Improvement of sea surface brightness temperature retrieval in coastal areas for the estimation of the wet tropospheric path delay

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Abstract

The Jason-1 satellite, which was launched on December 7, 2001, has been designed to ensure continued observation of the oceans for several decades. The radar altimeter Poseidon-2 emits pulses and measures their round trip time reflected by the ocean. The on-board Jason Microwave Radiometer (JMR), which operates at 18.7, 23.6 and 34 GHz, monitors and corrects the propagation path delay of the altimeter radar signal due to water vapor and other atmospheric liquid water in the atmosphere. The JMR Field of view (FOV) is already equipped by the presence of a cloud mask leading extensively to the extraction of the JMR brightness temperature associated with the sea component (JMR) and the surface wind component (wind speed and direction) in coastal areas, using satellite altimetry and microwave radiometry. The purpose of this work was to test a scheme to remove the cloud contribution, to estimate the sea surface brightness temperature and to correct the altimeter delay. A cloud mask algorithm developed by NOVELTIS was tested using JMR brightness temperatures over the ocean, with the Jason-1 mission period. The preliminary results showed the potential of this approach, but the noise level and the error budget should be improved in order to derive the best compromise to improve the altimeter path delay correction.

1- Methodology

The land-clearing refers to the process of estimating the brightness temperature (BT) measured by JMR in coastal areas. The JMR collects radiation emitted by the ocean at frequencies 18.7, 23.6 and 34 GHz. A lot of data close to the coast are spoiled by the presence of land.

- 34 GHz data set

The Jason Microwave Radiometer collects radiation emitted by the ocean at frequencies 18.7, 23.6 and 34 GHz. Let's focus on the case of 34 GHz.

2- JMR data sets

The JMR data set is used to derive the sea surface brightness temperature. The JMR measures the brightness temperature at three frequencies: 18.7, 23.6 and 34 GHz. The JMR data set is used to derive the sea surface brightness temperature.

3- Simulations cases

The land-clearing algorithm has been tested with simulated data. Two cases have been considered: one with a homogeneous sea surface and one with a heterogeneous sea surface.

4- Land-clearing error source: noise budget

Land-clearing errors have been estimated using a JMR brightness temperature derived from the Jason-1 satellite. This study was based on a statistical analysis of the JMR data set.

5- Land-clearing error source: Contrast sensitivity

Precise studies [1] showed that the methodology used to test the contrast sensitivity between adjacent measurements was derived from the statistical relationship related to the contrast between the considered adjacent measurements. The figure 5 displays the standard deviation of the land-cleared brightness temperature as a function of the percentage of land-cleared area. The results presented here have been done with a measurement error of 0.03 K and no error in the component weights. In this case, the noise was not taken into account in the heterogeneous brightness temperature calculation. This shows the strong impact of a small contrast percentage on the land-cleared retrieval. Such small contrasts can be found in the case of adverse direction or altitude. In addition, the contrast sensitivity is a key factor in the retrieval of the sea component, in particular by exploring the key role of the data used for the contrast between the considered adjacent measurements.


References


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