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A contribution to the vicarious routine calibration monitoring for the Soil Moisture and Ocean Salinity (SMOS) mission

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The SMOS mission was selected as the second Earth Explorer Opportunity Mission and aims to globally monitor surface soil moisture over land surfaces and surface salinity over the oceans.

In order to provide accurate measurements to the users and to continuous monitor the mission requirements performances, ESA is defining and implementing in the SMOS ground segment dedicated activities that are carried out in the context of the Sensor Performance, Product assessment and Algorithm development (SPPA) baseline. Part of this baseline consists in routine monitoring the calibration status of the sensors and providing inputs to maintain (or even exceed) the initial mission requirements. In this SPPA context a study has been carried out in order to assess the possibility to have a long term monitoring of the SMOS instrument measurements observing large areas of the Earth surface characterized by uniform, stable and known characteristics. This activity is well known as vicarious calibration monitoring. The areas investigated in this study are covering in particular the mid-range (200 K) and the warm end (280 K) of the SMOS measured brightness temperatures. Cold-range brightness temperature monitoring over the Ocean is also interesting and will be covered in next studies.

For the warm-range, the Amazon rain forest, which was already used for calibration of spaceborne scatterometers, has been considered as a candidate. In order to evaluate its performance a mixed approach, based on model simulations at L band and long term experimental data available at C band, has been adopted. Statistical studies about three years of AMSR-E signatures collected at C-band have been carried out, in order to select areas with the best spatial and temporal stability. Then a simulation of SMOS data using the SEPS-GS over the dense forest with the emissivity model developed by Università of Tor Vergata and a processing of simulated data using the L1 processor prototype has been performed in order to study the impact of the variation of foliar bio-mass and soil moisture on the retrieved temperature on the SMOS pixel. The Antarctica region is promising for mid-range calibration. Here, a calibration procedure can benefit of the studies carried out by IFAC-CNR. In addition to this, ERS Scatterometer data collected over the same Antarctica region have been analyzed. Finally an operational procedure to monitor the Brightness temperature over dense forest has been defined, to be implemented in the SMOS Monitor Facility (MF).

The paper describes the main findings of this study and the specific contribution on the Vicarious Calibration monitoring that has been proposed for the implementation in the SMOS MF.