Introduction to the special issue on the ESA's Soil Moisture and Ocean Salinity Mission (SMOS) : instrument performance and first results

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Guest Editorial for the IEEE TGRS special issue on SMOS

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The Soil Moisture and Ocean Salinity (SMOS) mission was launched on the 2nd of November 2009 and is one of ESA's Earth Explorer Missions, being research missions dedicated to investigate specific aspects of our Earth System, thus addressing areas of immediate environmental concern. They are meant to explore new territory, both in technological terms as well as scientifically. SMOS is very true to this idea.

The SMOS mission provides – for the first time - global observations of soil moisture and ocean salinity from space, two key variables in the water cycle. Both are important for climate research as well as for a variety of oceanographic, meteorological, agronomical and hydrological applications, such as water resources management. SMOS observations are also expected to provide valuable information on the characterisation of sea ice and snow covered surfaces and enhance our understanding of the exchange processes between the surface and the atmosphere.

Providing such data from space represented a real technical challenge. The instrument on SMOS, MIRAS the Microwave Imaging Radiometer using Aperture Synthesis, operates in L-Band at 1.4 GHz and measures brightness temperatures as a function of polarisation and angle. It applies interferometry to provide a spatial resolution suitable for the global measurements required by the scientific users. SMOS is the first mission to apply such a technology in space.

Already in 2008 a special issue on the SMOS mission was published in this journal [Ref] and focussed on the technological advances of the mission. Now, two years after launch, we would like to return to present first scientific results, more focussing on the calibration and validation of the SMOS data and the improvements to the retrieval algorithms to achieve the mission objectives, also giving an outlook to the applications ahead. The contributions in this special issue summarise the extensive work by the involved SMOS teams for the first one to two years after launch. The first six months after launch, the so called commissioning phase, were dedicated to test the functionalities of the spacecraft, the instrument and the ground segment including the data processors. This phase was successfully completed in May 2010 and SMOS

has since been in the routine operations phase and providing data products to the science community.

This special issue will be introduced by an overview paper by Mecklenburg et al, detailing the current technical status of the mission, providing an overall assessment as to achieving the mission's scientific objectives and pointing to the various contributions in this special issue. The paper by Kainulainen et al details the radiometric performance of the MIRAS instrument. The subsequent papers by Kerr et al, Boutin et al and Reul et al will provide the fundamentals for the soil moisture and ocean salinity retrievals. Given that the objectives and the technology of the SMOS mission are a first in many respects, new challenges are discovered as we continue to learn more about the SMOS data. One of them clearly was the detected Radio-Frequency-Interference, originating from man-made emitters on the ground, on aircraft or space borne systems and disturbing the natural microwave emission in the protected L-band frequency region. You will see this reflected in the three contributions by Oliva et al, Castro et al and Misra et al. We would also like to acknowledge the continuous collaboration with the NASA Aquarius and SMAP teams, two L-Band missions dedicated to observing ocean salinity and soil moisture now and in the future. There are many common areas were we share our expertise, RFI clearly being one but also collaborating with regard to calibration and validation activities. You will see this reflected in some of the contributions in this special issue (e.g. Jackson et al). The second half of this special issue will focus on the validation of the SMOS data products for soil moisture and ocean salinity.

Unfortunately, not all the contributions submitted could make it into this special issue but will most certainly be published at later stages. We still hope that the content of this special issue provides a good overview on the on-going scientific activities associated with the SMOS Mission.

Finally, the guest editors would like to thank all the reviewers for dedicating their expertise and time in support of the review process.