Potential of new retrieval algorithms for the wet tropospheric correction of the Jason1/Jason2 missions

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CONTEXT

- Retrieval algorithms formulated over learning database (dh, TB1, TB2,TB3)
- Formualtion based on the minimization of both **global bias and the standard deviation**
  - Loglinear algorithms dh=c0+c1 ln (280-TB18.7) + c2 ln(280-TB23.8) + c3 ln(280-TB34)
  - Neural algorithms dh =NN(TB18.7,TB23.8,TB34)
- This minimization of global bias and standard deviation ignores seasonal or regional specificities = > geographically correlated errors

Objective

- To improve Open Ocean altimetry products
- To develop a new retrieval algorithm (Jason1 /Jason 2 configurations)
- To assess the performances with respect to classical algorithms

Retrieval algorithm formulation

- Database built with 4 ECMWF analyses (one per season in 2008)

- For each mesh (0.5 degree):
  - Surface parameters : temperature (**SST**), wind, pressure
  - Atmospheric parameters: profiles (90 levels) of water vapor, cloud liquid
  - Wet tropospheric correction **dh** for each mesh
  - Lapse rate **γ800** : temperature decrease rate between the surface and 800mb
  - Simulated **TBs at 18.7, 23.8 and 34 GHz** with a radiative transfer model

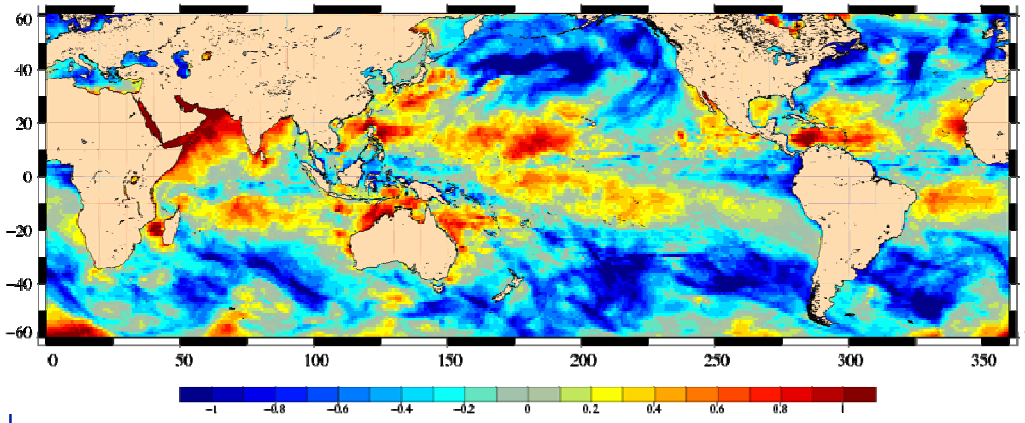
- 10% of the database for learning, the rest for testing

Performances between different types of algorithm

- linear bi-frequency : dh=c0+c1 ln(280-TB23.8)+c2 ln(280-TB34)
- neural bifrequency : dh=NN(TB23.8, TB34)
- linear tri-frequency : dh=c0+c1 ln (280-TB18.7) + c2 ln(280-TB23.8) + c3 ln(280-TB34)
- neural tri-frequency : dh=NN(TB18.7,TB23.8, TB34)

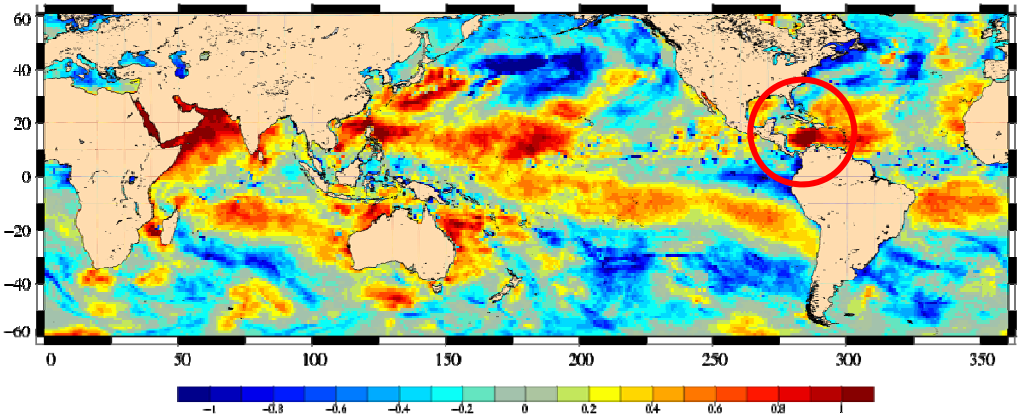
Residuals = Differences between retrieved and reference dh

LIN 23.8 34 => σ=8.4 mm



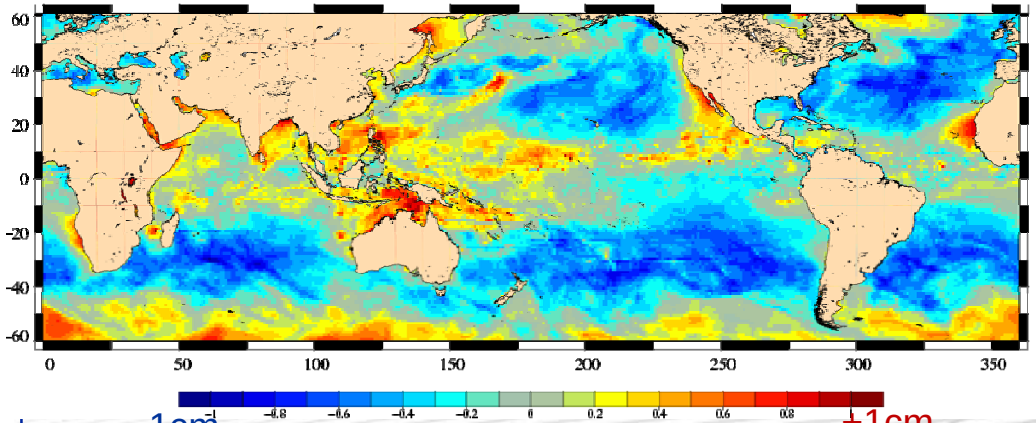
-1cm +1cm

NN 23.8 34 => σ=5.6 mm



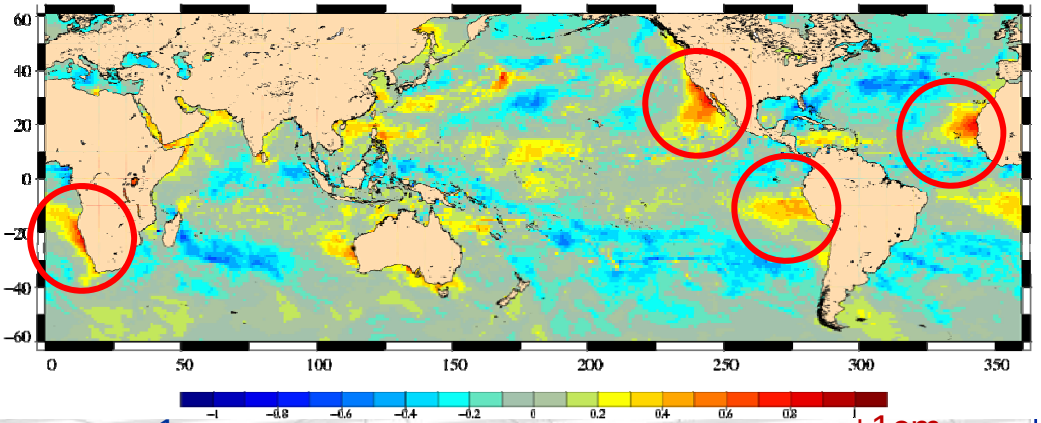
-1cm +1cm

LIN 18.7 23.8 34 => σ=4.1 mm



-1cm +1cm

NN 18.7 23.8 34 => σ=2.2 mm

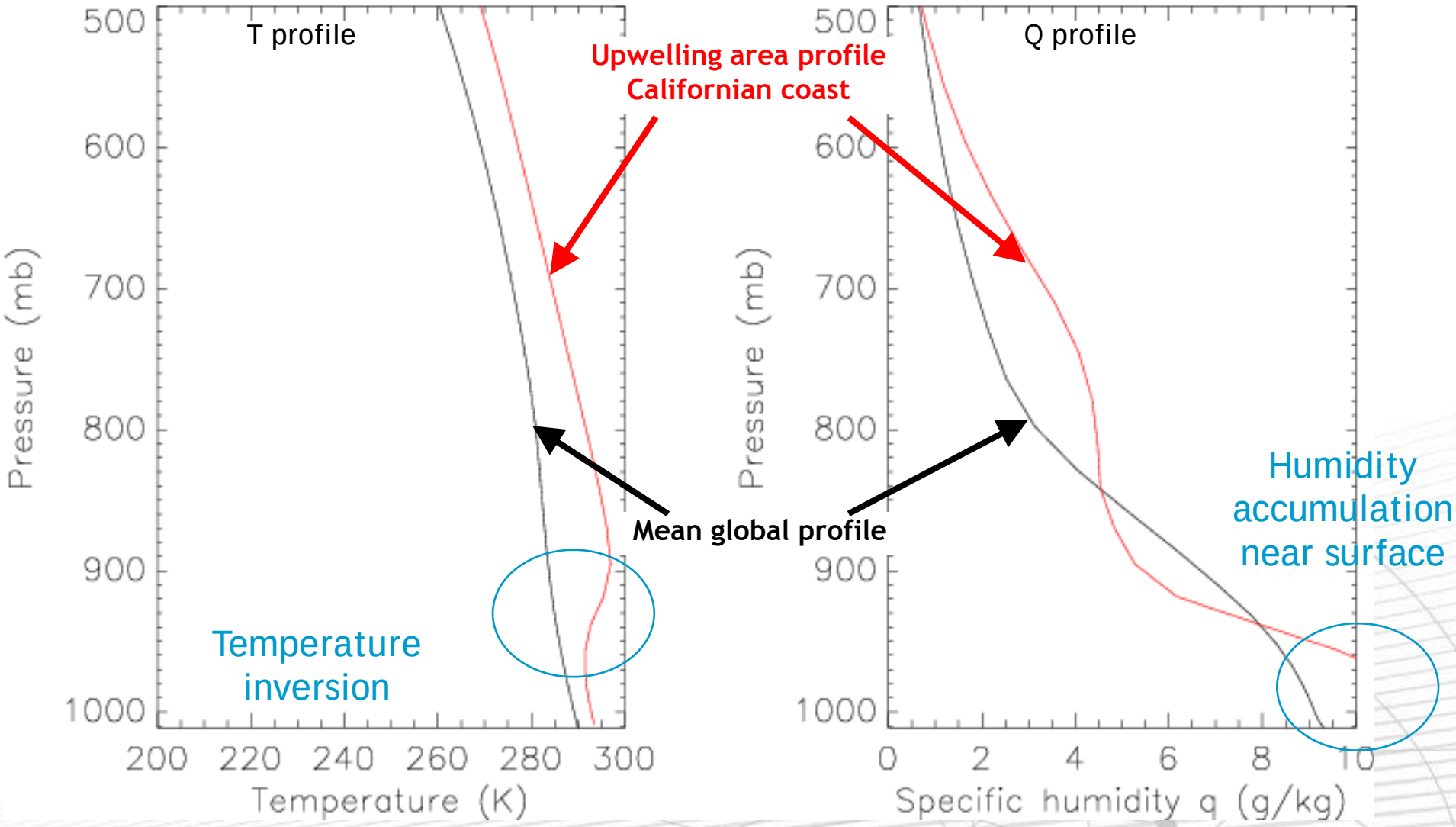


-1cm +1cm

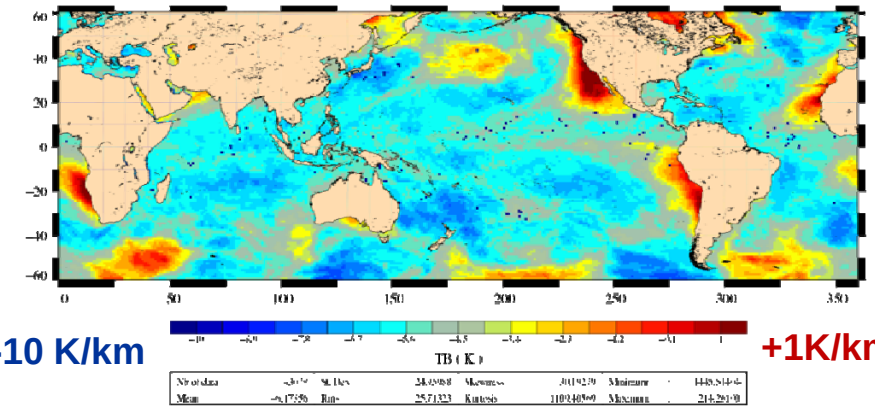
Performances of the different algorithms

- A linear tri-frequency is better than a neural bi-frequency.
- Necessity to add the altimeter backscattering information in case of bi-frequency radiometers (Envisat, AltiKa, Sentinel 3)
- Even with a neural regression
  - Some underestimations
  - Over estimations in the Eastern part of the subtropical bassins
- New parameters added as inputs in the retrieval algorithm (Obligis et al, 2009)
  - decrease rate of the temperature
  - SST

Example of atmospheric profiles near the californian coast

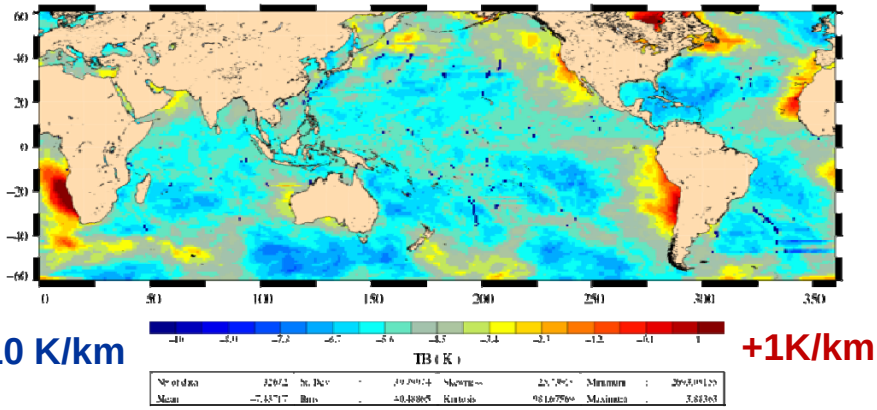


Interannual variability of intensity/extent of the upwelling



-10 K/km +1K/km

2008

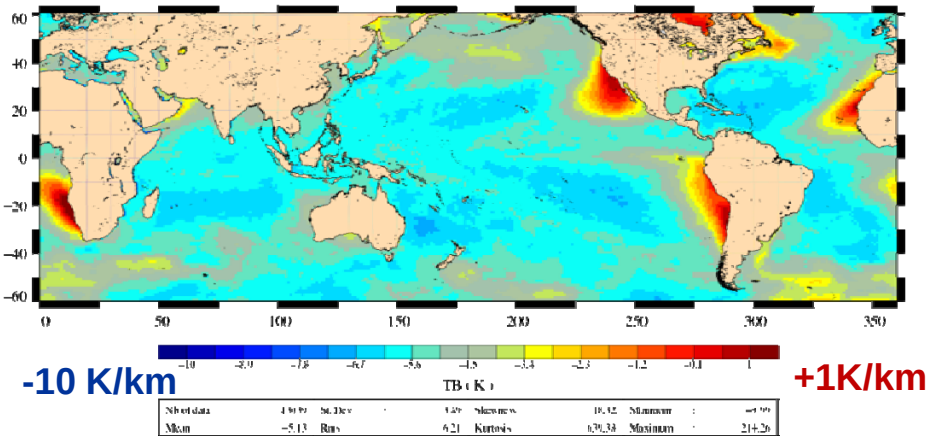


-10 K/km +1K/km

2004

- Auxiliary information computed from 5 years of ECMWF atmospheric profiles

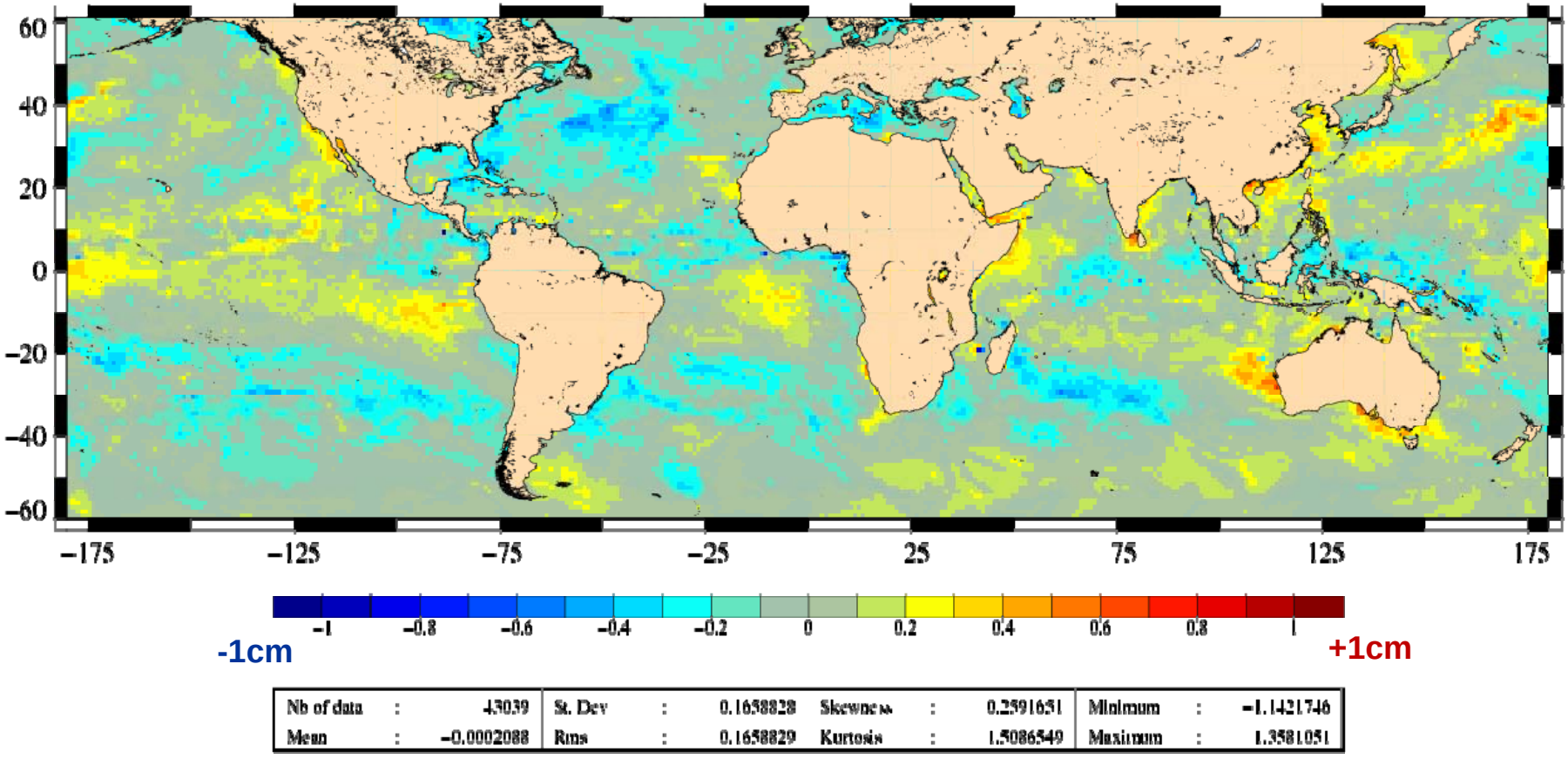
GAMMA_800 2003–2008



-10 K/km +1K/km

Performances of a new algorithm on simulated database

dh=NN(TB18.7,TB23.8, TB34,γ800,SST)



Nb of data	:	43039	St. Dev	:	0.1658828	Skewness	:	0.2591651	Minimum	:	-1.1421746
Mean	:	-0.0002088	Rms	:	0.1658829	Kurtosis	:	1.5086549	Maximum	:	1.3581051

Conclusions

- Evaluation of a new algorithm with SST and γ800 as new input parameters
- SST does not bring additionnal information in case of a 3-frequency radiometer. Already contained in the low frequency TB (18.7 GHz)
- γ800 allows considering specificities of atmospheric profiles in upwelling areas
- With the new algorithm, large scale differences with the ECMWF model are reduced (not shown)