Wet Tropospheric Correction (WTC) : A stratified approach applied to Neural Networks

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The wet tropospheric correction (WTC) is a major source of uncertainty in altimetry budget error, due to its large spatial and temporal variability: this is why the main altimetry missions include a microwave radiometer (MR) The commonly agreed requirement on WTC for current missions is to retrieve WTC with an error better than 1cm rms.

JPL for NASA/CNES (Jason-2/Jason-3) missions on one hand and CLS/IPSL for CNES (AltiKa) and ESA (Sentinel-3) missions on the other hand based their retrievals on similar approaches with still identified differences.

In the frame of CNES project PEACHI-J3, we defined a combined approach using the ECMWF analysis and the neural network in a stratified scheme. A sensitivity study is performed on the range definition of wind speed and WTC. Stratified-NN WTC are computed and applied to Jason-3 and Jason-2.

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

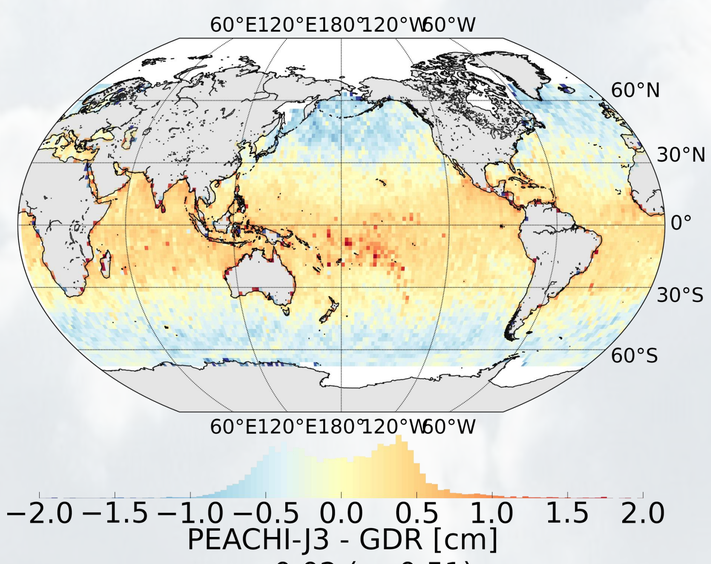
	[0,7]	[3,11]	[7,15]	[11,19]	[15,40]
[0,60]					
[0,15]	1	2	3	4	5
[5,25]	6	7	8	9	10
[15,35]	11	12	13	14	
[25,60]	15	16	17		

Performance assessment on Jason-3

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

PEACHI more wet on inter-tropical regions

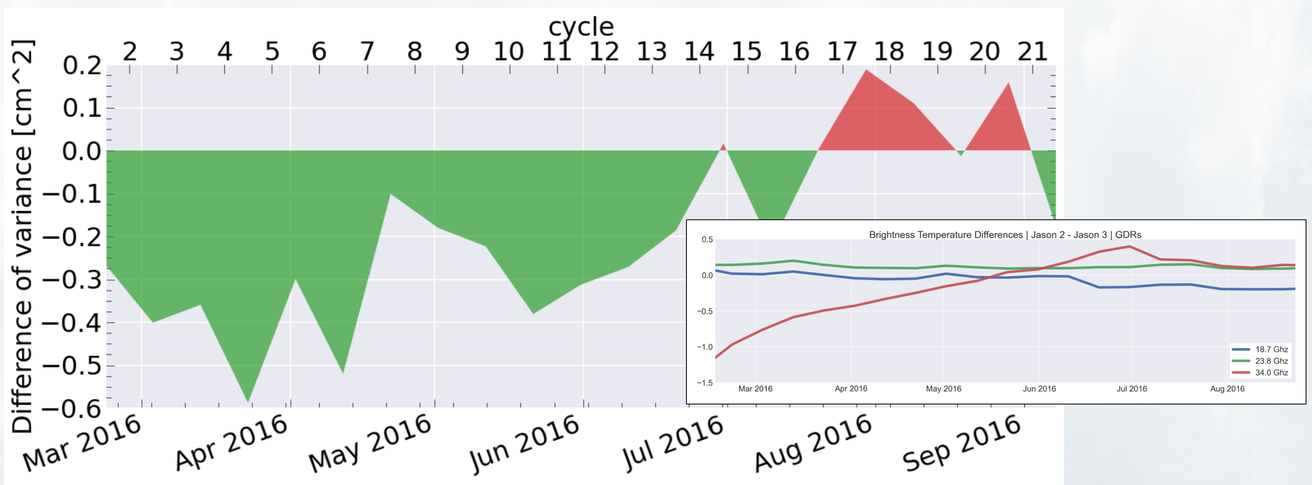
PEACHI dryer at high latitudes



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



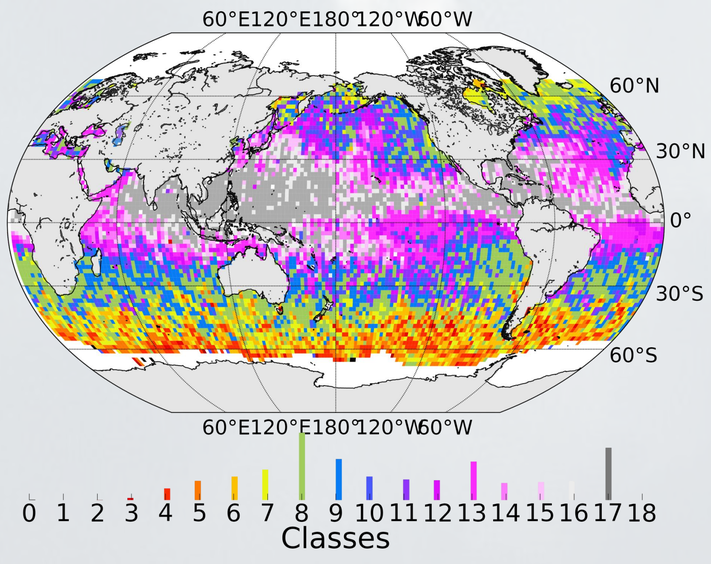
Same approach applied on Jason-2

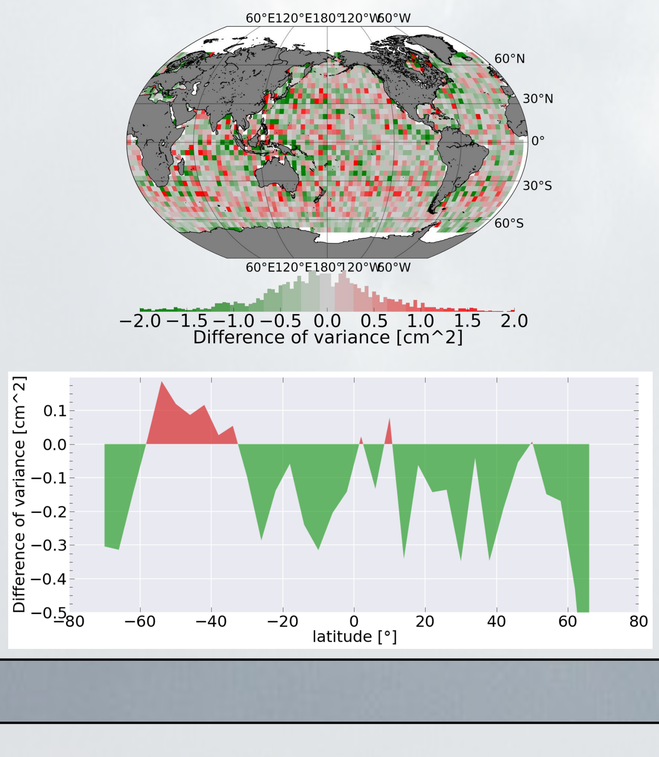
Expected results on Jason-3 with sufficient amount of data:

-improvement at high latitudes

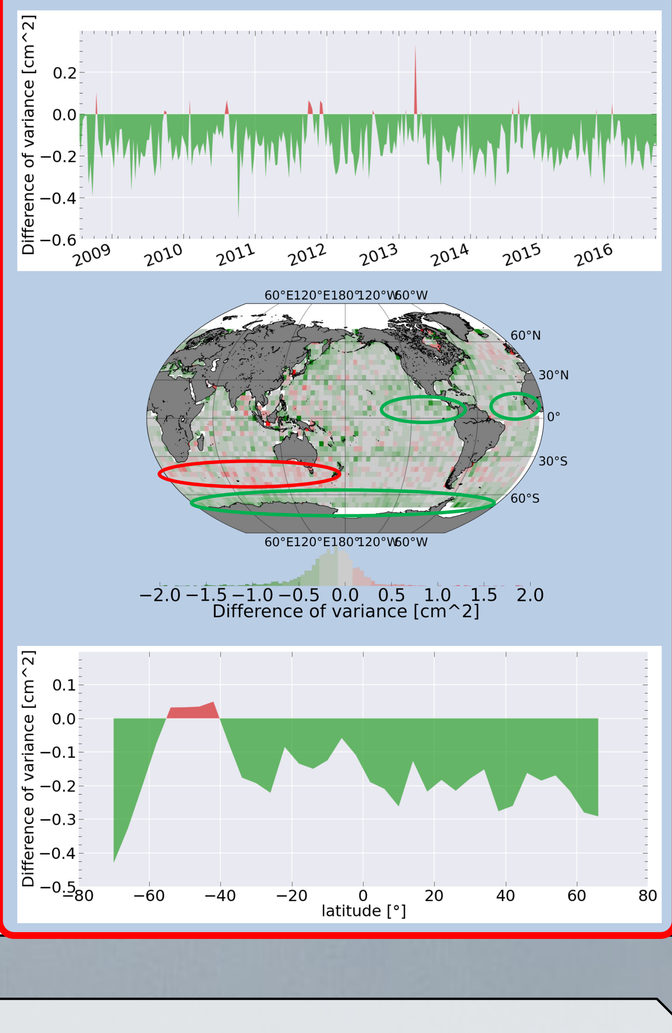
-improvement on upwelling regions

-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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