MAPPING SOIL MOISTURE VARIABILITY: INTER-COMPARISON BETWEEN L-BAND RADIOMETRY AND COSMIC RAY NEUTRON EMISSIONS

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The third Soil Moisture Active Passive Experiment (SMAPEx-3) was conducted from 5 to 23 September 2011, in the Coleambally Irrigation Area (CIA), located in the Murrumbidgee River catchment in south-eastern Australia. This catchment is intensively monitored by the OzNet network, which has provided long-time series of soil moisture and soil temperature over the past ten years (www.oznet.org.au). SMAPEx-3 is the last of a series of experiments intended to provide prototype observations of the upcoming Soil Moisture Active Passive (SMAP) mission, scheduled for launch in 2014. The experiment covered an area of 60km by 60km within the CIA, to include both SMAP radiometer and radar footprints. The SMAP configuration was replicated by an airborne simulator using the Polarimetric L-band Multibeam Radiometer (PLMR; 1.41GHz) and the Polarimetric L-band Imaging Synthetic aperture radar (PLIS; 1.26GHz). High-resolution ground and airborne observations were acquired over six 2.8km × 3.1km sites distributed across an area equivalent to a SMAP radiometer pixel (40km). The intensive sampling of the volumetric soil moisture content at 0-5cm was performed on a 250m grid concurrently with aircraft overpasses, on a weekly basis to track spatio-temporal changes in soil moisture and vegetation conditions. In addition, a combination of temporary and permanent monitoring stations provided information of the temporal trends throughout the campaign duration.

This study focuses on one out of the six focus sites, mainly covered by native grass. Apart from the regular ground sampling and PLMR airborne observations, specific flights at lower altitude were conducted over this site using the PLMR along with the Cosmic-ray Soil Moisture Observing System (COSMOS) Rover. As opposed to the general stationary deployment of the COSMOS at permanent monitoring sites, the roving system is mounted on vehicles, in order to cover larger areas and to reproduce the local spatial patterns. The COSMOS Rover has recently been used to estimate the area-average soil moisture with good results across field sites in Hawaii and Oklahoma, and its potential use as a calibration/validation sensor for satellite missions such as SMAP is under study. During this experiment, it was also installed in a car and driven across the grazing area on the same dates when ground and airborne data were acquired, in order to provide measurements at different reference heights and spatial scales. Soil moisture estimates derived from PLMR observations at high and low altitude are compared to COSMOS area-averaged soil moisture and validated against the high-resolution ground observations. Finally, a regional flight across part of the CIA is compared with the PLMR observations and a circuit driven with the COSMOS Rover in a car.

This paper will discuss the accuracy of the COSMOS Rover measurements and its potential to acquire large-scale high-resolution soil moisture maps.