PEACHI_Jason-3 :
A processing laboratory for innovative altimetry products

***Sophie Le Gac[1]**, J.-C. Poisson[2], P. Thibaut[2], F. Boy[1], A. Guillot[1], N. Picot[1], B. Picard[2], L. Amarouche[2], N. Tran[2]*

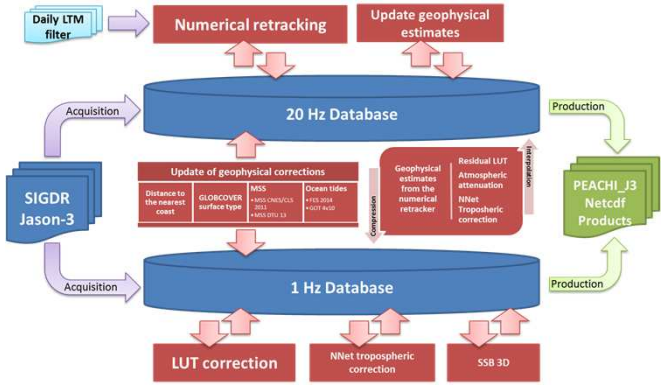
Prototype for Expertise in Altimetry, Coastal, Hydrology and Ice

Overview

Similarly to the **PEACHI** prototype for SARAL/AltiKa *[1]*, the PEACHI_Jason-3 prototype will serve as a laboratory for processing **Jason-3 data** and delivering **experimental algorithms and solutions** such as :

- **Numerical retracking** estimates
- Enhanced retracking algorithms estimates (real MLE), possibility to add other retrackings (e.g. ICENEW)…
- New wet tropospheric correction (WTC)
- New 3D Sea State Bias (SSB)
- Iterative editing method
- All up-to-date geophysical corrections

Along-track products generation



Products availability & distribution

- PEACHI J3 prototype prime objective is to **ensure** and **demonstrate** the **quality of new algorithms before possible implementation** into Jason-3 operational ground segment.
- During the **assessment phase** (Launch + 12 months), Jason-3 data will be processed and the PEACHI J3 product will be available to the **4-partners designated experts** for an in-depth evaluation of its quality.

References

[1] ***Valladeau et al.***, *« Considering SARAL/AltiKa to improve Ka-band altimeter measurements for coastal zones, hydrology and ice: the PEACHI prototype » – Marine Geodesy special issue*

[2] ***Boy et al.***, *« Towards Jason-3 waveforms processing : assessment of the Numerical Retracking performances » – OSTST Konstanz, 2014*

[3] ***Thao et al.***, *« Comparison of Retrieval Algorithms for the Wet Tropospheric Path Delay » – JSTAR, accepted, 2015*

[4] ***Tran et al.***, *« Updated wind speed and sea state bias models for Ka-band altimetry » – OSTST Konstanz, 2014*

Numerical retracking

The **numerical retracker** was initially developed by CNES in the frame of SAR altimeter processing.

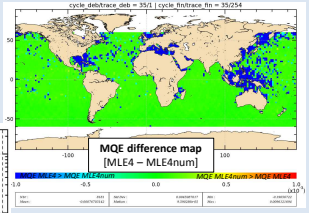
Through the **use of the altimeter real PTR**, it helps **improving the radar echo modeling,** prevents misleading treatment of data caused by **instrument ageing**, and ensures the sea level product **quality over time**.

Differences with current MLE4 retracking :

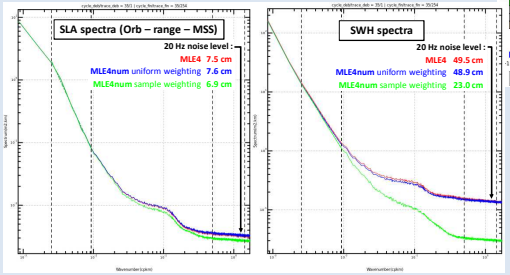
MLE4	Numerical retracking (MLE4num)
Hayne's Model for radar echo modeling	Hayne's model using σ_p=0
Gaussian PTR approximation	Real time convolution with the instrument PTR (CAL1 measurement)
Analytical computation of derivatives	Numerical computation of derivatives, using finite difference method
Look-Up Tables approach to correct for the PTR gaussian approximation (computed offline for a reference PTR)	**No LUTs needed !**
Uniform weighting only (⇔ Least Square Estimator)	Uniform (⇔LSE) or non-uniform by sample (⇔ real MLE) weighting

Main results and improvements :

Numerical retracker performances have been demonstrated using Jason-2 data (cycle 35) *[2]*.



↑ Significant reduction of MQE (quality of estimation) in low SWH regions



← SLA and SWH spectra show the **performances of MLE4num** wrt MLE4

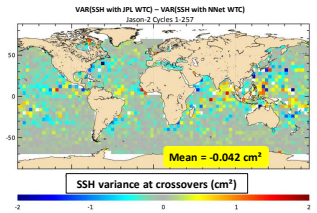
- **Significant reduction of estimation noise** using non-uniform sample weighting (-8% on SLA, -53% on SWH).
- No impact on other parameters (σ_0 and ξ^2) *[not shown]*
- Same analysis has been performed to verify the capability of MLE4num to adapt to instrument ageing over 5 years of service : **between cycle 35 and cycle 219** (internal delay reduction by 1.5 mm and PTR total power reduction by 1.1 dB : these effects are currently corrected after retracking) → **no bias** observed !

ⓘ PEACHI Jason-3 product will contain both MLE4num and MLE4 for a full assessment of retracking performances.

Wet tropospheric correction (WTC)

In preparation for Jason-3 radiometer data analysis and CAL/VAL process, a new WTC is computed through **neural network (NNet) inversion** *[3]* and will be available in the PEACHI_Jason-3 product.

This method is **different from the official JPL product** obtained through a fully stratified approach (both on wind speed and WTC) using a log-linear regression.



• A statistical approach using wind classes shows very satisfying results based on Jason-2 full lifetime SSH data

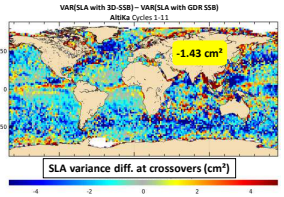
→ The performance of the NNet WTC is close to the performance of the reference product.

ⓘ This new WTC will be thoroughly evaluated over the first cycles of Jason-3 after radiometer thermal stabilization.

3D Sea State Bias (SSB)

The 3D SSB solution presented at OSTST 2014 for AltiKa will be applied to Jason-3 data.

This solution aims at considering wind speed (U), waveheight (SWH) and **mean wave period (Tm)** obtained from **Wavewatch III database**, thus improving our description of the sea state behavior.



For PEACHI_Jason-3 product, **SWH estimates from MLE4 and MLE4Num** retracking algorithms will be used and resulting SSBs will be compared.

← Clear improvement (i.e. variance reduction) already shown with **AltiKa** data *[4]*

ⓘ This 3D SSB will be available no earlier than 3 months after Jason-3 has reached its final orbit.

Geophysical Corrections

Values of the latest available geophysical corrections will be included in the 20Hz /1Hz PEACHI_Jason-3 product:

- Ocean tides : GOT4v10, FES2014
- Mean Sea Surface interpolated at each location : CNES-CLS11, DTU13
- Distance to the nearest coast
- GLOBCOVER surface type

1. ***Centre National d'Etudes Spatiales (CNES),*** *Toulouse, France*
2. ***Collection Localisation Satellites (CLS),*** *Ramonville-St-Agne, France*

Contact : Sophie.LeGac@cnes.fr