A New High-Resolution Sea Surface Salinity Product for the Southern Ocean

We are pleased to announce the publication of the new dedicated **Level-4 SMOS Sea Surface Salinity (SSS) product** (and its uncertainty) **for the Southern Ocean** with an unprecedented **6.25 km resolution**. This new development was carried out within the framework of the H2020 EU **CRiceS project** (AO/1 –10461/20/ I–NB, grant no. 101003826).

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The new product has the following specifications:

Geographical coverage	180◦ W − 180◦ E; 30◦ S − 90◦ S
Temporal coverage	2011-02-01 to 2023-03-31
Spatial resolution	6.25km x 6.25km
Coordinates reference	EASE-SL 6.25km
Temporal resolution	Daily
DOI	https://doi.org/10.20350/digitalCSIC/17709

What is this new product?

The product is created by **fusing**:

- **SMOS SOFRESH Level-3 SSS data** (https://doi.org/10.20350/digitalCSIC/15493)
- **MUR SST** daily fields

This multiscale fusion method allows us to resolve much finer ocean structures than SMOS alone following the methodology described in Umbert et al. [2014] and Olmedo et al. [2016].

The MUR SST product (Chin et al. [2017]) from the JPL MUR MEaSUREs Project is used for the template in the fusion algorithm. This product provides a Level-4 Global Foundation Sea Surface Temperature Analysis. This SST product is originally provided at a resolution of 0.01º × 0.01º . Therefore, before applying the fusion algorithm, we performed a regridding to the final EASE grid at 6.25 km × 6.25 km.

Validation assessment

Validation has been performed against many in situ datasets by using the Pi-MEP platform. The statistics reveal clear differences in performance across the various in situ platforms. Argo exhibits the lowest dispersion (Std = 0.18 psu, RMS = 0.18 psu) and the highest R^2 (0.40), confirming it as the most consistent reference for SMOS, with negligible median and mean differences. Marine mammals show similarly small biases (Median = 0.00 psu), but slightly higher dispersion (Std = 0.25 psu) and lower correlation ($R^2 = 0.08$), reflecting their operation in dynamically active frontal regions. See figures 1 and 2 below.

Why does it matter?

The Southern Ocean plays a key role in global climate, ocean circulation, and atmosphere— ocean exchanges. High-resolution SSS helps to:

- Identify freshwater inputs and mixing
- Improve ocean and climate model validation
- Resolve small-scale fronts and filaments

The new **L4 SSS Southern Ocean product** represents an important step forward in observing salinity at high resolution in a region where data are scarce. It will support research on ocean dynamics, sea-ice interactions, and climate processes.Data is freely available at BEC Data system and open to users in secure ftp (sftp) service in bec.icm.csic.es/data-access-ftp/.

Figure 1: Validation statistics against ARGO floats data

Figure 2: Validation statistics against Marine Mammals CTD measurements

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New release of the SMOS SSS product for the Arctic region

We are pleased to announce the publication of the **new** dedicated **Arctic Ocean SMOS Sea Surface Salinity (SSS)** products produced at BEC (DOI: https://doi.org/10.20350/digitalCSIC/16251). This new SMOS **(v4)** data set has been created under the **ESA ARCTIC+SSS CCN project** (contract Nº 4000125590/18/I-BG).

The retrieval of satellite SSS in polar regions is challenging due to several technical difficulties, such as the low sensitivity of L-band radiometry to salinity on cold waters, the contamination of the radiometric signal close to sea ice and the scarcity of in-situ measurements, which limits the validation of the new products .

In this context, we have developed algorithm improvements from the level 0 to level 3 for the generation of this dedicated SSS product. The main improvements are:

- to use the Nodal Sampling technique (González-Gambau et al., 2016) to avoid contamination close to ice edges (allowing the reduction of the radiometric errors very significantly),
- modification of the Debiased non-Bayesian retrieval method (Olmedo et al., 2017) to correct systematic biases as a function of the distance to sea ice, and
- the annual reference has been modified to WOA2023.

This product has been extensively validated through the comparison to in-situ measurements from Argo, drifters, ICES data, marine mamals, thermosalinographs on board opportunity ships and other in situ measurements available in the [Pi-MEP platform](#) (Salinity Pilot-Mission Exploitation Platform). The validation of BEC ARCTIC v4 SSS results in: (i) the spatial and temporal variability is consistent with those of in situ datasets with an RMS between 0.3 and 0.7 psu depending on the region, (ii) there is an improvement on RMS (of about 20-25%) and correlation versus the previous version (BEC ARCTIC v3.1) , being more significant nearer than 100 km from ice edges and coast, (iii) there is a significant increase (about 30-40%) on the number of retrievals near the ice edges, (iv) the product describes more properly the freshwaters from rivers runoff.

This product has been shown to be suitable for understanding rapid changes in the last years in the Arctic and to compute the freshwater content and fluxes in the region.

Please, be aware we will keep the former version in our sFTP for 3 months, then it will be discontinued and available on request to smos-bec@icm.csic.es.

New Black Sea SMOS-derived Colored Detrital Matter (CDM) product

We are pleased to announce the publication of the experimental Colored Detrital Matter (CDM) derived from the regional SMOS Sea Surface Salinity (SSS) products for the Black Sea produced at BEC. This new experimental CDM product, specific for the Danube mouth, has been created under the funded ESA project ITT Earth Observation data for Science and Innovation in the Black Sea (EO4SIBS) (contract 4000127237/19/I-EF).

New Black Sea SMOS Sea Surface Salinity products

We are pleased to announce the publication of the first dedicated SMOS Sea Surface Salinity (SSS) products for the Black Sea produced at BEC. These new SMOS Sea Surface Salinity products specific for the Black Sea region have been created under the funded ESA project ITT Earth Observation data for Science and Innovation in the Black Sea (EO4SIBS) (contract 4000127237/19/I-EF).

New Baltic SMOS Sea Surface Salinity products

We are pleased to announce the publication of the first dedicated SMOS Sea Surface Salinity (SSS) products for the Baltic basin produced at BEC. These new SMOS Sea Surface Salinity products specific for the Baltic region have been created under the funded ESA project ITT Baltic+ Salinity dynamics (4000126102/18/I-BG).