A Soil Moisture Monitoring and Prediction System for Australia

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With the recent launch of the European Space Agency's Soil Moisture and Ocean Salinity (SMOS) mission, work is currently underway to utilize the data from this first soil moisture dedicated satellite. Generally, water resources management as well as weather prediction systems in Australia solely rely on the atmospheric input into the land surface model, leading to relatively large uncertainties in the performance accuracy of the land surface model. The improvement of the model quality would therefore provide a reliable tool for farmers and authorities to better manage the scarce water resources in Australia and the weather service to improve weather forecasting skills. Consequently, a soil moisture monitoring and prediction system for Australia is being tested across the Murrumbidge River catchment in south-eastern Australia as a demonstration. The ~80,000km^2 Murrumbidgee catchment exhibits a wide range of surface conditions from arid to alpine, making it an ideal test bed for such a study. The SMOS observations are assimilated through an Ensemble Kalman Filter (EnKF) into the Australian community land surface model CABLE. The aim is to provide a high resolution accurate soil moisture product at 1km resolution, which may then be used by farmers, catchment authorities, or other interested parties to improve water resource management in Australia.

In a first step, the accuracy of the SMOS observations is being studied. This assessment is being performed using airborne microwave observations obtained over a 5-week long field campaign during the commissioning phase of SMOS in early 2010. This field campaign took place across a 100km x 500km transect of the Murrumbidgee catchment, also providing a 1km near-surface soil moisture map for evaluation of downscaled SMOS data and model predictions. In a second step, the performance of the LSM is compared to in-situ soil moisture observation stations, which have been installed throughout the catchment since 2001. The catchment contains a total of more than 70 monitoring stations, distributed throughout the Murrumbidgee catchment with three focus areas (Colleambally Irrigation Area, Kyeamba, and Adelong Creek) hosting a higher density of stations. At all stations surface soil moisture and temperature, and precipitation are observed. About half of the stations also collect data over a 90cm deep profile (for a detailed description and data access see www.oznet.unimelb.edu.au). The advantage of such a monitoring network over the airborne data is two-fold. First, it provides a temporally continuous data set also providing data, when the aircraft is not flown over the area, and secondly it also provides actual information of the surface conditions as opposed to airborne data that are derived from optical or passive microwave data, and therefore also serves as a validation of the airborne data.

In this paper, results of the LSM predictions obtained with the EnKF assimilation of SMOS data are presented and discussed in comparison with the in-situ data.