Along Track Sea Surface Salinity from new ESA v500 processings (July 2010 month)

Major improvements with respect to previous versions are a decreased pollution by land and ice and decreased orbital and seasonal biases related to antenna temperature and to Sun corrections.

Given the bidimensional field of view of SMOS (Fig 1.), SSS along the satellite track is retrieved with a resolution of ~40km from the combination of more than ~100 brightness temperature (Tb) measurements of the radiometer allowing a simultaneous retrieval of SSS, wind speed and SST and their associated errors (Font et al., 2011). The error on these non averaged 40km SSS is on the order of 1; nevertheless they allow to track large SSS gradients as the ones linked to river discharge (see the signature of the Amazon plume on Fig 2.)

SMOS samples the global ocean after 3 days. Averaging over 10 days or 1 month makes the SSS precision to improve to 0.2-0.6 (preliminary results) with better precision in the warmest regions. At global scale (Fig 3), while large oceanic features are well reproduced, blank areas (north Atlantic Ocean, Asian coasts, Mediterranean Sea) are due to bad consistency between SMOS Tbs along a dwell line and correspond mostly to regions affected by Radio Frequency Interferences (RFI). Some biases remain e.g. in the eastern Southern Atlantic Ocean along South African coast and close to ice in the Southern Ocean.

At regional scale, the rms error (rms error = std (diff) over 10 days-100km) is 0.2 in a warm and non rainy region (Fig 4 top) and 0.4 in a rainy region (Fig 4 bottom). In the rainy region, the statistical distribution of the difference exhibits a slight negative tail, maybe the signature of a larger rain freshening closer to the surface (as seen by drifters, poster by Morisset, Reverdin et al.).

SUMMARY AND PERSPECTIVES

New SMOS processings demonstrate the capability of retrieving SSS with a precision of ~0.3 on SSS averaged over 1° and one month after thorough filtering (e.g. RFIs). The advantage of an interferometer with respect to a real antenna radiometer is its large swath and its relatively high spatial resolution (~40km). In particular, fronts can be more precisely located. Using singularity analysis technique (Turkel et al., 2009), the Barcelona Expertise Center (BEC) has implemented a detection of SSS fronts which can complement and be improved from the detection of SST fronts (work in progress).

However the GOUDA requirements (precision of 0.1-0.2 over 20km-100km) are not fulfilled. Major improvements are expected from improved image reconstruction and direct modeling.

- SMOS is the first interferometer radiometer in space; a complicated image reconstruction process is necessary to retrieve brightness temperatures. Dedicated teams are working on improving this modeling.

- The modeling of the impact of roughness and scattered galactic signal onto L-band brightness temperature remain imperfect. Comparison of SMOS and Aquarius measurements should help refining this modeling.


References


SMOS SSS Sea Surface Salinity from French CATDS-CEC OS

In order to identify the origin of the large biases observed on first versions of SMOS data, a simplified processor has been developed at the expertise center of Centre Aéral de Traitement des Données SMOS (CATDS-CECOS). The whole 2010 year has been reprocessed. In order to sort out outliers linked to RFI, consistency checks based on yearly SMOS data have been performed before retrieving SMOS SSS. It leads to a better RFI sorting than ESA processing (e.g. less contamination in the eastern Southern Atlantic) and to less outliers in the Southern Ocean (Fig 5 & 7). When comparing monthly 1° SMOS SSS with ships, ARGO and moorings in situ SSS performed at global scale, the rms error is ~0.3 (Fig 6); 0.25°-10day SMOS SSS compared with drifters show rms error ~0.4 in the open tropical Atlantic Ocean with larger differences in eddying regions linked to high SSS spatial variability.

Fig. 8: SMOS SSS at 0.25°-10day resolution compared to drifters SSS (daily means; large rain-freshening events removed). Far from coast and from eddying regions, the rms error remains ~0.4.

Fig. 8: Example of SSS retrieved from a single SSMOS pixel in the equatorial Pacific (ITCZ region: 5°N-15°N, 180°W-160°E).