The Envisat/MicroWave Radiometer five years after launch :
Drift correction, new in-flight calibration and consistent retrieval algorithm

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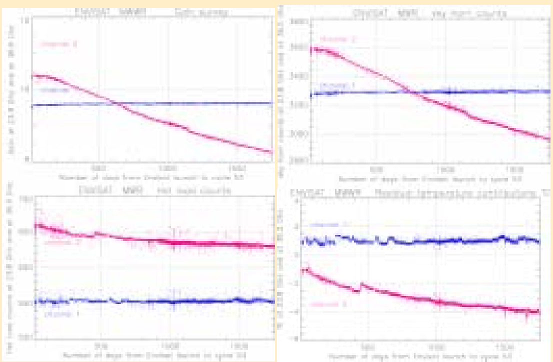
Introduction

The European satellite Envisat has been launched on 1rst of March, 2002. In order to correct the altimeter range for water vapor path delay over ocean, a nadir-looking microwave radiometer is added to the mission. This radiometer provides at the location of the altimeter footprint brightness temperatures measurements at 23.8 and 36.5 GHz. These two brightness temperatures, as well as the backscattering coefficient in Ku band are used to retrieve the wet tropospheric correction. As any error in this term directly impacts the sea level determination, the constraints on the quality and stability of the in-flight calibration and data processing of the radiometer are particularly stringent.
After 5 years in orbit, we recently proposed to improve the quality of the radiometer products. This improvement lies on 3 different evolutions in the radiometer data processing :

I. Correction of the instrumental drift observed at 36.5 GHz
II. New in-flight calibration of the radiometer
III. New neural retrieval algorithm for the wet tropospheric correction.

I. Correction of the drift observed at 36.5 GHz

Since the beginning of the mission, all instrumental parameters measured at 36.5 GHz are drifting with time :

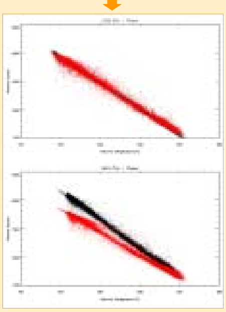


First analysis

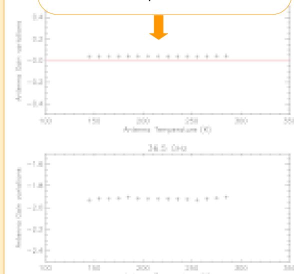
	TB (K)	Antenna counts cycle 6 (June 02)	Antenna counts cycle 48 (June 06)	Variations
Cold calibration	2.7	3500	3017	-483
Coldest Ocean	157	2126	1908	-218
Hot calibration	330	656	632	-24
Amazon forest	288	781	719	-62

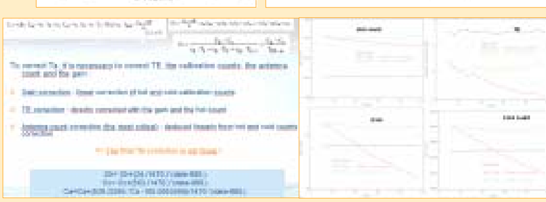
Results consistency using a global statistical approach

For cycle 6 (June 2002) and 48 (June 2006)
All measurements (land/ice/sea)
Averaging in 1°x1° boxes

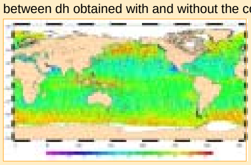


Gain variations between cycles 6 and 48 estimated for different classes of temperatures
=> the gain drop is the same, whatever the observed antenna temperatures





Map of the differences between dh obtained with and without the correction (cm). Cycle 26.

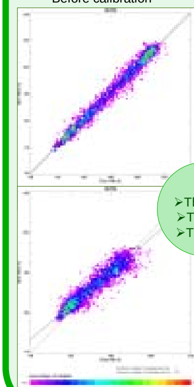


II. New in-flight calibration

Our strategy

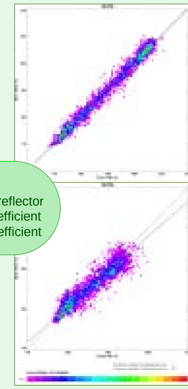
To adjust measurements on simulations
performed from ECMWF analysis with our radiative transfer model.

Before calibration



In-flight calibration

After calibration

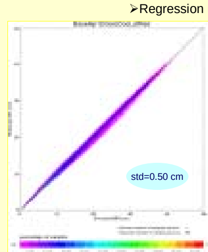


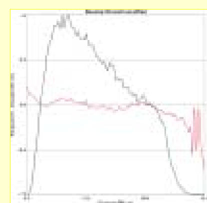
Modification of :
- The transmission coefficient of the reflector
- The sky horn feed transmission coefficient
- The main antenna transmission coefficient

III. New neural retrieval algorithm

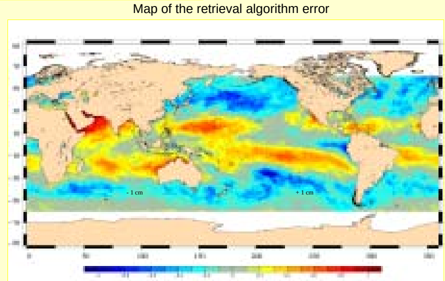
Our strategy

- Building of a learning database
- Wet tropospheric correction from 12 global ECMWF analysis
- Consistent brightness temperatures simulated by our radiative transfer model
- Regression using the neural formalism





Map of the retrieval algorithm error



Retrieval bias is geographically correlated
- The correlation is not related to DH, but rather to several geophysical parameters (more likely a combination of them)
- Same structure has been detected on other radiometers (different sensors and algorithms)

Accuracy of the retrieval algorithm is a key issue
- Neural network to better account for other pertinent variables
- Regional algorithms
- Classification

For 2005, difference between ECMWF and Radiometer Path delays (cm)