Water vapour scaling exponent derived from microwave radiometry using structure functions

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The wet tropospheric correction (WTC) plays a critical role on the altimetry mission budget error due to its large spatial and temporal variability.

Ubelmann et al 2013 has shown the effect of the WTC on the performance of the future SWOT mission using simulated 2D fields obtained from spectral analysis of existing WTC measurements provided by radiometers. This work raised some questions on the geographical and seasonal variability of WTC power density spectra (PSD), specifically on its slope, also called scaling exponent.

Based on the work of G. King and A. Stoeffelen performed on scatterometer winds (JGR 2015), we propose to analyse the sensitivity of water vapor scaling exponent using structure functions against SST, clouds and rain. Structure functions are related to PSD but preferred to these latter since less sensitive to gaps and boundary effects.

We will show how rain and convection events strongly modify the slope, we will compare AltiKa , Jason-2 and GMI water vapour products and we will conclude on how these results could affect the SWOT budget error.

PEACHI Jason-3

PEACHI = **P**rototype for **E**xpertise in **A**ltimetry, **C**oastal, **H**ydrology and **I**ce

The prototype **fully supported by CNES** is seen as a laboratory for processing Jason-3 data and delivering experimental products with foreseen added-value.

Prime objective of PEACHI Jason-3 is to ensure and demonstrate the quality of new algorithms before possible implementation into Jason-3 operational ground segment.

Two different approaches

JPL and CLS approaches to retrieve the wet tropospheric correction are **mostly similar**: an empirical relation is established between simulated TB and a geophysical database. … But **somehow different** in:

the settings of the algorithm

JPL	CLS
Database • Radiosondes	Database • ECMWF
Inversion • log-linear	Inversion • NN

the algorithm processing

JPL	CLS
Retrieval per classes • wind • WTC	Global retrieval

To adapt Neural Networks to the stratified approach

Two main issues for a stratified approach applied to NN:

no interpolation possible between NN coefficients ➔ jumps on WTC

under-populated domains ➔ degraded performance of the retrieval

Solutions:

overlapping domains

JPL	CLS
linear interpolation of the regression coefficients	overlapping domains

Some classes are gathered in order to avoid under-population

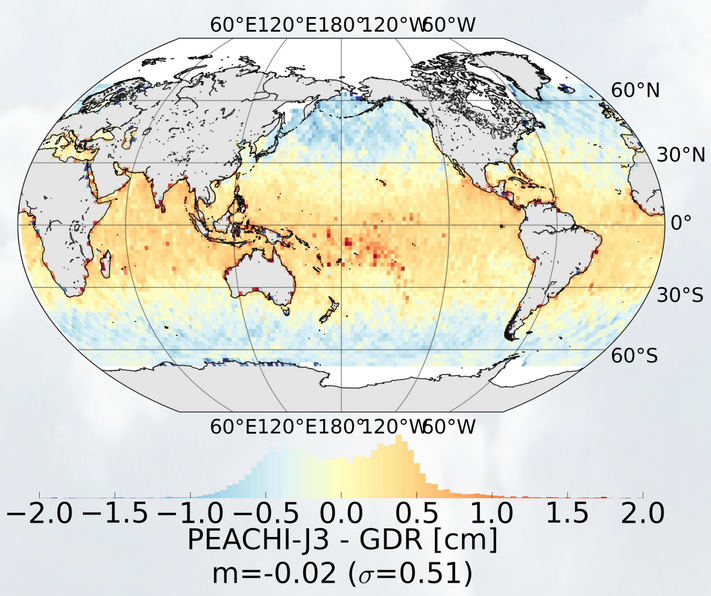
	[0,7]	[3,11]	[7,15]	[11,19]	[15,40]
[0,60]					
[0,15]	1	2	3	4	5
[5,25]	6	7	8	9	10
[15,35]	11	12	13	14	
[25,60]	15	16	17		

Performance assessment on Jason-3

WTC PEACHI (CLS) - WTC GDR (JPL) [cm]

PEACHI more wet on inter-tropical regions

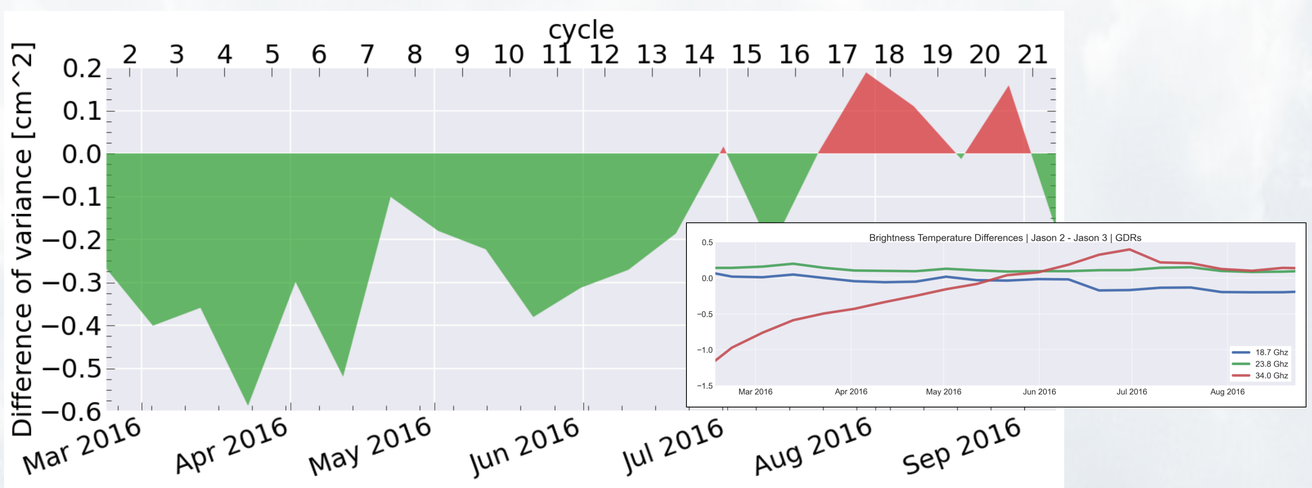
PEACHI dryer at high latitudes



VAR_SSH_WithPEACHI (CLS) - VAR_SSH_WithGDR (JPL) [cm²]

improvements of PEACHI wrt GDR ~ -0.20 cm²

potential impact of TB @ 34 GHz drift from launch to July 2016



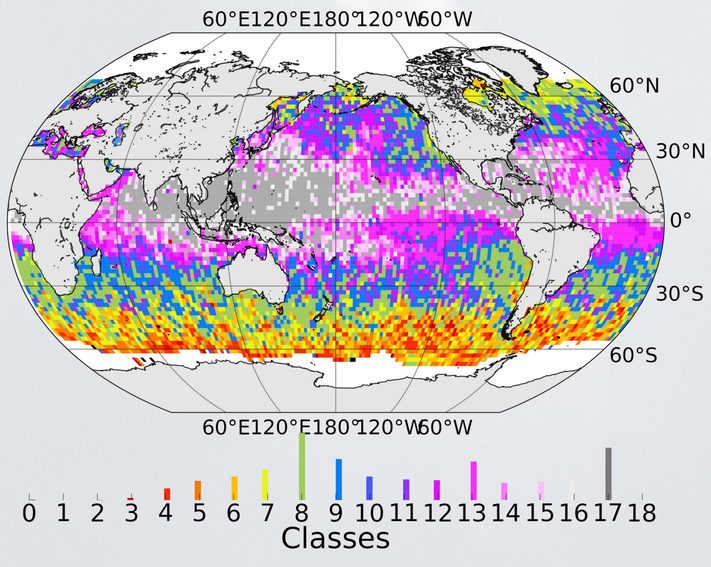
Same approach applied on Jason-2

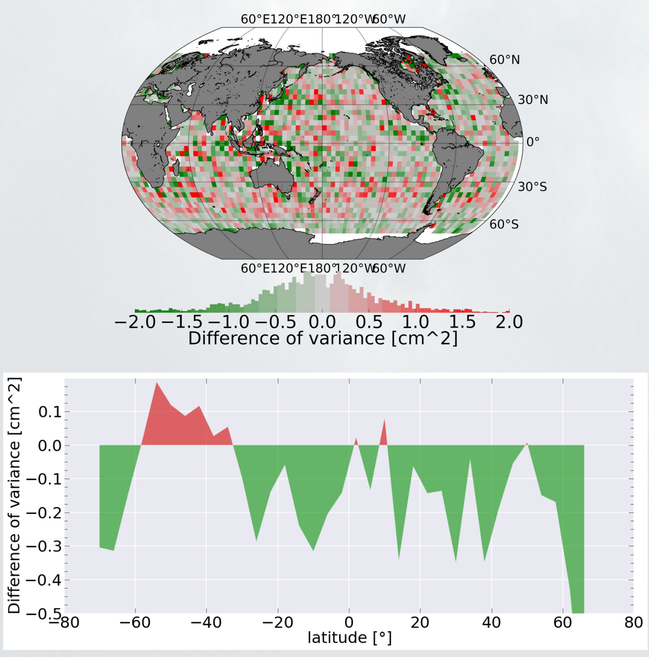
Expected results on Jason-3 with sufficient amount of data:

-improvement at high latitudes

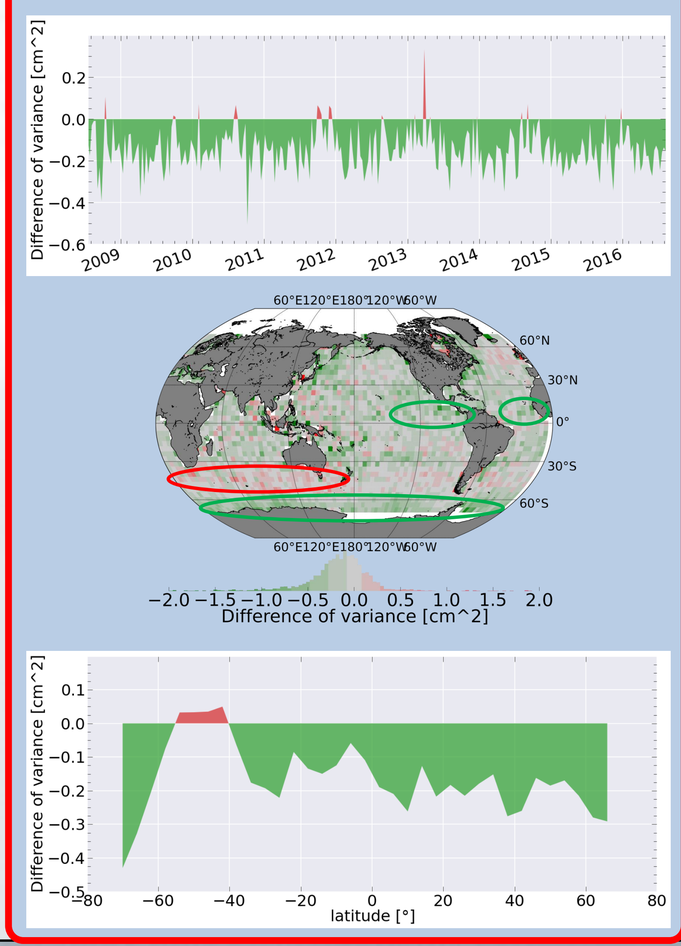
-improvement on upwelling regions

-degradation on classes 7/8 ?





PEACHI on Jason-2



Conclusion & Perspectives

the PEACHI WTC retrieved using a stratified approach applied to Neural Networks shows similar performances wrt to GDR WTC on Jason-2.

Some **improvements** shown at high latitudes where PEACHI WTC is dryer than GDR WTC

Some **improvements** shown on specific regions (Mediterranean sea, upwelling)

Some **degradations** shown on specific regions (surface ?): need for better definition of class 7/8 ?

The TB@34 GHz could be corrected using J2/J3 bias monitoring

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