Intercomparison of spaceborne microwave radiometers (ERS1-ERS2-TOPEX-SSMI)

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ABSTRACT

Lot of remote sensing applications use simultaneously data obtained from several satellites instruments. Making maps of geophysical products, validation of radiative transfer models (by comparing the satellites data to the simulated ones), assimilation of the remote sensed data in the meteorological prediction models, are some examples where the synergistic use of the different satellites products is necessary and where the intercalibration of the measurements is essential (authors like J. Etcheto 1988 underlined this problem). In order to eliminate the differences (and than the errors) due to the instruments calibration differences, we propose to use an inter-calibration of these instruments before using their data. The aim is not to change the calibration of the instruments but to make homogenous the data for the users who need that for their application. We limited this work to the radiometers only (of ERS-1, ERS-2, TOPEX-POSEIDON and SSM/I). The work undertaken is based on the cross comparisons between the different instruments and the comparison with the ECMWF meteorological fields. We use directly the electromagnetic quantities measured by the instruments (microwave brightness temperatures MBT) in the different channels (frequency bandwidth: 18 - 85 GHz). First, the intercalibration of these MBT's is done, with a precision of 1 K. Then, an appropriate retrieval algorithm for each instrument is proposed for the common retrieved geophysical parameters (integrated water vapour WV, integrated water content WC and wet tropospheric correction DH). The algorithms are then validated by comparing their results directly to the coincident on-shipment measurements. We reach a precision of 1 cm for DH, 0.15 g/cm2 for WV and 2-3 mg/cm2 for WC.
The geophysical products are retrieved using the same algorithms form (linear logarithmic, described by E. G\'erard, 1996). This permits to get homogenous coverage when using different remote sensing sources. These algorithms have their own defaults, but the geophysical data issued from the different satellites will have the same behaviour. All the data used in this paper are issued from the tandem period where the four satellites were in orbit (June 1995 to June 1996).