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SMOS Sea Surface Salinity and its relevance to ocean biogeochemistry

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The Soil Moisture and Ocean Salinity (SMOS) satellite mission launched in November 2009 monitors the Sea Surface Salinity (SSS) over most of the global ocean regions for more than four years. The objective of this presentation is to summarize the main characteristics and accuracy of the SMOS SSS derived with the most recent processings, to provide examples that illustrate its complementarity to in situ SSS measurements and to discuss potential use of these new satellite products in ocean biogeochemistry studies.
Satellite SSS measurements are performed using microwave radiometer operating at 1.4 GHz. At that frequency, the dielectric constant of the ocean that determines the ocean emissivity depends on the salinity. Since the senstivity of the radiometer measurements to the salinity decreases with descreasing temperature, the most accurate SSS are retrieved in warm waters. The SMOS satellite carries the Microwave Imaging Radiometer with Aperture Synthesis (MIRAS) instrument, a microwave radiometer using interferometric technique for the first time on-board a satellite. Owing to this novel technique, the spatial resolution of SMOS products is 43km but at this resolution, SMOS SSS are very noisy (rms error on the order of 0.6 in tropical and subtropical regions). When averaged over typically 100km and one month, the rms error, as deduced from comparisons with in situ SSS measured by ARGO floats or ships, is typically 0.3 in tropical and subtropical regions. However, this estimate includes large scale seasonal biases; when they are removed, rms error in subtropical regions far from land and far from radio frequency interference sources is on the order of 0.15.
The complementarity of SMOS to in situ SSS for monitoring the SSS variability at 50-100km and 10days-one month scales has been demonstrated in various regions of the world (Amazone plume, subtropical Atlantic ocean, tropical Pacific Ocean, Gulf Stream region...). In some regions and seasons, observed spatial SSS structures are consistent with spatial structures observed on sea surface temperature (SST) but we find that signatures of the ocean dynamics as seen from altimetry are often much better tracked by SSS than by SST which variability is strongly affected by air-sea fluxes. In some regions like the gulf stream, at a given SST, the variability of the chlorophyll is strongly correlated to the one of SSS. Hence, in future studies, new satellite SSS could be used in synergy with other satellite products to better identify the physical, chemical and biological contributions to the variability of biogeochemical parameters.