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# Dealing with Radio Frequency Interference in SMOS Data

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The Soil Moisture and Ocean Salinity mission (SMOS), led by the European Space Agency (ESA), produces global maps of soil moisture and ocean surface salinity over the Earth. These are key variables used in predictive hydrological, oceanographic and atmospheric models. The presence of man-made emissions is jeopardizing part of the scientific retrieval, requiring the development of new strategies to overcome this difficulty.

The SMOS payload, MIRAS, is a passive microwave 2D-intereferometric radiometer using aperture synthesis. The instrument measures the microwave radiation emitted from Earth's surface within L-band (1400 – 1427 MHz), which is a purely passive band allocated to the Earth Exploration Satellite Service (passive). All emissions are prohibited in this protected band according to the ITU-R Radio Regulations (No.5 340) and administrations are urged to ensure that unwanted emissions of active services in neighbouring bands do not exceed the maximum levels recommended in ITU-R Resolution 750.. Nevertheless, since the SMOS launch on November 2, 2009, it has become clear that Radio Frequency Interferences (RFI) impact the data provided by the SMOS mission, essentially degrading the quality of geophysical retrievals over some areas. Data affected by RFI, depending on the strength of the contamination, need to be discarded. This is in particular applicable for sources located over continental areas.

RFI sources are present all over the world with certain regions such as Asia, Southern Europe and Middle-East showing significantly more contamination. In order to improve scientific retrieval, the SMOS team is implementing two different strategies.

The first approach is to request the national spectrum management authorities to comply with the ITU regulations by switching off the emissions within the protected passive band that are perturbing the SMOS data. Emissions within this protected passive band are either:

a) illegal in-band emissions inside the protected band; or

b) excessive unwanted emissions from either terrestrial radars or other terrestrial sources operating in the neighbouring bands.

To this purpose, detection algorithms have been developed in order to determine the on-ground coordinates of the emitting source. ESA provides regularly this information to the national authorities to support further investigations by the regional offices to identify the type of emitter. To date some 50 RFI sources have been switched off in 14 European countries. However, in general, this procedure is rather time consuming.

The second approach is to work on data processing strategies to localise and flag the RFI in the data products so as to suppress them from the processing. For this, the Level 1 Prototype Processor (L1PP) has been used to test algorithms designed to detect and flag the unwanted emissions observed by SMOS, enabling scientists to prevent making incorrect use of the observations. Moreover, work has been done on the design, implementation and testing of algorithms to blank the effect of the RFI, by estimating the power emission observed and removing its contribution from the measurements. However the real benefit of such filtering techniques is still to be proved, in particular for salinity retrievals.

The mission has already seen a significant improvement in the RFI situation over the world. The results obtained on these different subjects will be presented during the EGU 2011 conference.