Australian Soil Moisture Field Experiments in Support of Soil Moisture Satellite Observations

Edward Kim 1
Jeff Walker 2
Christoph Rüdiger 3
Rocco Panciera 3

1. NASA Goddard Space Flight Cneter, USA
2. Department of Civil Engineering, Monash University, AUSTRALIA
3. The Department of Civil & Environmental Engineering,
The University of Melbourne, Australia

Large-scale field campaigns provide the critical link between our understanding retrieval algorithms developed at the point scale, and algorithms suitable for satellite applications at vastly larger pixel scales. Retrievals of land parameters must deal with the substantial sub-pixel heterogeneity that is present in most regions. This is particularly the case for soil moisture remote sensing, because of the long microwave wavelengths (L-band) that are optimal. Yet, airborne L-band imagers have generally been large, heavy, and required heavy-lift aircraft resources that are expensive and difficult to schedule. Indeed, US soil moisture campaigns, have been constrained by these factors, and European campaigns have used non-imagers due to instrument and aircraft size constraints. Despite these factors, these campaigns established that large-scale soil moisture remote sensing was possible, laying the groundwork for satellite missions.

Starting in 2005, a series of airborne field campaigns have been conducted in Australia to improve our understanding of soil moisture remote sensing at large scales over heterogeneous areas. These field data have been used to test and refine retrieval algorithms for soil moisture satellite missions, and most recently with the launch of the European Space Agency's Soil Moisture Ocean Salinity (SMOS) mission, to provide validation measurements over a multi-pixel area. The campaigns to date have included a preparatory campaign in 2005, two National Airborne Field Experiments (NAFE), (2005 and 2006), two campaigns to the Simpson Desert (2008 and 2009), and one Australian Airborne Cal/val Experiment for SMOS (AACES), just concluded in the austral spring of 2010. The primary airborne sensor for each campaign has been the Polarimetric L-band Microwave Radiometer (PLMR), a 6-beam pushbroom imager that is small enough to be compatible with light aircraft, greatly facilitating the execution of the series of campaigns, and a key to their success. An L-band imaging radar is being added to the complement to provide simultaneous active-passive L-band observations, for algorithm development activities in support of NASA's upcoming Soil Moisture Active Passive (SMAP) mission.

This paper will describe the campaigns, their objectives, their datasets, and some of the unique advantages of working with small/light sensors and aircraft. We will also review the main scientific findings, including improvements to the SMOS retrieval algorithm enabled by NAFE observations and the evaluation of the Simpson Desert as a calibration target for L-band satellite missions. Plans for upcoming campaigns will also be discussed.