithms) showed the strongest and most consistent performance among the satellite products across the different locations and climate zones considered (average $R \approx 0.75$). Among the model products, the water balance model WaterDyn proved most successful (average $R \approx 0.83$). Using cluster analysis we found satellite products generally grouped, as did model products, with some notable exceptions. The results of the clustering analysis highlight the need to critically analyse the assumptions upon which datasets for assimilation are selected.

Keywords: *Soil moisture, remote sensing, models, cluster analysis*