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TEC obtained from 3^{rd} Stokes parameter for improved quality of SMOS salinity retrieval

Jean-Luc Vergely (1), Philippe Waldteufel (2), Jacqueline Boutin (3), Xiaobin Yin (3), and Paul Spurgeon (4)
(3) LOCEAN, UMR UPMC/CNRS/IRD/MNHN, France, (1) ACRI-st, France, (2) LATMOS, UMR UVSQ/UPMC/CNRS, France, (4) ARGANS, UK

While SMOS was designed with full polarimetric capability, the 3^{rd} Stokes parameter information has not been introduced so far in the data processing. The analysis reported in the present contribution proposes to estimate from this information the total ionospheric electron content (TEC).

Indeed the Faraday effect generated by the ionospheric electrons on the path from Earth to satellite is believed to be responsible for large uncertainties in the evening half-orbits (circa 06 PM local time) when the ionospheric content is close to its diurnal maximum.

It is shown that the 3^{rd} Stokes parameter exhibits a maximal sensitivity to TEC in a restricted area located at the front of the SMOS 2D field of view.

However, since the Faraday angle depends on the scalar product between line-of-sight and magnetic field vectors, a latitudinal zone is found where this sensitivity vanishes. This zone occurs around 15°N a latitude nearly invariant with longitude around the Earth. Accordingly it is possible, when carrying out the TEC estimation over a descending half-orbit, to isolate over this "blind zone" the so-called "Ocean Target Transformation" parameter, which aims at correcting for pixel dependent biases.

TEC maps obtained in this way compare favorably with maps built from GPS measurements, which have been introduced so far in the SMOS processing chain as auxiliary data. The space resolution is somewhat improved, allowing a better selection of the relevant electron content in zones exhibiting large horizontal TEC gradients.

In a latter step, based on the TEC maps, it becomes possible to recompute the OTT correction for those brightness temperature components to be used as input in the salinity retrieval.

Then the additional information impacts the salinity retrieval both directly (as the quality of the TEC auxiliary data is improved) and indirectly (as the empirical OTT correction is no longer contaminated by spurious Faraday rotation effects).

The respective contributions of both effects will be assessed and discussed. They result on the whole in a significant improvement of the SMOS retrieved salinity; this is evidenced by a large reduction of a spurious latitudinal variation which was so far considered as a bias originating in instrumental effects.