Meridional Variability in SMOS Salinity Retrievals: Trade-off between Sensitivity to Geophysical Effects and Increased Temporal Sampling

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ESA's Soil Moisture and Ocean Salinity (SMOS) mission will be launched in mid 2009 to provide synoptic sea surface salinity (SSS) measurements with frequent temporal coverage [1]. To allow a proper estimation of the SSS fields derived from the multi-angular brightness temperatures (T_B) measured by the MIRAS (Microwave Interferometric Radiometer by Aperture Synthesis) sensor, the single payload onboard SMOS, a comprehensive inversion procedure has been defined [2]. Nevertheless, several critical salinity retrieval issues remain open [3]. Among them, the adequate spatio-temporal averaging of the retrieved SSS that has to be performed to meet the proposed accuracy requirement of the mission: 0.1 psu (practical salinity units) after averaging in a 30-day and 2ºx2º spatio-temporal boxes (the so-called Level 3 SSS product). Theoretically, the standard deviation of the retrieval errors decreases with the inverse of the square root of the number of the measurements being averaged, despite it has already been demonstrated that spatial patterns and correlation in the radiometric measurements prevent the accomplishment of such theoretical noise reduction [4].

Being SMOS a Low Earth Orbit (LEO) polar satellite and considering a meridional transect spanning from 0º to 80º N, an improvement in the Level 3 retrieved accuracy going towards Northern latitudes should be expected, due to the increased sampling of pixels at the same longitude in successive locations. The least-frequent revisit time in the Equator is one measurement every three days, whilst the satellite sampling increases noticeably at Polar latitudes. Therefore, due to this sampling variability, better results should be obtained, in principle, at mid-high latitudes.

On the other hand, at higher latitudes sea surface temperature (SST) is generally low and it is known that the T_B sensitivity to SSS decreases at colder SSTs. Furthermore, at these latitudes the average wind speed is progressively higher. Both geophysical effects oppose to the expected improvement related to the augmented sampling. It is interesting to figure out which effect outperforms and which is the real trend of the error reduction with respect to the number of samples being averaged, and if some degree of correlation exists.

The overall dataset needed to perform the study will be simulated using the SMOS End-to-end Processor Simulator (SEPS) [5], in its full-mode, including co- and cross-pol measured antenna patterns for each antenna, all instrument errors, and G-matrix image reconstruction. The corresponding SEPS brightness temperatures maps will have thus the realistic instrument features such as biases and the pixel-dependent radiometric accuracy. The UPC SMOS-Level 2 Processor Simulator (SMOS-L2PS) will perform the salinity retrieval as a whole and will produce the SSS maps to be subsequently spatio-temporally averaged.

Summarizing, the geographical trend of the retrieved SSS accuracy along a Northwards meridional transect will be studied, stressing the degree of displacement from the theoretical SSS error reduction and the concomitant counterbalancing geophysical effects of low SSTs and high wind speed fields.

References

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