Glancing over RFI sources

The Microwave Imaging Radiometer with Aperture Synthesis (MIRAS) instrument onboard SMOS is a Y-shaped antenna with a total of 72 receivers distributed along its three arms and central body. Each receiver captures the thermal radiation in the microwave L-band, more specifically in the protected passive band comprised between 1400 and 1427 MHz. Since the emission within this band is prohibited by the International Telecommunications Union (ITU), no relevant external interferences were expected before SMOS launch (2009). Nevertheless, the real situation is that the Radio Frequency Interferences (RFI) are present in large areas of Europe and Asia leading to low quality measurements. Moreover, due to the MIRAS interferometric processing, RFI sources located far away, even beyond the MIRAS Field of View (FOV), can contaminate large portions of the MIRAS image.

Figure 1. Map of the number of retrieved L2 SSS values during 2012 for ascending passes. White areas have no valid L2 SSS values along 2012.

For a given zone, RFI signals can be classified in terms of the mean life time of the interference as transient emissions or permanent emissions. The former have a limited temporal influence and are mainly produced by mobile sources (for instance ships in open ocean). The latter have a strong effect and may even systematically prevent the retrieval of salinity or soil moisture.

Our Web Map Server service (based on ncWMS and Godiva2 developed by Reading e-Science Centre at the University of Reading) can be used to reveal the spatial distribution of persistent RFI over ocean. The presence of a RFI source reduces the number of valid measures in the zone. Thus, affected zones can be detected by mapping the *L2 used measures* parameter.

Figure 2. Same as figure 1 for descending passes.

The comparison of figures 1 and 2 (images can be zoomed by clicking on them) shows that the affected areas are slightly different, depending on the orbit pass. Nevertheless, seas around Europe, Madagascar, Bay of Bengal, Arabian Sea, East and South China Seas and Sea of Japan are systematically RFI contaminated in both ascending and descending passes.

L-band transmitters in islands (as the Solomon, Ascension, or Barbados) may also prevent accurate retrievals in regions of great interest as the Amazon Plume.

The following two videos show the monthly evolution of RFI sources for ascending and descending passes. (Similar animations can be created on-line using our above mentioned Web Map Server).

The small number of retrieved values of SSS for descending passes in the Northern Hemisphere during the October-January period is related to Sun activity. Transient RFI can also be easily detected in monthly animations: the large RFI burst observed in Madagascar between August and November, the intermittent nature of the RFI located in front of Brazilian coast (Natal), or the fading, as seen by descending orbits, of the RFI affecting the coast of Namibia. It is also possible to detect short RFI episodes such as that which took place in February at Samoa Islands.

RFI evolution. Ascending orbits

RFI evolution. Descending orbits