Challenges of Retrieving Sea Surface Salinity over the Baltic Sea

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The Baltic Sea is one of the most challenging regions for the satellite Sea Surface Salinity (SSS) retrieval. Nowadays, the availability of SMOS SSS products is quite limited over this region (temporal and spatially) due to several technical limitations related to the low sensitivity of L-band TB at SSS changes in cold waters, land-sea and ice-sea contamination, and high contamination by Radio-Frequency Interferences (RFI) sources. The assessment of the quality of the SMOS SSS products in the Baltic Sea is also an issue. On one hand, the basin is strongly stratified and therefore, differences between the first centimetres (SMOS measurements) and the few meters (measurements provided by in situ) can be noticeable. On the other hand, the basin is very shallow and then, the near surface vertical salinity gradient must be estimated from different sources. There are also seasonal salinity variations in the surface, which are caused by melting of ice and spring floods from rivers. Thus, the representativeness of satellite salinity must be assessed. Besides, some parts of the Baltic Sea such as the Gulf of Finland have estuarine regimes and therefore exhibit relatively strong horizontal salinity gradients.

In the recent years, the Barcelona Expert Center (BEC) team has developed innovative algorithms for improving the quality of brightness temperatures and sea surface salinities dealing with the main processing issues: (i) Nodal Sampling [1] to mitigate the RFI contamination, (ii) Debiased non-Bayesian SSS retrieval [2] to empirically mitigate systematic biases and improve the spatial coverage of SSS maps, and (iii) Multifractal Fusion technique [3] to improve the temporal and spatial resolution to better describe the salinity dynamics. The application of these techniques has led to the generation of regional SMOS SSS products over some critical areas such as the Mediterranean Sea (http://bec.icm.csic.es/ocean-experimental-dataset-mediterranean/).

The Baltic+ Salinity Dynamics project is a recent European Space Agency funded initiative, which aims at advancing research and consolidating existing developments towards the generation of a dedicated SSS product suited for Baltic Earth research (https://www.baltic-earth.eu/organisation/bewg_salinity/index.html). The project started in December 2018. We will present at the conference the up-to-date Baltic+ SSS products generated in this project. We will provide a quality assessment of the SMOS SSS dataset in the Baltic Sea and we will present the potential scientific applications of this product.

[1] V. González-Gambau, E. Olmedo, A. Turiel, J. Martínez, J. Ballabrera-Poy, M. Portabella, and M. Piles, "Enhancing SMOS brightness temperatures over the ocean using the nodal sampling image reconstruction technique," Remote Sensing of Environment, vol. 180, pp. 205 – 220, 2016, special Issue: ESA's Soil Moisture and Ocean Salinity Mission - Achievements and Applications.
[2] E. Olmedo, J. Martínez, A. Turiel, J. Ballabrera-Poy, M. Portabella, "Debiased non-Bayesian retrieval: A novel approach to SMOS Sea Surface Salinity", Remote Sensing of Environment, vol. 193, no. Supplement C, Pages 103-126, 2017.
[3] Olmedo, E., Martínez, J., Umbert, M., Hoare au, N., Portabella, M., Ballabrera-Poy, J., Turiel, A., 2016. "Improving time and space resolution of SMOS salinity maps using multifractal fusion". Remote Sens. Environ. 180, 246–263.