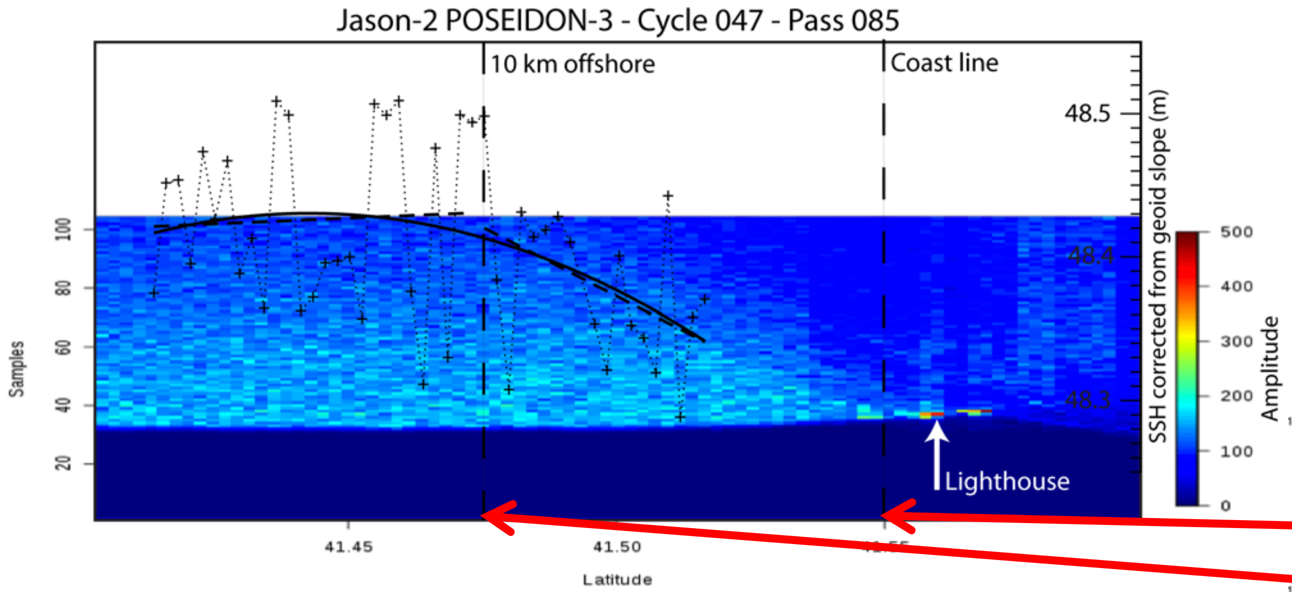
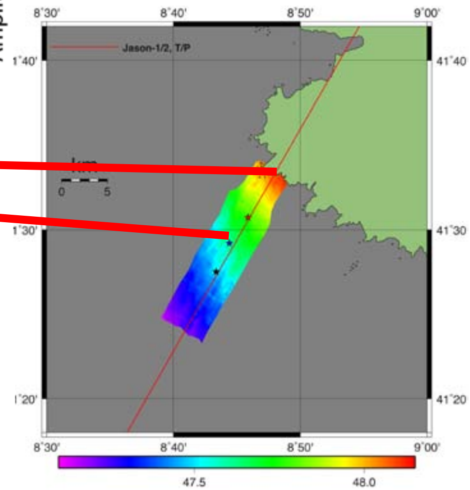
Slides for IP discussion

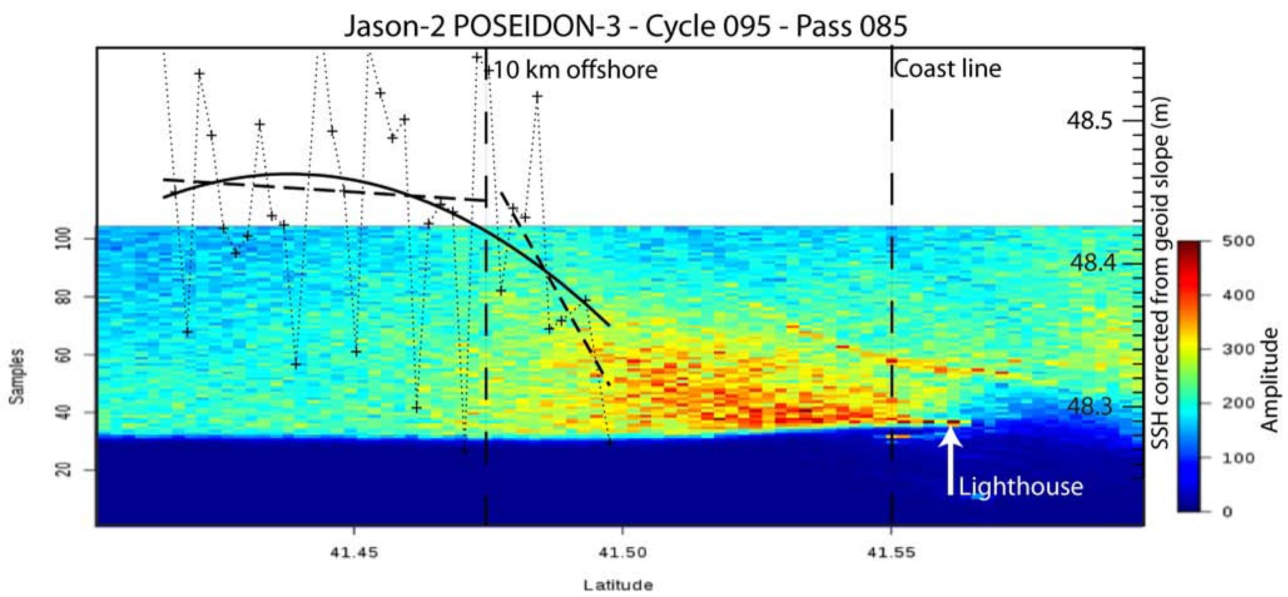
IP retracking sub-splinter

Land contamination



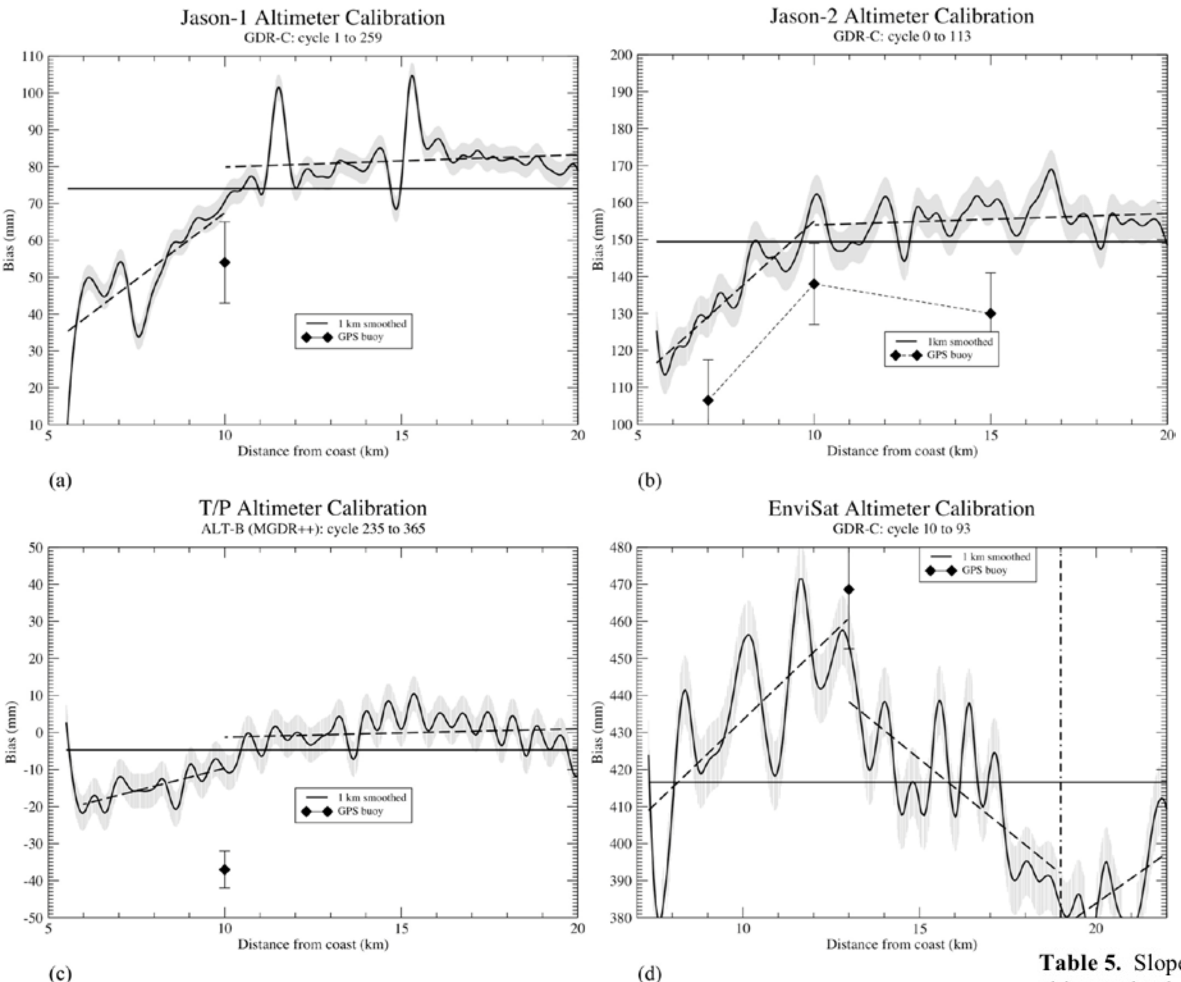


Land contamination + Sea State effects



ALTIMETER CONTAMINATION

ALTIMETER CONTAMINATION



Bonnefond et al., **GPS-based sea level measurements to help the characterization of land contamination in coastal areas, *Advances in Space Research***, Available online 14 July 2012, ISSN 0273-1177, 10.1016/j.asr.2012.07.007 .

See also poster # 15

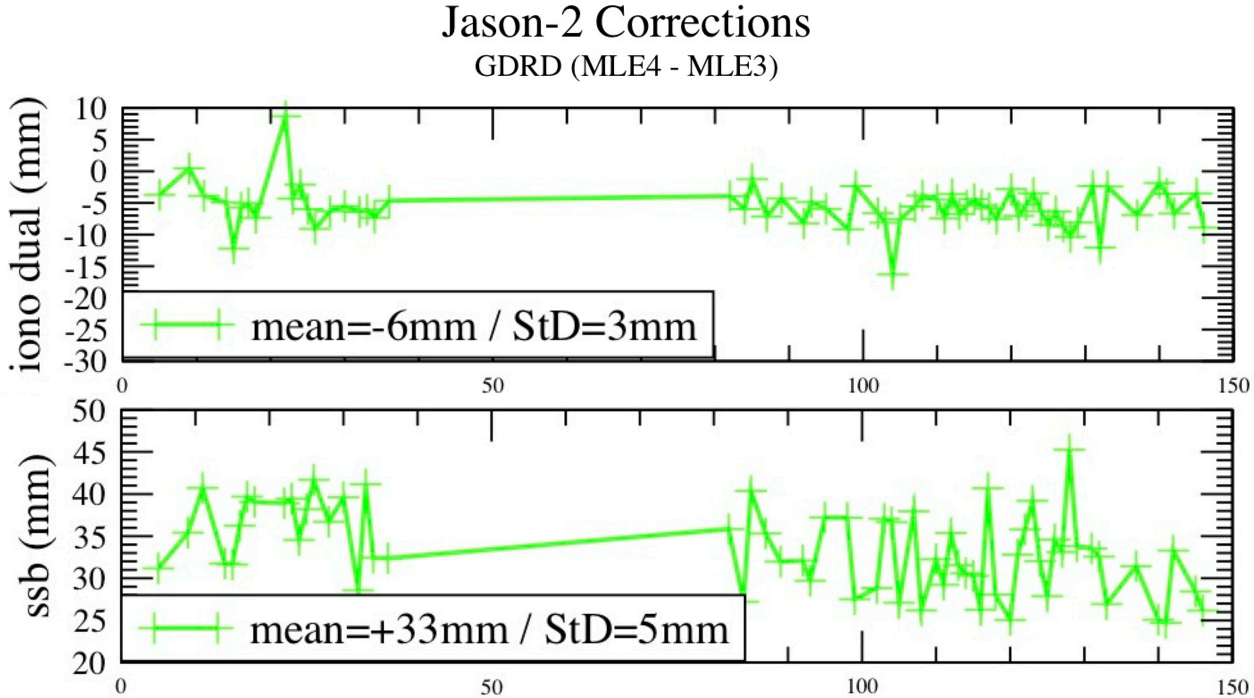
Integrated effect of the land contamination over the full set of data available

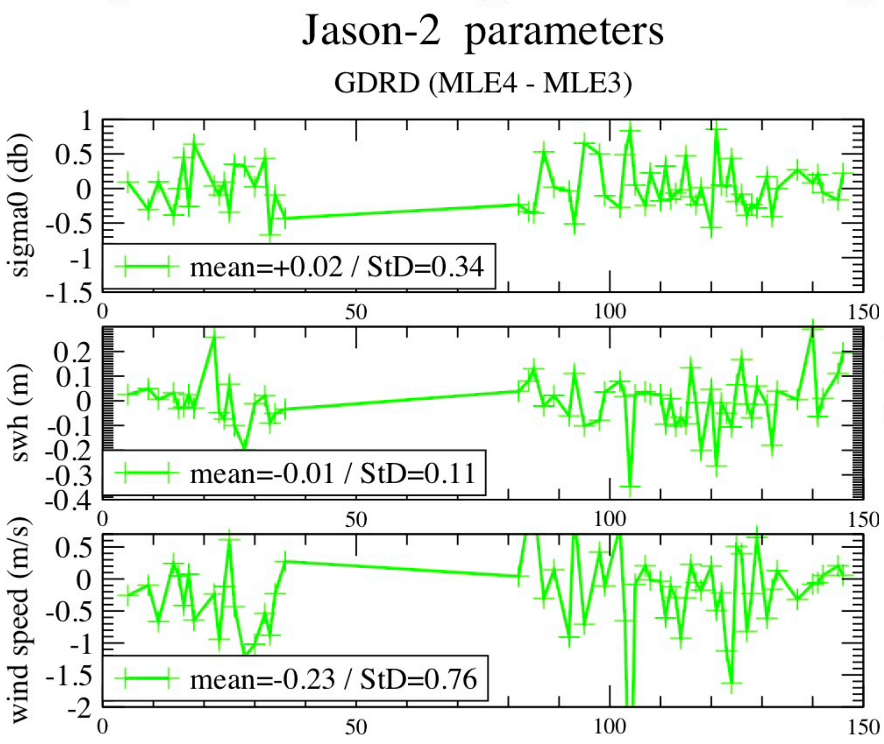
For each cycle, the SSH bias (altimeter - tide gauge) is the result of the mean of all the SSH biases evaluated at each 20-Hz (or 10-Hz for T/P) point on approach to the coast and entering the surfaces mapped with the Catamaran-GPS. These individual “high-rate biases” are saved and can be stacked over a long period to be able to extract any persistent behavior as a function of distance to the coast.

Table 5. Slope in the SSH and bias differences due to the altimeter land contamination (derived from Figure 7)

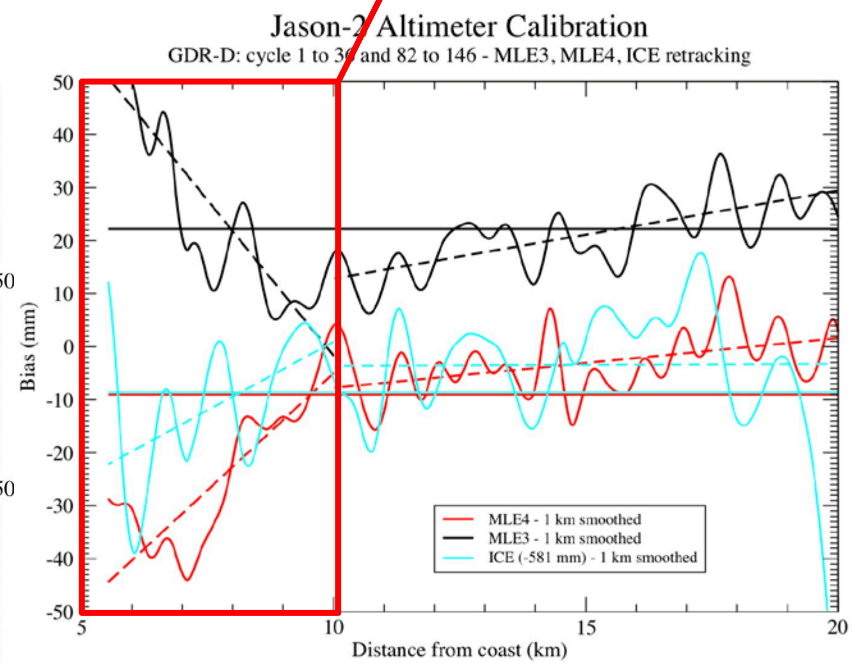
Site / Instrument	Slope (mm/km)	Bias differences* (mm)
Senetosa (5 km to 10 km)		
ALT-B (TOPEX/Poseidon)	+2.4	+4.6
POSEIDON-2 (Jason-1)	+7.2	+7.6
POSEIDON-3 (Jason-2	+8.6	+6.1
Ajaccio (RA-2, Envisat)		~+30
7 km to 13 km	+9.1	
13 km to 19 km	-7.7	
19 km to 22 km	+6.8	

*estimated from the area where altimeter should not be contaminated: 10 km to 20 km at Senetosa and only at 13 km for Ajaccio (see text in the beginning of section 3.1.1 for details).





Opposite behavior from 10 km up to the coast

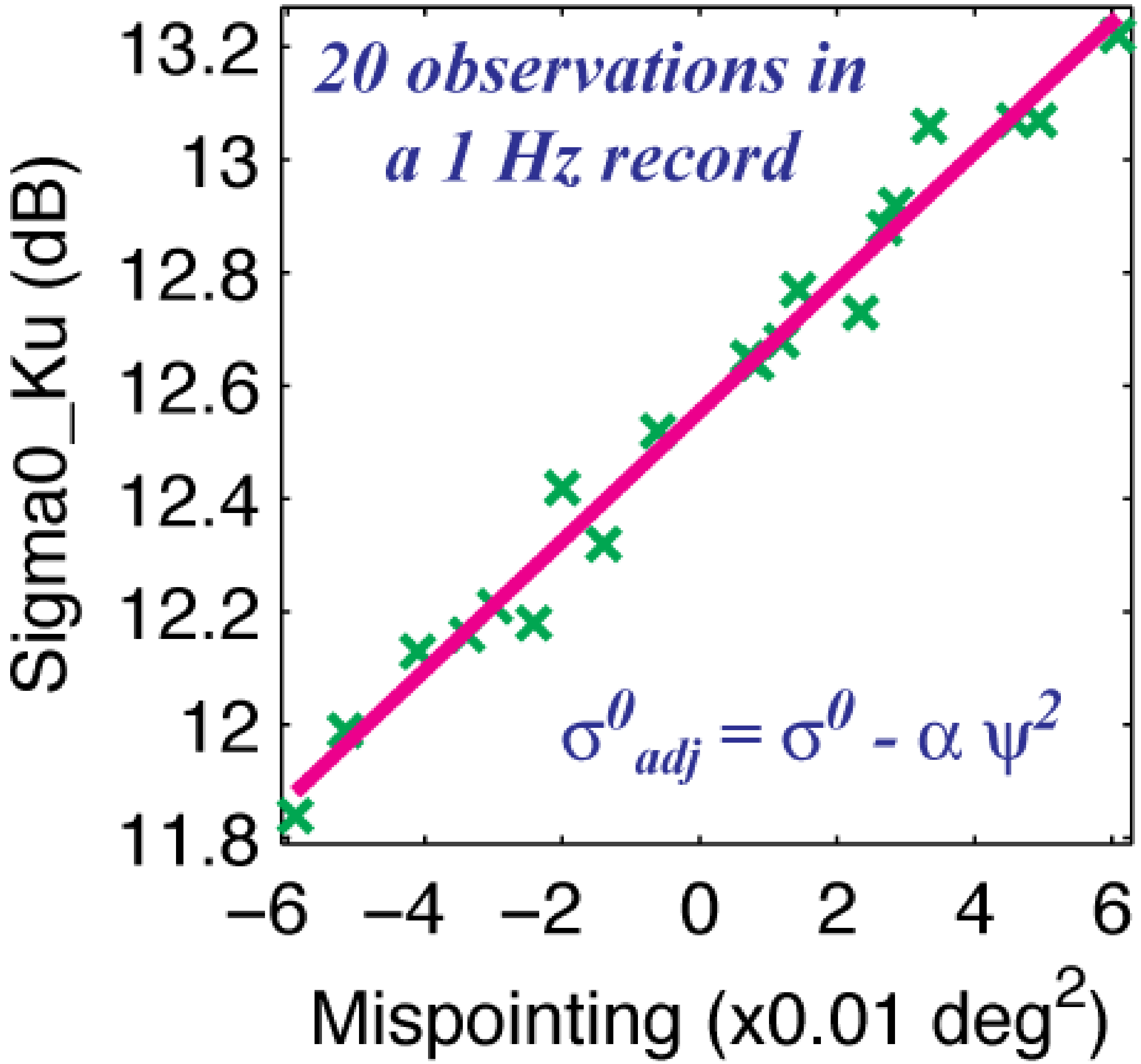


GDR-D MLE4 vs MLE3

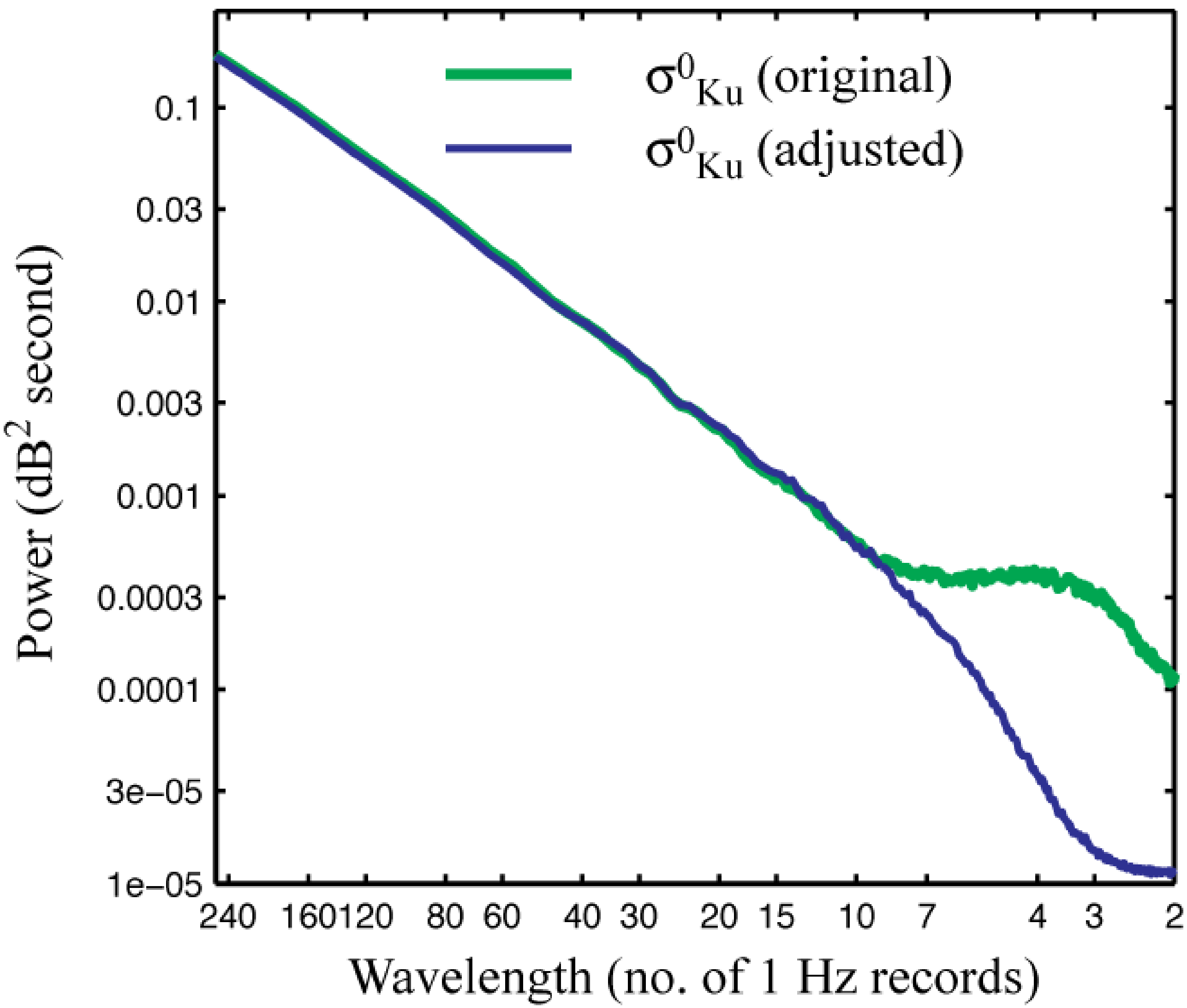
Use of MLE-4 retracker leads to a very strong statistical relationship between estimates of backscatter and mispointing

Backscatter values can be adjusted to give value for zero mispointing.

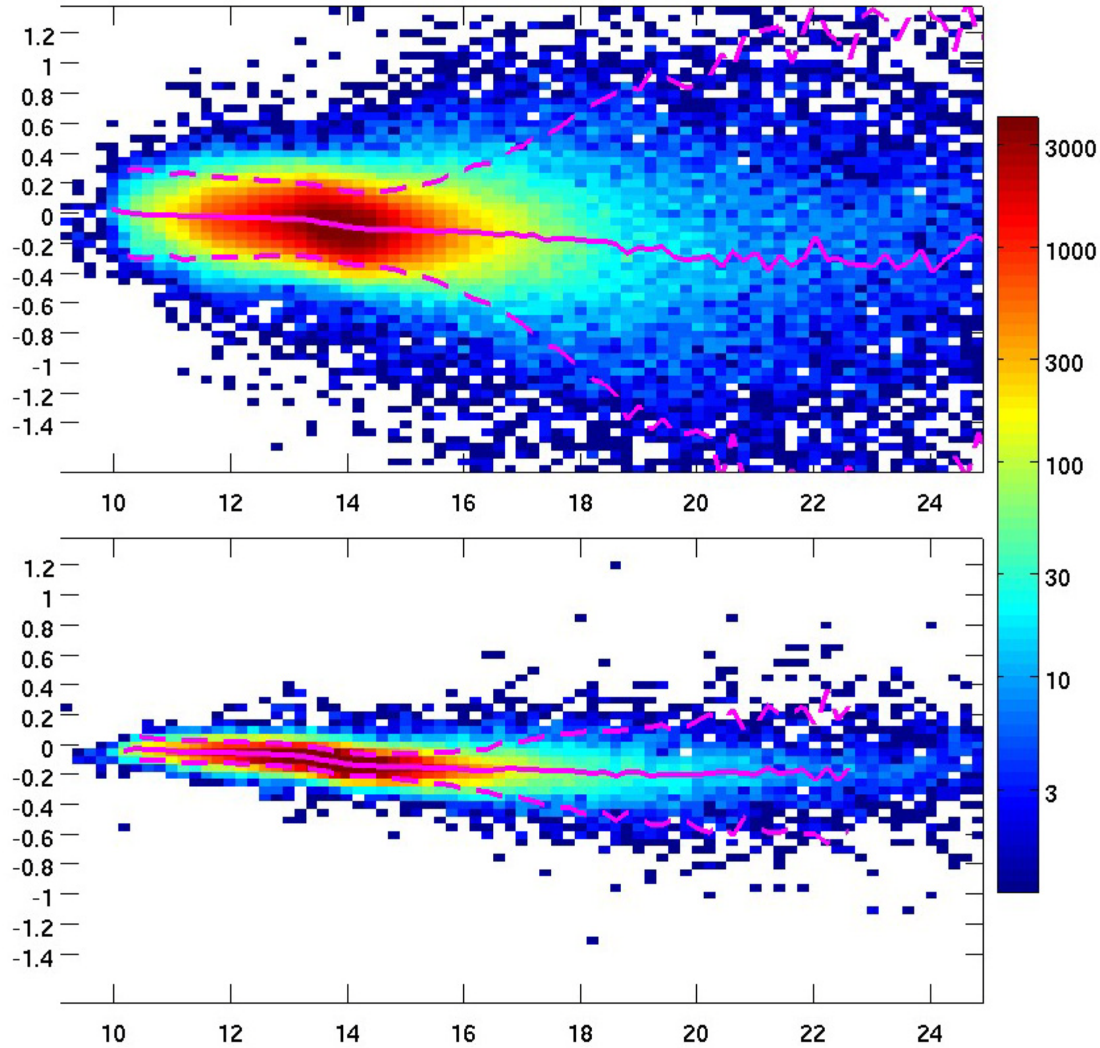
When applied to the 1 Hz data, this has 3 positive effects:



1) Marked reduction in apparent short spatial scale variability in sigma0

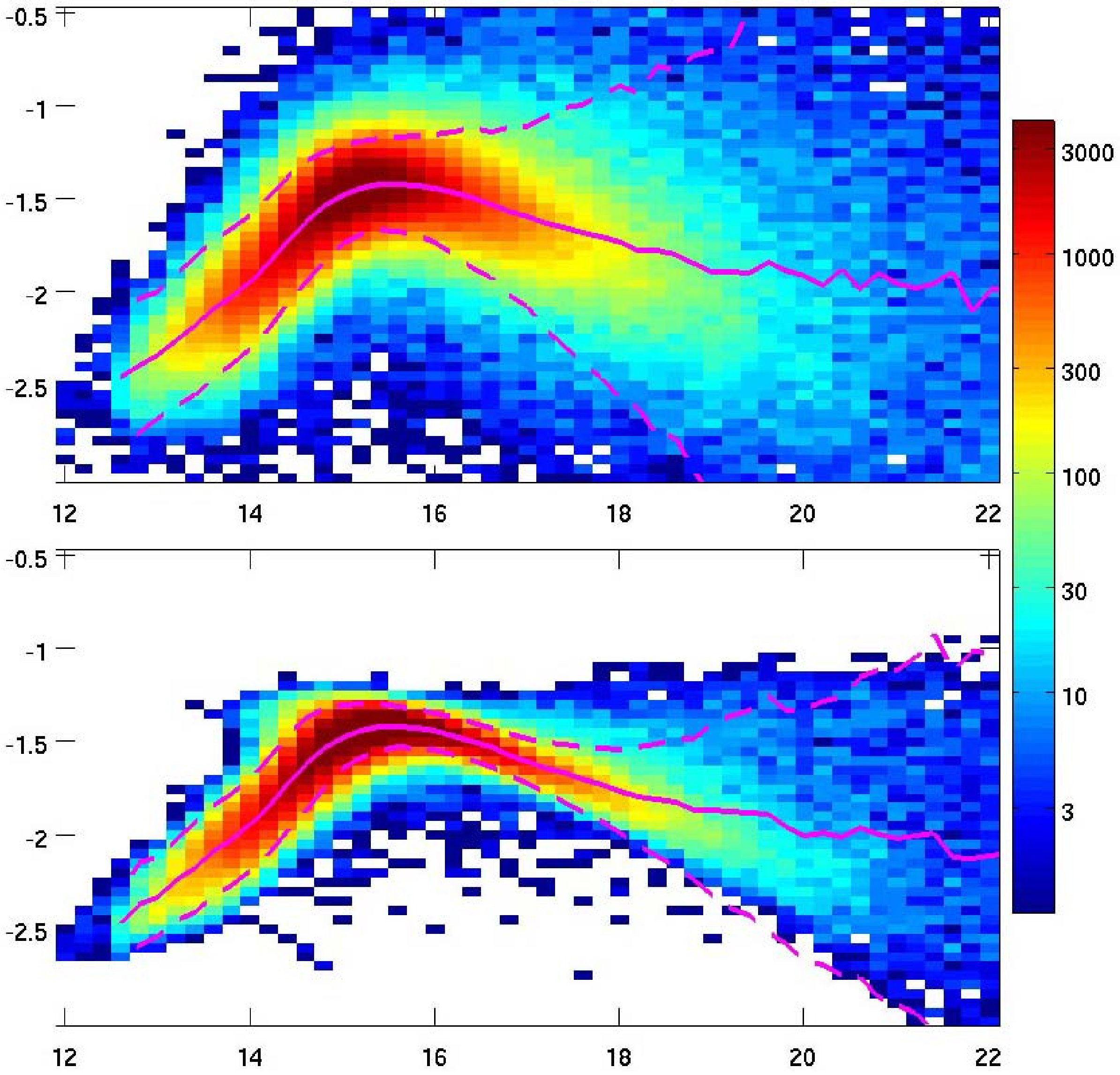


2) Mismatch between Jason-1 and Jason-2 1 Hz sigma0 values is reduced by a factor of 3 from r.m.s. difference of 0.15 dB (top) to 0.05 dB (bottom)



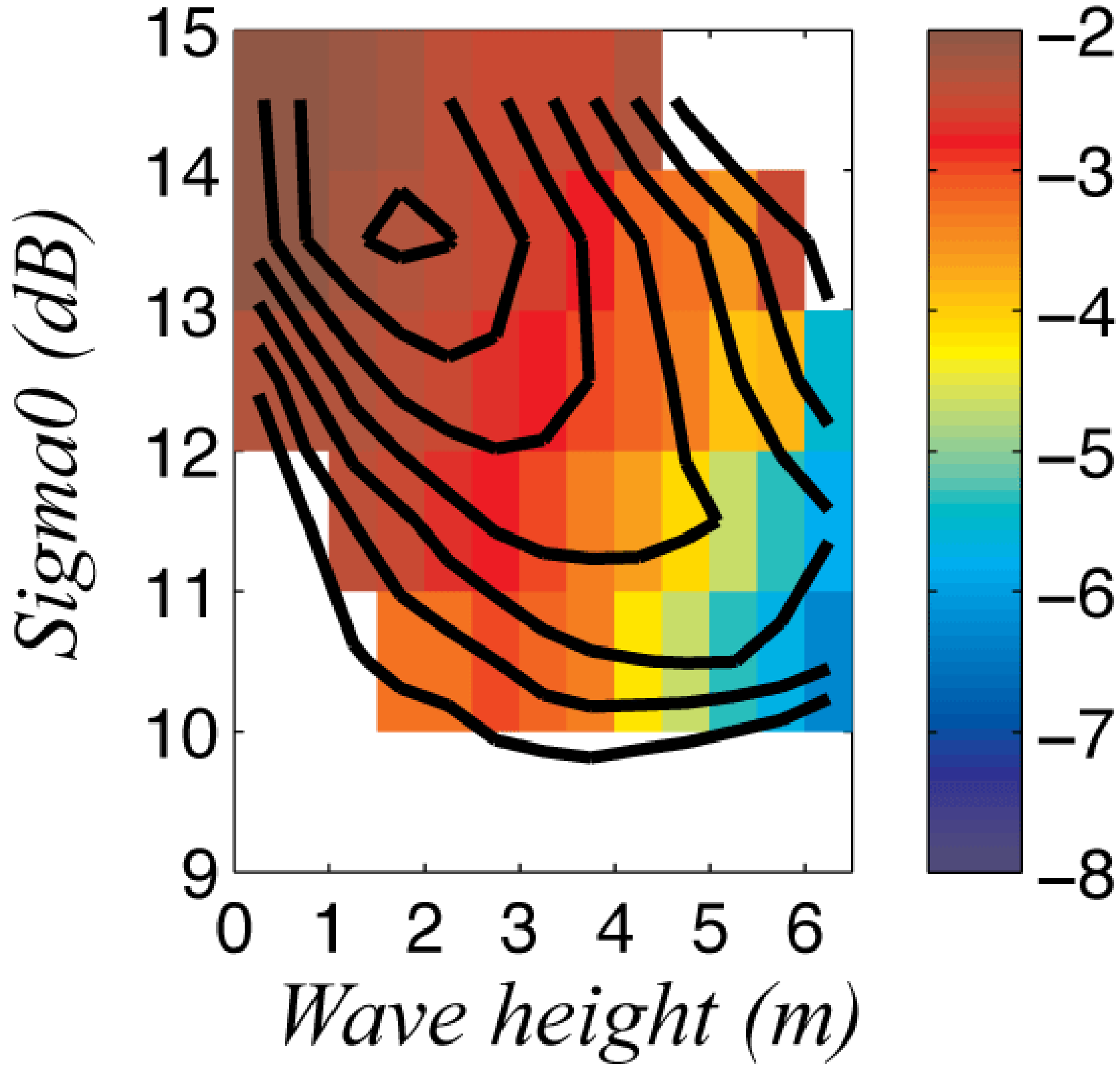
Sigma0_Ku difference (Jason2-Jason1) as a function of Sigma0_Ku
Top uses data from MLE-4; bottom after adjustment

3) The empirical relationship between Ku- and C-band values becomes much tighter, meaning that a reliable rain flag can be applied to edit SSH data that are affected by rain.



Sigma0_Ku – Sigma0_C a a function of Sigma0_C
Top uses data from MLE-4; bottom after adjustment

A reminder that offset in bias between 2 different retrackers (e.g. when switching from open ocean to coastal) will in general be a function of wave height and sigma0 i.e. equivalent to requiring a slightly different SSB model for each retracker



Difference in CM between Red3 and standard ocean retracker (both available in Pistach product)
Black lines are contours of number density.

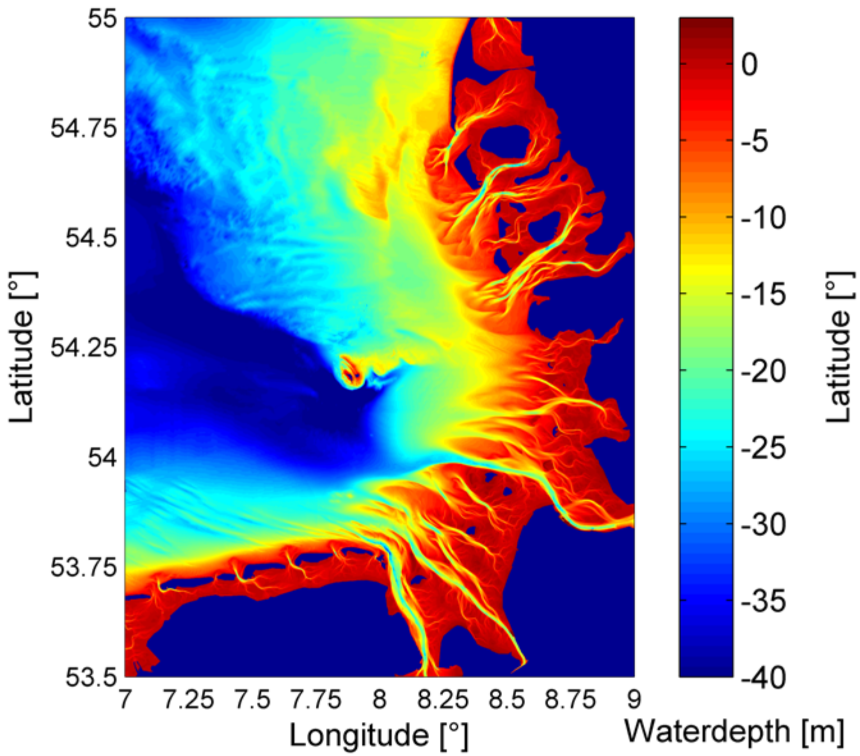
Institute of Geodesy, Technische Universität Darmstadt:
Luciana Fenoglio-Marc, Matthias Becker

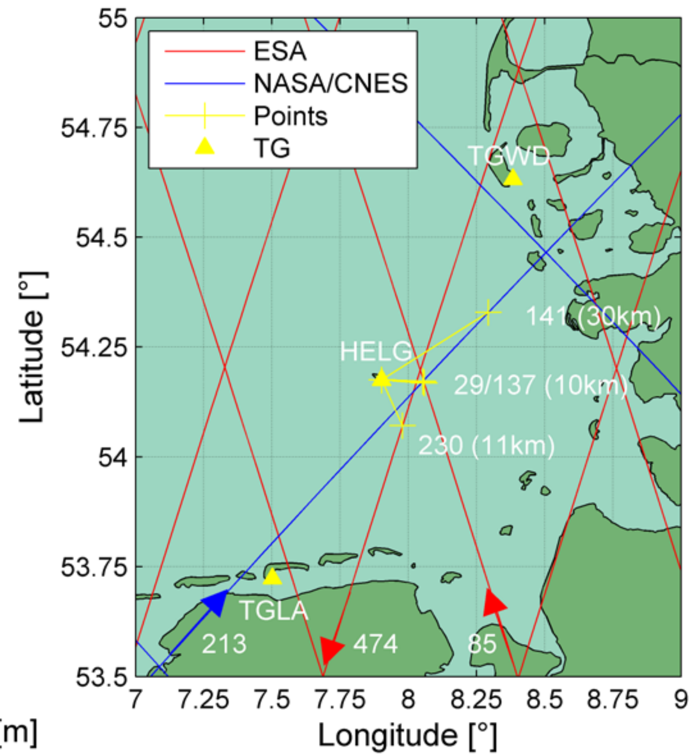
Bundesanstalt für Gewässerkunde, BfG, Koblenz, Germany
Robert Weiss

In the German Bight we perform a validation of SSH via GNSS-TG stations and altimetry (absolute and relative) and of SWH Cryosat

2. Area for validation

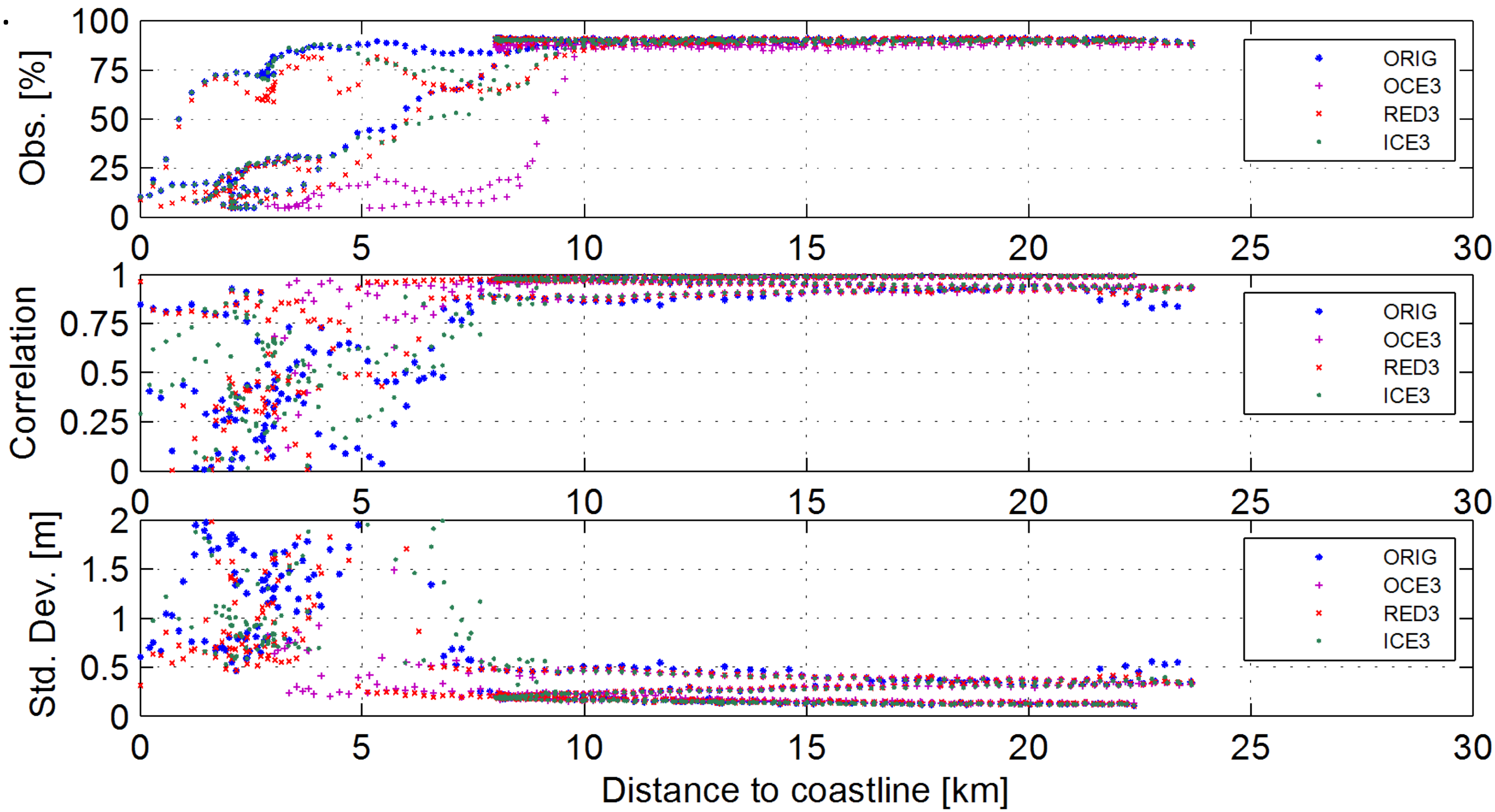
- Waterlevels – Tide Gauges minutes 2000-2010 WSV
- GPS@TG – 19 permanent (BfG), 3 BKG EUREF GNSS, GREF
- AltimetryPISTACH (SSH), Cryosat (SWH)



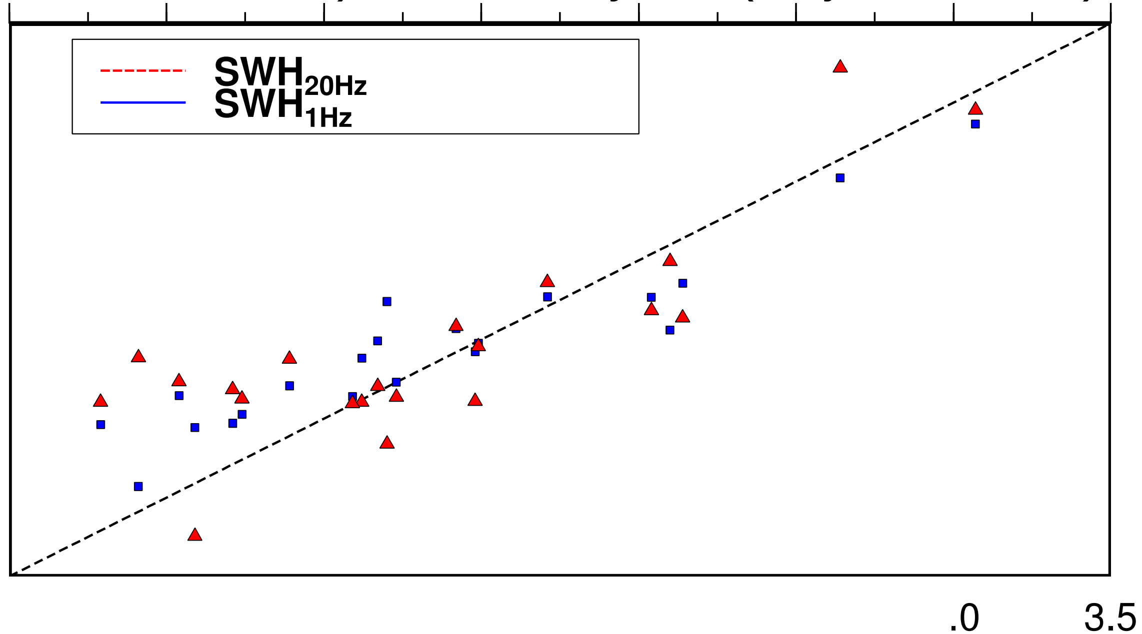


3.1 Results – Coastal SSHs, Sea-Land

- RED3 performs at best



3.2 Results SWH – AWAC (Acustic Wave and Current Profiler) and SAR Cryosat (Project Somosa)



21 passes in 2011

	Mean	STD	RMS
SWH C2	1.45	0.66	1.59
SWH FINO3	1.34	0.73	1.52
C2-FINO3	0.12	0.42	0.43

4. Key findings and open issues

- **The PISTACH** data give improved sea level (SSH) between **5 and 10 km** from coast

- At less than **4 Km from the coast** also PISTACH data are **too noisy**

- **PISTACH data are not available in Wattenmeer < 53.7 lat**

- **The RED3** retracker performs as **„best retracker“** near the coast

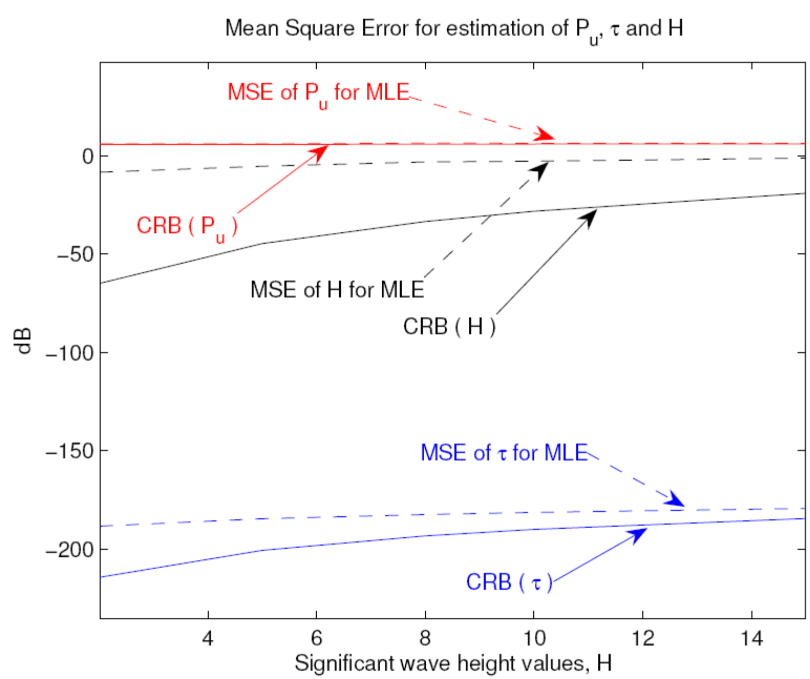
- **SWH from SAR Cryosat (Project Somosa)** compare well with **AWAC** measurements within 0.4 m (rms), 0.12 (bias) (21 passes)

Round Tables
LRM processing studies on CNES side

François Boy

Why still working on LRM processing?

- Looking at the Cramer-Rao boundaries estimated for Jason-2, we noticed that the theoretical performances are not reach with the current MLE4 retracking. Why?
  - Are t … n Brown's mode … tenna patte…
  - Is the … emented?



CNES LRM processing study

- CNES has started last year a study with CLS to build a new retracking algorithm based on:
  - ✦ A numerical LRM echo model computed without any approximation (use of the real instrument PTR and antenna pattern)
  - ✦ A "real" MLE algorithm: The so-called MLE4, currently used in the operationnal processing chains, is a Least Squared Estimator, not a Most Likehood Estimator.
  - ✦ Study still on going, results planned next year. (cf JC Poisson presentation in IP-2 session).

- This new approach (use of a numerical model) may bring many advantages for past et future altimetry missions. For example, we can envisage to reprocess Topex data, taking into account the real degraded instrument PTR.

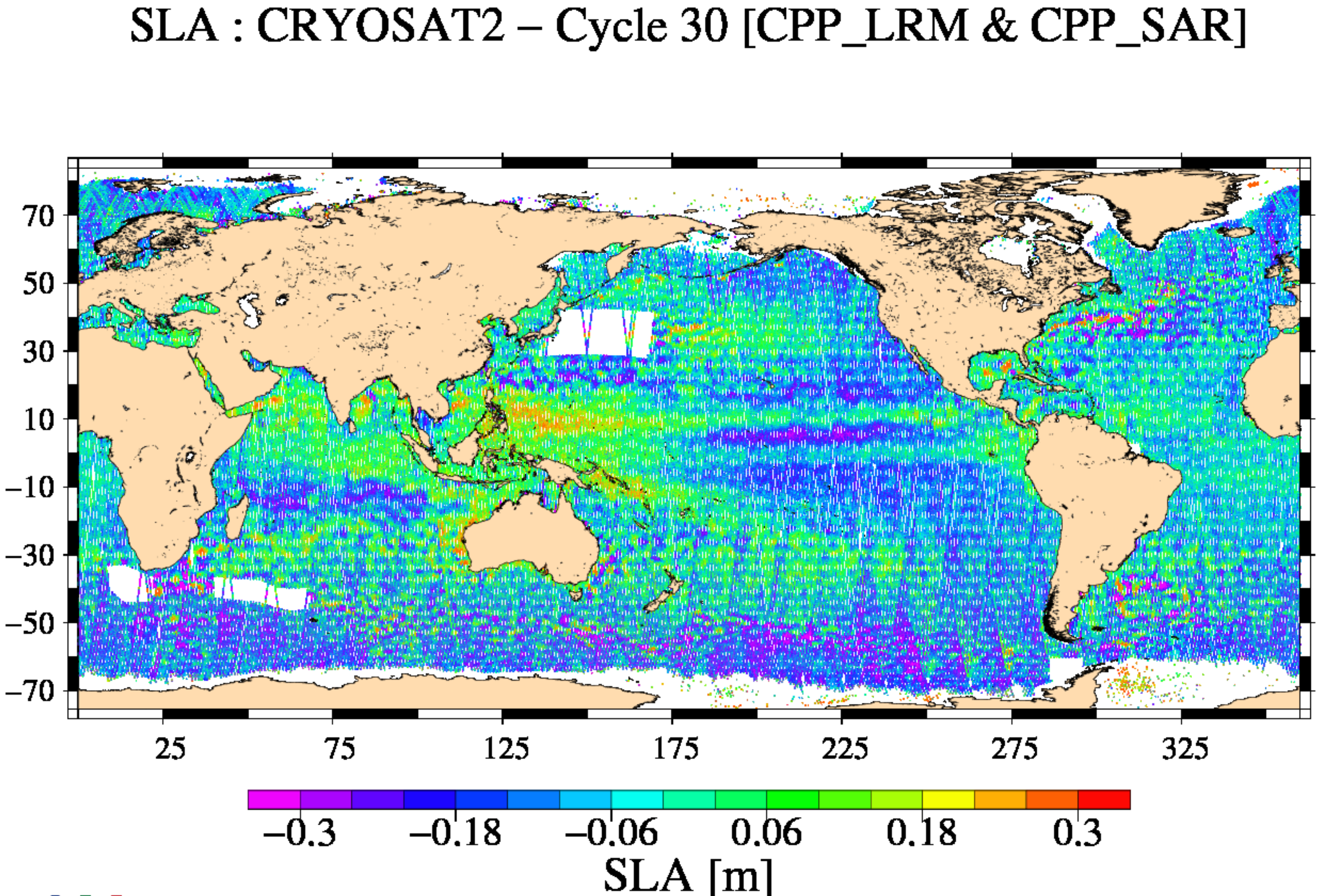
Round Tables
SAR processing results on CNES side

François Boy

CNES SAR Retracking solution

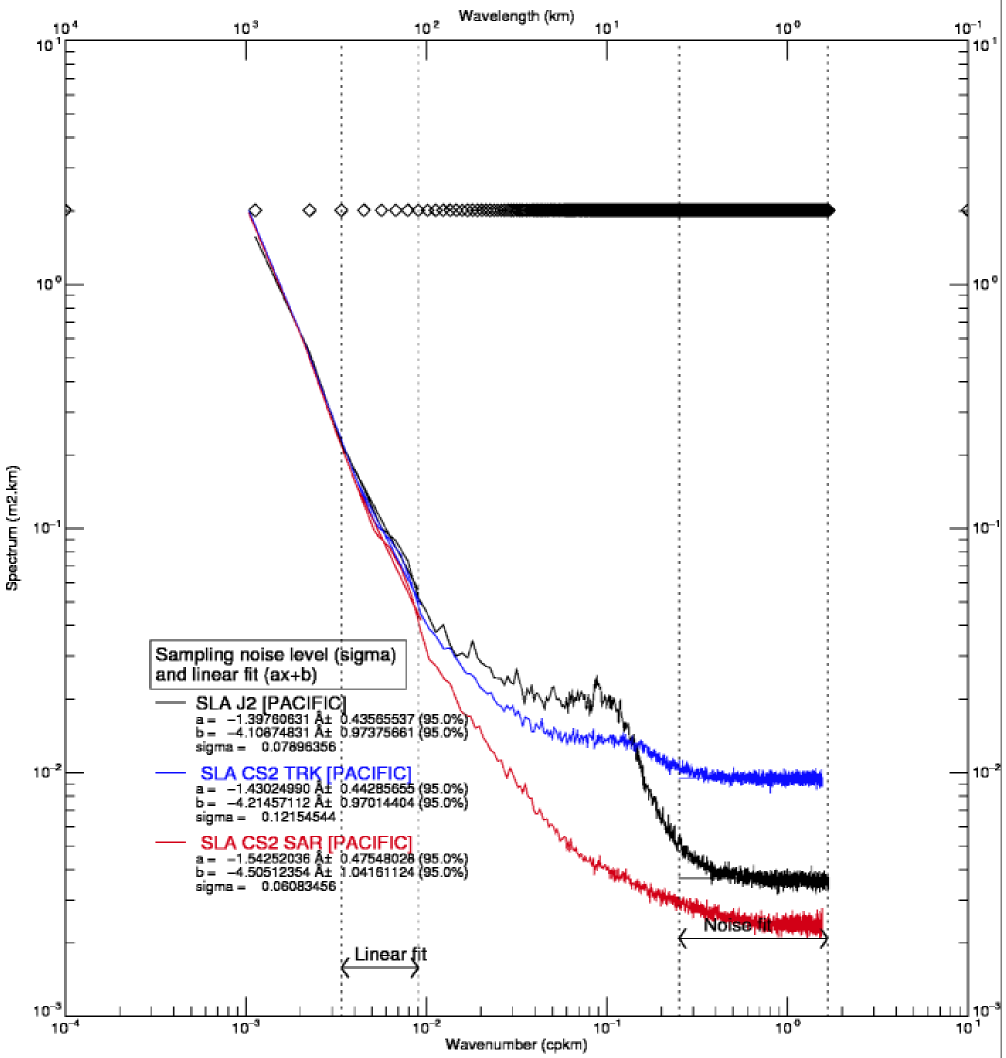
- Developed in the frame of CPP activity (CRYOSAT Processing Prototype) to prepare the processing strategy for Sentinel-3.
- CRYOSAT-2 SAR measurements are processed from telemetry and provided with Sea Level Anomaly and SWH values.
- SAR Level-1b processing has been implemented respecting Raney approach.
- SAR level-2 processing is based on a full numerical Doppler model providing the doppler echo shape for any sea state (SWH, epoq and Pu) and a constant mispointing angle (0.1° x 0.1°) .
- The CNES SAR retracking also provides with the so-called RDSAR (pseudo LRM measurements built from SAR waveforms) = best reference to assess SAR biases (but very noisy).
- CRYOSAT-2 data (both LRM and SAR) have been processed from May to August 2012 and deeply analyzed through CLS analysis tool box.

CRYOSAT-2 Sea Level Anomalies with LRM and SAR data (Mav-



CLS

Spectrum analysis and Comparison with Jason2 data



Wavenumber spectrum (m2.km)

SAR and RDSAR (TRK) SLA Spectrum:

- Computed on pacific area
- Comparison with Jason-2

SAR noise is much lower **AND** the spectral signal is very different (and certainly better) than the one from conventional LRM data around 10 kms.

Open questions and difficulties

- The CNES SAR retracking faces problems with very low SWH.

- The SAR retracking is very sensitive to mispointing angles. CY2 data have been processed with a model computed with a constant mispointing angle (0.1x0.1 = mean value assessed by NOAA) but there are temporal and geographical mispointing variabilities on CY2 mission. Need to find a solution to estimate or compute the mispointing angle to reduce related errors.

- The azimuth resolution of the SAR mode is of the same order than the swell wavelength (around 300m). What is the impact of the swell?

- No SSB knowledge!