Independent assessment of Sentinel-3A wet path delay

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Abstract:

Launched on 16 February 2016, Sentinel-3A (S3A) possesses a two-band microwave radiometer (MWR) similar to that of Envisat, aimed at the precise retrieval of the wet tropospheric correction (WTC) through collocated measurements with the SRAL instrument.

Due to their instrumental characteristics and retrieval algorithms, the two-band MWR on board the European Space Agency (ESA) altimeter missions are known for their good performance in the open-ocean. However, when they approach the coast, the retrieval algorithm, designed for surfaces with ocean emissivity, generates very noisy values as the footprint encounters surfaces with different characteristics. The same happens at high latitudes in ice-covered regions.

This study aims at presenting an independent validation of the S3A wet path delay derived from the on-board MWR, present on S3A products, released for validation purposes, for the open and coastal ocean.

The validation is performed by means of comparisons with independent data sets namely: scanning imaging microwave radiometers (SI-MWR) such as the GPM Microwave Imager (GMI); Global Navigation Satellite Systems (GNSS) derived path delays determined at coastal stations; wet path delays from the MWR on board various contemporary altimeter missions - Jason-2 (J2), Jason-3 (J3) and SARAL/AltiKa.

In addition, the overall along-track performance is compared against WTC obtained from the GNSS-derived Path Delay Plus (GPD+) algorithm, developed at the University of Porto, and from atmospheric models. For this purpose, GPD+ wet path delays have been derived by combining, through space-time objective analysis, all available observations but not including those from S3A MWR, i.e. using only third-party observations.

In addition to the statistical comparisons between the S3A MWR-derived WTC and the various WTC sources, the correction is also evaluated by means of sea level anomaly variance, both along-track, at crossovers and function of distance from coast.

Considering the relative short period of the analysis, overall performance of S3A MWR seems good and stable. Small scale factors and offsets relative to GMI, J2 and J3 and a larger bias relative to SARAL have been found. RMS differences (cm) of S3A with respect to the various radiometers of 1.0 (GMI), and in the range 1.3 to 1.6 cm (other altimetric missions) indicate good agreement between these sensors.

In spite of the short analysed period, a stable temporal evolution of the S3A WTC has been observed. Periodic patterns of the differences with respect to GMI are explained by the different orbits and corresponding samplings of these sensors.

In agreement with the similar two-band instruments carried by previous ESA altimetric missions, strong ice and land effects can be observed, the latter one being mainly up to 20 km from the coast. GPD+ corrections tuned to S3A are under development, aiming at generating continuous WTC, also valid in the coastal zones and at high latitudes.