ESA’s Soil Moisture and Ocean Salinity (SMOS) mission will be launched in late 2008 and will provide sea surface salinity maps (SSS) on a global basis with frequent temporal coverage [1]. SMOS ocean community is currently trying to define a reliable inversion scheme to gather salinity estimations from dual-polarization multi-angular brightness temperatures (TB).

To support this, a comprehensive error budget analysis would be helpful to identify the different aspects associated to the SSS retrieval, their relative impact, and ultimately establish a hierarchy of the issues to be tackled in the upcoming SSS retrieval scheme definition. This error budget should especially focus on the different contributions of the geophysical parameters to the final error.

In [2], an attempt of defining an error budget table was performed, following the guidelines of [3], but providing the error contributions in SSS at Level 3 (L3), that is, after spatiotemporal averaging, to be consistent with the mission accuracy requirements: 0.1 psu, every 30 days and 200x200 km².

A unique characteristic of this study is that all simulations have been carried out using the SMOS End-to-end Processor Simulator (SEPS), an ad hoc tool that takes into account all the instrument specific features, such as measured antenna patterns, measured receivers, frequency response and so on [4]. Brightness temperatures maps generated by SEPS have thus the realistic features induced by the image reconstruction algorithm such as biases and the pixel-dependent radiometric accuracy. Level 2 processor, in turn, is in charge of producing SSS maps out of SEPS brightness temperatures.

A controlled master scenario has been defined and each parameter under study has been inserted into the simulations one by one to isolate the different contributions to the errors. The whole study has been performed over a 10ºx10º test zone in the Mid-Atlantic. To ensure the proper L3 sampling over one month, the simulation dataset consists of 10 overpasses resulting into 730 snapshots.

In a first approximation, the error budget table embedded information coming from previous studies, especially concerning the auxiliary data impact on SSS error [5]. The additional error sources have been identified, listed, and binned.

In an updated version of [2], the error budget table has been reorganized separating bias and rms accuracy. The next step has been the analysis of the pending issues to be studied, namely the radiometric sensitivity, the Sun contribution, the Faraday effect and some extra analysis on the variations introduced by using a different sea water dielectric constant model or including the foam parameterization. Besides, results obtained from previous studies have been revised and homogenized with the new ones, in a more congruent common framework.

Concerning the Sun, its contribution was originally addressed by considering the corresponding average radiometric noise degradation introduced by the residual error of the sun self-estimation algorithm [6]. Sun contamination, in turn, is currently being studied in two ways: in a first one, the Sun has been activated in the simulator, and its residual effect in term of L3 SSS, due to an imprecise cancellation, has been studied. In a second case, this Sun self-estimation algorithm has been switched off, and thus the effect of having the Sun contamination in the measurement, but without correcting for it, has been evaluated.

Besides, with the aim of providing a complete range of impact of the Sun referred to the solar activities, the considered Sun TB has been estimated respectively at its minimum and maximum value.
To define a range of variability of the Sun contamination derived from the minimization algorithm setup, restrictions on salinity have been disregarded. To quantitatively compare the effect at L3, in this case the master scenario without radiometric noise has been simulated in a non-restricted configuration.

The rate of degradation among the results without noise, and when sun $T_B$ is minimum or maximum has been studied, as well.

There are still some unresolved retrieval issues which deserve further attention. It is quite clear that the definition of the minimization setup and the tuning of the cost function might have an impact in the results. In order to foster consensus on these inversion scheme details, and hopefully establish a consolidated minimization function, this error budget study will be performed in an extended way. Whether restrictions on SSS have to be inserted or not and which is the covariance of the final SSS error with the a priori SSS field error ($\sigma_{SSS}$) are, for instance, still a matter of debate.

A part of this ongoing study will be thus producing an error budget table in which salinity is not constrained by an additional term. This will provide of course worst results but will constitute the worst case scenarios that will define the upper boundary error of the retrieval accuracy.

On the other hand, the error on SSS input/auxiliary field ($\sigma_{SSS}$) is known to be a critical parameter. An interesting study would be to address the entire range of variability of the SSS error directly related to the variability of such parameter. Indeed, this would supply synthetic information of the sensitivity of the SSS error to the imperfect knowledge of the reference field itself, with the aim of possibly identifying whether SSS restrictions are a bottle-neck for the retrieval and ultimately establish the importance of the constraining terms.

The overall final product of this extended error budget analysis will thus be an entire table with restrictions on SSS (already performed), another table without these restrictions, plus a cascade of simulations related only to the master scenario and its evolution as ($\sigma_{SSS}$) increases.

Summarizing, with the aim of increasingly improve the ocean salinity error budget analysis, an effort to refine some of the inherent issues has been performed, and this extended configuration will provide an overall vision of the issues related to SSS, but in a wider set of configuration.

REFERENCES


