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Statistical characterization of global Sea Surface Salinity for SMOS level 3 and 4 products

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The Soil Moisture and Ocean Salinity (SMOS) mission of the European Space Agency will soon provide sea surface salinity (SSS) estimates to the scientific community. Because of the numerous geophysical contamination sources and the instrument complexity, the salinity products will have a low signal to noise ratio at level 2 (individual estimates??) that is expected to increase up to mission requirements (0.1 psu) at level 3 (global maps with regular distribution) after spatio-temporal accumulation of the observations. Geostatistical methods such as Optimal Interpolation are being implemented at the level 3/4 production centers to operate this noise reduction step. The methodologies require auxiliary information about SSS statistics that, under Gaussian assumption, consist in the mean field and the covariance of the departures from it. The present study is a contribution to the definition of the best estimates for mean field and covariances to be used in the near-future SMOS level 3 and 4 products. We use complementary information from sparse in-situ observations and imperfect outputs from state-of-art model simulations.

Various estimates of the mean field are compared. An alternative is the use of a SSS climatology such as the one provided by the World Ocean Atlas 2005. An historical SSS dataset from the World Ocean Database 2005 is reanalyzed and combined with the recent global observations obtained by the Array for Real-Time Geostrophic Oceanography (ARGO). Regional tendencies in the long-term temporal evolution of the near-surface ocean salinity are evident, suggesting that the use of a SSS climatology to describe the current mean field may introduce biases of magnitude similar to the precision goal. Consequently, a recent SSS dataset may be preferred to define the mean field needed for SMOS level 3 and 4 production.

The in-situ observation network allows a global mapping of the low frequency component of the variability, i.e. decadal, interannual and seasonal scales. Unfortunately, its sparse spatio-temporal sampling allows only an incomplete description of higher frequency variability. At this point, hindcasts from operational ocean prediction systems appear as a potential source for the characterization of high frequency SSS variance and spatial correlations. Preliminary validation of model outputs is performed.

This work is part of the effort conducted at the SMOS Barcelona Expert Center (http://www.smos-bec.icm.csic.es) aiming at contributing to the ground segment of the SMOS mission.