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SMOS Measurements Preliminary Validation: Objectives and Approach

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The Earth Explorer Soil Moisture and Ocean Salinity (SMOS) mission was successfully launched on November 2nd, 2009, in the framework of the European Space Agency Living Planet programme. It will provide long-awaited remotely-sensed Sea Surface Salinity (SSS) maps over the oceans with a 3-day revisiting time [1].

The SMOS Barcelona Expert Centre (SMOS-BEC) in Barcelona, Spain, will be involved in several activities at different levels of the salinity retrieval processing chain, which are classified according to the objectives/issues being addressed. In particular, those described hereafter refer to the validation of the products and the consolidation/improvement of the salinity retrieval procedure itself [2]. This will be carried out by performing specific comparisons against modelled brightness temperatures (TB) or external salinity data sources.

Due to start at the beginning of the Commissioning Phase, the post-launch 6-month checkout and calibration period, these studies will continue through the nominal satellite operation phase. They will support the choice of an optimal data selection strategy in regard to the existing trade-off, for instance the Ascending/Descending tracks selection, the AF-FOV/EAF-FOV (Alias-Free Field Of View/Extended Alias-Free Field Of View) selection, and some possible across-track data filtering. Moreover, they will help in the definition of an optimal processing configuration (separated polarization retrieval versus first Stokes parameter retrieval).

Concerning the TB, the approach is to perform inter-comparisons of the TB departures (SMOS TB minus modelled TB, assuming knowledge of auxiliary information and proper TB direct modelling). The TB departures statistics analysis will be performed at both Antenna and Earth-surface levels. In order to obtain the latter product, a surface TB module is being derived taking into account the various TB perturbing sources. The comparison with forward-modelled TB will help to devise an optimum strategy to mitigate the scene-dependent bias found in the SMOS measurements.

The comparison of TB departures distributions will be performed within specific classes, aiming at reducing the degrees of freedom of the measurement. Namely, the data will be sorted according to the incidence angle, the wind speed, the across-track distance, the radiometric accuracy and the spatial resolution.

Concerning SSS, in turn, the proposed activities will involve inter-comparisons with various external salinity sources. As a further classification, external sources can be distinguished into data coming from models and data collected in-situ.

The validation strategy foresees the comparison of SSS misfit (retrieved SSS minus ground-truth SSS) distributions within specific classes. This will be performed sorting geographical areas (different oceans, different zonal frames) and geophysical conditions (e.g. low/high surface temperature, wind speed and SSS conditions).

Specific comparisons with in-situ data coming from oceanographic cruises transects and from VOS (Voluntary Observatory Ships) are foreseen, as well as against moored buoys, profilers, and drifters. These data will be arranged in specific match-up datasets, to properly organize the spatio-temporal collocation of the SMOS and in-situ measurements. The possibility of using model solutions for validation will also be considered. Model data are obtained from hindcast simulations from available prediction systems.

Concerning the salinity retrieval inversion scheme, efforts will be devoted to the optimization of both the GMF (Geophysical Model Function) and the minimization cost function. With the increase of data availability, the semi-empirical GMF in the ocean salinity Level 2 operational processor will be improved, in particular the roughness-dependent TB term. The introduction of non-linear relationships in the semi-empirical roughness

model is a likely extension of this formulation. The prospective approach is to develop, at a later stage, a fully empirical GMF derived ad-hoc for the specific SMOS problem. Finally, the need for a comprehensive balancing of the different terms included in the inversion cost function is also stressed by recent studies [3]. The relative contribution of each of the observational and background terms will be quantified.

The activities herein present some degree of overlapping, since a mutual feedback exists among some of them. As a matter of fact, the overall processing chain will be verified downstream (Level 1 to Level 4), thus gathering important insights and feedback which will be used to improve the procedures upstream.

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