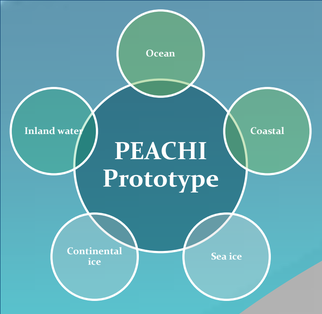
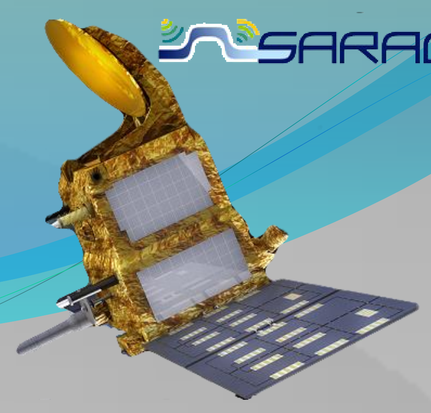


Using SARAL/AltiKa to improve Ka-band altimeter measurements for coastal zones, hydrology and ice: status of the PEACHI project



Guillaume Valladeau, P. Thibaut & the PEACHI team (1)
N. Picot, A. Guillot, F. Boy, S. Le Gac (2)
(1) Collecte Localisation Satellite (CLS), Toulouse, France.
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OVERVIEW

PEACHI: Prototype for Expertise on AltiKa for Coastal Hydrology and Ice

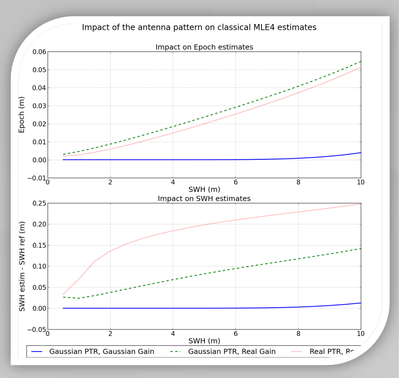
- ❑ CNES initiative to complement SARAL/AltiKa processing software and the dissemination of the operational Level-2 products *[1]*
- ❑ New or improved algorithms are being developed to better observe the open ocean and achieve SARAL secondary objectives on the study of coastal dynamics, inland waters, polar oceans, or continental and sea ice
- ❑ PEACHI reprocessing performed in 2015: focus on a handful of key algorithm improvements with regard to the operational GDR products

Category	Algorithms available	PEACHI Prototype / SARAL 'GDR-E'
Altimeter processing	Antenna Gain Pattern	PEACHI / SARAL 'GDR-E'
	DCORE retracker	PEACHI
Wind speed	2D wind speed	PEACHI / SARAL 'GDR-E'
Sea State Bias	2D Sea State Bias	PEACHI / SARAL 'GDR-E'
	3D Sea State Bias	PEACHI
Continental Ice	Snow Classification	PEACHI / SARAL 'GDR-E'
Sea Ice	Sea Ice Flag	PEACHI / SARAL 'GDR-E'
	Radar freeboard estimation	PEACHI
Radiometer algorithms	Updated Wet Tropospheric Correction	PEACHI / SARAL 'GDR-E'
Tide Models	FES2014	PEACHI / SARAL 'GDR-E'

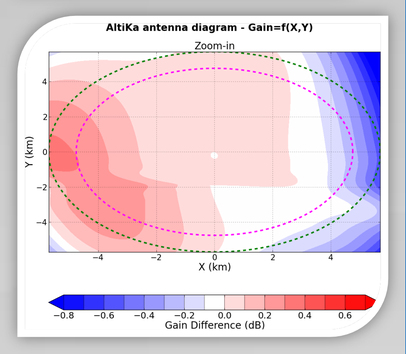
ALTIMETER PROCESSING

➢ Antenna Gain Pattern:

→ The gaussian approximation of AltiKa antenna gain pattern used in the Brown model (green curve) has a significant impact on estimates: 1.0 cm (8.0 cm) on the range and 4.0 cm (12.0 cm) on the waveheight at 2 m SWH (8 m SWH, respectively)



→ Over the waveform footprint (green circle), the gain difference between gaussian (model altimeter antenna) and real AltiKa antenna is not homogeneous and reaches 0.5 dB locally



→ ***A LUT approach is implemented in the PEACHI prototype to correct for these effects*** (cf. Le Gac et al. talk, OSTST 2015)

ALTIMETER RANGE CORRECTIONS

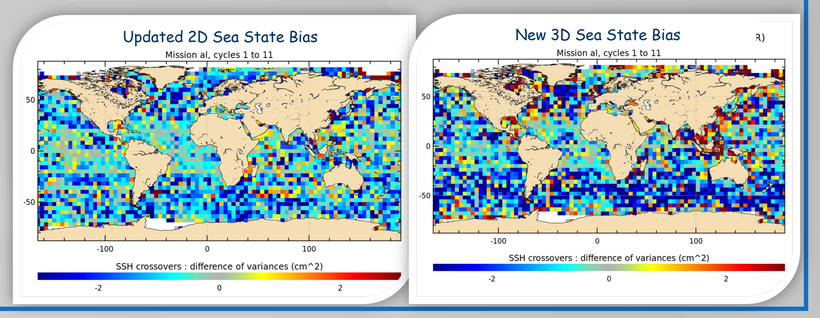
➢ 2D Wind Speed (σ0, SWH): *[2]*

→ Collocations with ASCAT-A scatterometer winds
→ SWH dependence on retrieved winds is reduced
→ ***Derived look-up table recommended to users***
(more accurate wind speed for Altika mission)

➢ Sea State Bias: *[2]*

→ New computations of updated 2D SSB and new 3D SSB
→ Use of new 2D altimeter wind speed and a refined radiometer WTC (2D SSB)
& IFREMER WW3 mean wave period (TM02) products (3D SSB)

→ ***Clear improvements are obtained with both solutions when compared with current GDR products***



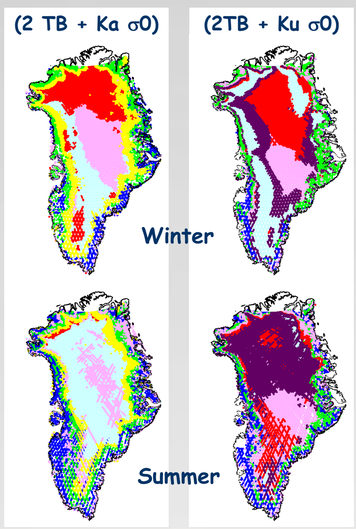
CONTINENTAL ICE

➢ Snow classification:

→ Partition of the two ice-sheet into different homogeneous regions can help for the interpretation of altimetry data

→ One algorithm for each polar region

→ Differences over Greenland related to changes from 2012 summer (melting observed over all of the ice sheet) more than differences between Ku / Ka ?



RADIOMETER ALGORITHMS

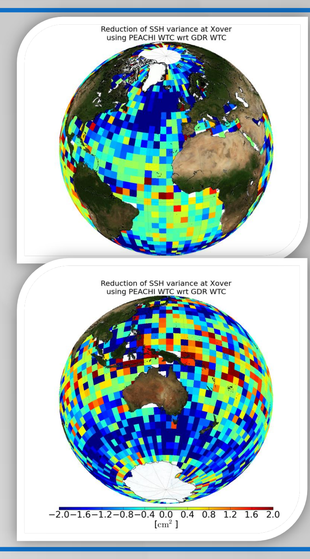
➢ Updated Wet Tropospheric Correction: *[3]*

→ Current GDR WTC performances are not optimal due to the difficulty of altimeter backscattering simulation in Ka band

→ Updated WTC based on measurements
(see Picard 2015, MG special issue)

→ Results display -1 cm2 SSH variance at Xovers wrt GDR
(strong improvement at high latitudes)

→ ***PEACHI WTC is strongly recommended to users***



SEA ICE

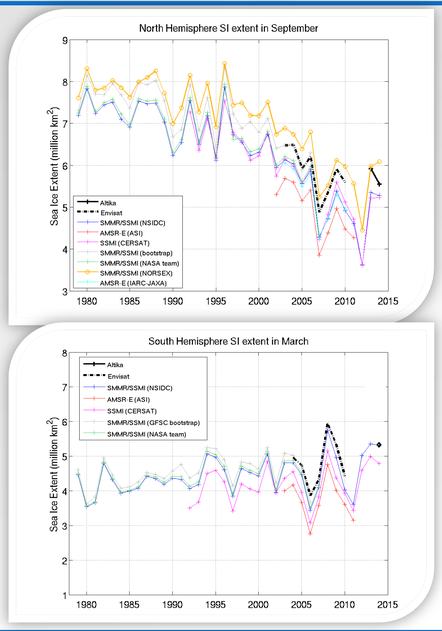
➢ Sea Ice flag:

→ Development of a 1-Hz multi-state sea-ice flag to help both oceanic and cryosphere studies in data selection

→ One algorithm for each polar region

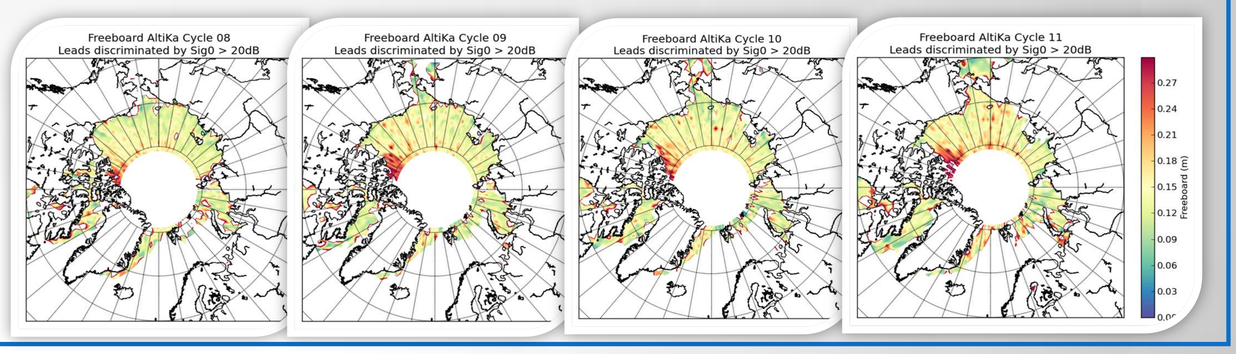
→ Time series of minimum of sea-ice extent for both Northern and Southern hemispheres

→ ***Extent monitoring displays good continuity with the Envisat data***



➢ Radar freeboard estimation:

→ First attempt to compute a freeboard map with AltiKa measurements using the waveform classification and the PEACHI retracker
→ Evolution of the freeboard is displayed between November 2013 and March 2014
→ ***AltiKa data are very promising for the freeboard estimation***



FUTURE – SEA ICE STUDIES

❑ **Refine the waveform classification over sea ice regions:**
- ➢ Surface classification performed on AltiKa, CryoSat-2 and ENVISAT data
- ➢ Use of external datasets (radiometer data, emissivity, sea ice flag, OSI-SAF)

❑ **CryoSat-2 LRM/P-LRM waveform classification:**
- ➢ Classification of CryoSat-2 LRM/PLRM echoes
- ➢ First performed on CPP V14 CryoSat-2 data and then on ESA/COP products

❑ **CryoSat-2 LRM/P-LRM echoes retracking**

❑ **Freeboard computation and comparison with:**
- ➢ ESA CryoSat-2 Baseline C (SAR)
- ➢ AWI CryoSat-2 (SAR)
- ➢ SARAL/AltiKa

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

[3] Picard et al., « First Year of the Microwave Radiometer aboard SARAL.AltiKa: In-Flight Calibration, Processing, and Validation of the Geophysical Products », Marine Geodesy special issue

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PEACHI products available at http://odes.altimetry.cnes.fr/