



Calibration and validation activities for ESA's Soil Moisture and Ocean Salinity Mission

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The Soil Moisture and Ocean Salinity (SMOS) mission, launched on 2 November 2009, is the European Space Agency's (ESA) second Earth Explorer Opportunity mission. The scientific objectives of the SMOS mission directly respond to the current lack of accurate global observations of soil moisture and ocean salinity, two key variables describing the Earth's water cycle. SMOS observations will also provide information on the characterisation of ice and snow covered surfaces and the sea ice effect on ocean-atmosphere heat fluxes and dynamics, which affects large-scale processes of the Earth's climate system.

A major undertaking in any environmental science related satellite mission is the calibration of the instrument and the validation of the measured brightness temperatures and the derived geophysical parameters, i.e. soil moisture and ocean salinity.

The validation of the data is handled through a combination of ESA led activities and national efforts. The SMOS Validation and Retrieval Team (SVRT) comprises the scientific contributions that have been made by the projects selected in response to the SMOS calibration and validation Announcement of Opportunity in 2005 as well as the two level 2 Expert Support Laboratories being involved in the development of the soil moisture and sea surface salinity data products. For the validation of the soil moisture data products ESA's activities focus on two main sites, the Valencia Anchor Station, located in the East of Spain, and the Upper Danube Catchment, located in the South of Germany. In preparation to the SMOS commissioning phase, airborne rehearsal campaigns were conducted in spring 2008 over both aforementioned key sites and have been repeated, in collaboration with the French Space Agency CNES, in spring 2010. These are coupled with a SMOS match-up generation exercise to verify that the methodology proposed actually meets the foreseen performances. Other activities include the deployment of the ground-based ESA funded ELBARA radiometers, of which there are presently three, located at the Valencia Anchor Station, at a test site in Vercor (France) and in Sodankyla (Finland). Also, in collaboration with the Technical University Vienna, ESA funds the establishment of a soil moisture network data hosting facility in support to the SMOS calibration and validation activities.

The validation of sea surface salinity data products will be a challenging task requiring a highly accurate and stable instrument calibration. At local scales, the foreseen validation activities are focused on a better understanding of the emission of L-band radiation from the sea surface through dedicated airborne campaigns, whereas validation at global scales will rely on buoy networks and basin scale ocean models. Close collaboration with the NASA Aquarius Team will further contribute to the validation of sea surface salinity data products.

A variety of airborne and ground based campaigns have been performed to investigate uncertainties in the soil moisture and ocean salinity retrieval. The major aspects to investigate with regard to soil moisture are the influence of the various types of vegetation and their seasonal variability, as well as the influence of surface roughness. Over oceans, the impact of sea-surface state on the polarimetric radiometric signal is the main issue. The DOMEX campaigns will provide information for vicarious calibration over Antarctica.

The presentation will provide an overview on the calibration and validation activities related to the SMOS mission with a special emphasis on airborne campaigns. It will also provide a summary of the results and open issues following from the first SMOS calibration & validation workshop in November 2010.

