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Sea surface salinity as detected by SMOS and by in situ sensors

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The ESA/SMOS (European Space Agency/Soil Moisture and Ocean Salinity) satellite mission provides new measurements of the Sea Surface Salinity (SSS) using L-band interferometric radiometry since end of 2009. It is the first time that this technology is used for measuring SSS from space, providing global ocean coverage every 3 to 5 days and a spatial resolution of up to 40km.
We first assess the accuracy of the SMOS SSS reprocessed by ESA (version 5) with respect to in situ measurements, and then discuss observed differences, with a focus on rainy conditions in tropical oceans.
Between 45°N and 45°S, SMOS SSS is in relatively good agreement with SSS derived from traditional in situ measurements (rms error between SMOS SSS averaged over 10 days and 100x100km2 and ARGO SSS on the order of 0.5). In tropical and subtropical regions, the rms error is on the order of 0.3 but we evidence that monthly SMOS SSS are systematically fresher by about 0.1 than ARGO SSS in the tropical Pacific Intertropical Convergence Zone.
At large scale, in the tropical oceans, SSS anomalies between 2010 and 2011 detected by SMOS are in good agreement with the ones derived from in situ measurements using an optimal interpolation (the LPO/IFREMER In Situ optimal Analysis System version 6 (ISAS)). Nevertheless, fresh anomalies linked to rain anomalies are often fresher on SMOS SSS than on ISAS SSS maps.
This apparent SMOS rain-freshening effect may originate from various effects: salinity stratification between 1cm and 5m depth (an important feature for air-sea interactions studies), rayleigh scattering by rain dropplets in the atmosphere, changes of sea surface roughness during rainfall. The atmospheric effect is expected to be much smaller than the observed effect; on another hand the roughness effect is very badly known.
We will discuss the stratification effect hypothesis in view of the salinity variability recently sampled in situ in the upper 50cm of the sea surface by surface autonomous drifters.