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SMOS Observations of the Gulf of Mexico and Caribbean Sea: Evaluating Surface Salinity Retrieval and Roughness Correction Performance.

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With the successful launch of ESA's SMOS spacecraft, and the anticipated launches of NASA's Aquarius/SAC-D and SMAP satellites, a new era in global L-band microwave retrieval of Sea Surface Salinity (SSS) and Soil Moisture commenced. The launch of SMOS on 2 Nov., 2009 and distribution of calibrated L2 products beginning 13 July, 2010, opened up new avenues for mapping the global oceans and marginal seas, approaching within ~50 km of the coast. MIRAS, the single scientific instrument payload of SMOS, is the first 2D microwave interferometric radiometer in space. It represents an innovative design which allows imaging SSS and related parameters over a swath of ~1100 km, with a pixel resolution ranging from 32 to 100 km, depending upon incidence angle. Considering the radiometric sensitivity of the instrument, which can be improved by spatio-temporal averaging, the goal is to map global SSS monthly with precision of 0.1 psu at spatial scales of 200 km. However, given the high signal to noise ratios of coastal areas, especially close to the mouths of major rivers, one can trade off SSS precision to improve spatial resolution, and potentially map SSS averaged over 3 to 7 day periods and 50 km spatial scales with a precision of ~2 psu.

The retrieval of SSS from L-band brightness temperature observations requires several environmental corrections. Among these, corrections for sea surface roughness dominate the SSS retrieval error budget. Because correction models for the influence of sea state on microwave emissivity are still evolving, the SMOS L2 processing chain includes three operational roughness correction models. Two are analytical approximations: SSS1, the Two-scale model and SSS2, the Small Slope Approximation/Small Perturbation Method (SSA/SPM) model. The third is an empirical optimal multi-parameter retrieval model.

In this work, SMOS observations over the Caribbean Seas and Gulf of Mexico, including the Mississippi River outfall, are presented to illustrate the potential for monitoring SSS using L-band radiometry throughout this domain. The temperature, wind and salinity data available in the SMOS L2 products are compared with in situ measurements from ARGO drifters and NOAA data buoys. Statistical estimates of the bias and precision of SSS values retrieved from SMOS are computed within the study domain, and the performance of the three L2 roughness correction models is compared. The new roughness spectrum model of Hwang et al. is also tested as an alternative to the one used in SSS2, and the performance of the resulting roughness correction model is evaluated relative to the current operational models (SSS1-SSS3).