

Enhanced retrieval of the geophysical signature of SMOS SSS maps

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ABSTRACT

The Soil Moisture and Ocean Salinity (SMOS) mission has provided a unique remote sensing platform capability for observing key variables of the hydrological cycle, such as the Sea Surface Salinity (SSS). However, due to some limitations related to the instrument interferometric concept and its challenging data processing, SMOS SSS maps still display significant artifacts and biases, especially close to the coast due to the presence of Radio Frequency Interferences (RFI) and Land-sea contamination (LSC). A new methodology for filtering salinity retrievals and correcting for spatial biases is introduced and validated here.

INTRODUCTION

The Soil Moisture and Ocean Salinity (SMOS) mission is an innovative Earth Observation satellite launched in November 2009 to remotely sense soil moisture (SM) over land and sea surface salinity (SSS) over the oceans.

The SMOS single payload is the Microwave Imaging Radiometer using Aperture Synthesis (MIRAS), a L-band 2D synthetic aperture radiometer with multi-angular and full polarization capabilities. This completely new Earth observation instrument concept has entailed a technological challenge for which the development of dedicated calibration and image reconstruction algorithms have been required.

SMOS L1 and L2 SM/OS products, provided by the European Space Agency (ESA) are freely available at <https://earth.esa.int/web/guest/data-access/browse-data-products?selectedTags=smos>. On the other hand, SMOS L3/L4 products provided by the SMOS Barcelona Expert Centre (SMOS-BEC) are freely available in <http://cp34-bec.cmima.csic.es>.

The L2 OS product provided by ESA has an overall good quality over open ocean. There are however significant issues, the most relevant of them are land-sea contamination (LSC), latitudinal bias and the seasonal bias. In this paper a new SSS retrieval algorithm aiming to correct some of those issues, is presented.

MATERIAL Y METHODS

The new algorithm is based in the non-Bayesian approach. This approach differs with the standard one in that we do

not assume any model either for the marginal or the joint distribution of the errors. Therefore, the statistics of the retrievals is analysed a posteriori, classified according to the orbital and geographical parameters that are known to influence the systematic biases. The classes allow to define SMOS-based annual climatologies and from them, with the appropriate filtering, SMOS-based anomalies. The final SSS product of absolute salinity is constructed by adding an annual climatology provided by the World Ocean Atlas.

By construction, L3 products (regularly gridded) are derived. Our reference product will be a global map at 0.25° of spatial resolution and defined over a 9-day map.

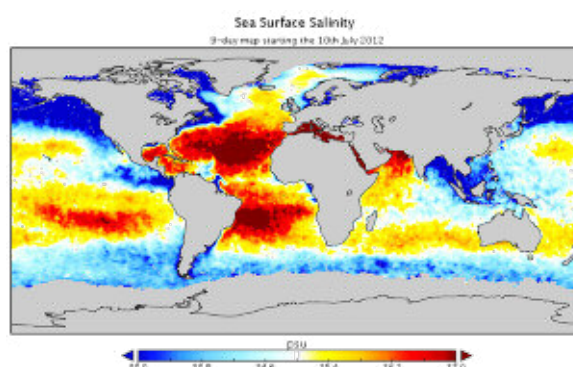


Fig. 1. Example L3 non-Bayesian SSS map

RESULTS AND DISCUSSION

The introduction of this methodology removes LSC and also improves the overall quality of the signal with respect to the standard product.

ACKNOWLEDGMENTS

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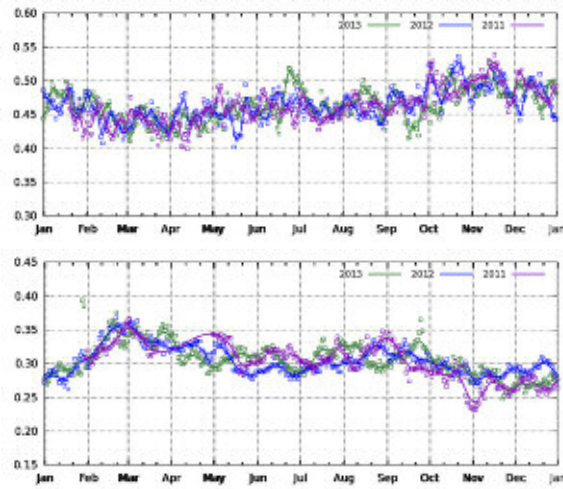


Fig. 2. Time evolution (for years 2011, 2012 and 2013) of the standard deviation of the difference of SMOS L3 maps (9-day, 0.25° resolution) with Argo close-to-surface SSS values. Top panel: Current ESA official version (v620); Bottom panel: non-Bayesian.