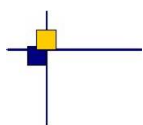




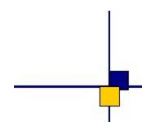
CalVal Saral/ Altika



SARAL/Altika validation and cross calibration activities

Executive Summary

2018



This is a synthesis of the annual report concerning validation activities of SARAL/AltiKa GDRs in 2018 under SALP contract supported by CNES at the CLS Space Oceanography Division.

The report covers different topics, which are investigated either as part of routine Cal/Val activities, or following mission events:

- mono-mission validation and monitoring,
- cross-calibration between SARAL/AltiKa and Jason-2 / Jason-3,

The results presented in the document are mainly based on the current version of GDR data (GDR-T Patch2). Sometimes results using IGDR, OGDR, or updated GDR data are also shown. This is mentioned in the text when needed. The content of the Patch2 reprocessing of SARAL/AltiKa data can be found in the annual report at chapter [Annex:Patch2](#). A detailed evaluation of the impacts of Patch 2 on mission performance was performed in 2014 when the reprocessing occurred.

Hereafter a brief summary of the main results of the validation activities run in 2018 on SARAL/AltiKa.

Data coverage and parameters monitoring

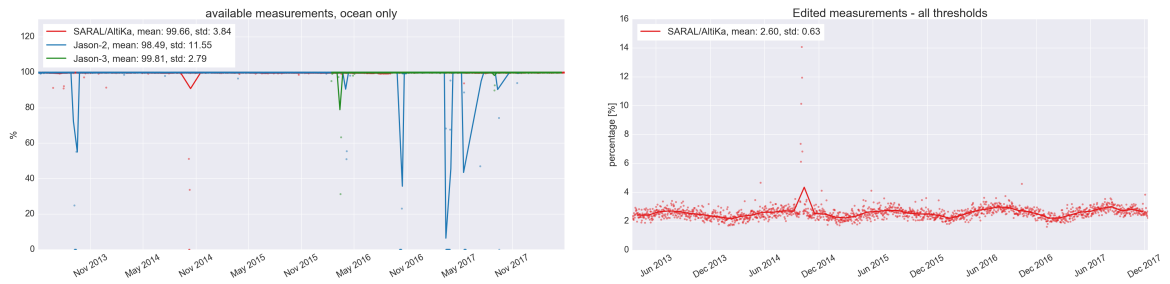


Figure 1: *Monitoring of GDR data since the beginning of mission (cycles 1 to 114). Percentage of available (left) and edited (right) measurements (on thresholds criteria).*

Considering all surface types, SARAL/AltiKa has an average of 96.85% of available data over its lifetime (March 2013 - January 2018). When considering only the ocean surface, the mean value of available measurements for SARAL/AltiKa is around 99.6%. SARAL/AltiKa had some periods with reduced data availability.

In any case, these figures largely exceeds the specifications for SARAL/AltiKa, which were 95% of all possible over-ocean data during a 3-year period with no systematic gaps plus the specific Ka-band limitation (5% of measurements may be not achieved due to rain rates > 1.5 mm/h according to geographic areas).

As for edited measurements, on average 20% of ocean measurements are edited, the majority of which are removed due to the sea ice flag $\approx 17.5\%$ while only $\approx 2.5\%$ are removed by threshold editing criteria. Statistics for the main parameters of SARAL/AltiKa are routinely monitored since the beginning of the mission and have been updated until cycle 114. Note that because of the several SHM periods that has been experienced by Jason-2 in 2017, the monitorings of parameters includes now both Jason-2 and Jason-3 to cover up for Jason-2's gaps and have a continuous comparisons over SARAL/AltiKa's lifetime. This systematic monitoring aims at detecting changes in parameter statistics, that would indicate a problem on the mission. No major change has been noticed in 2018.

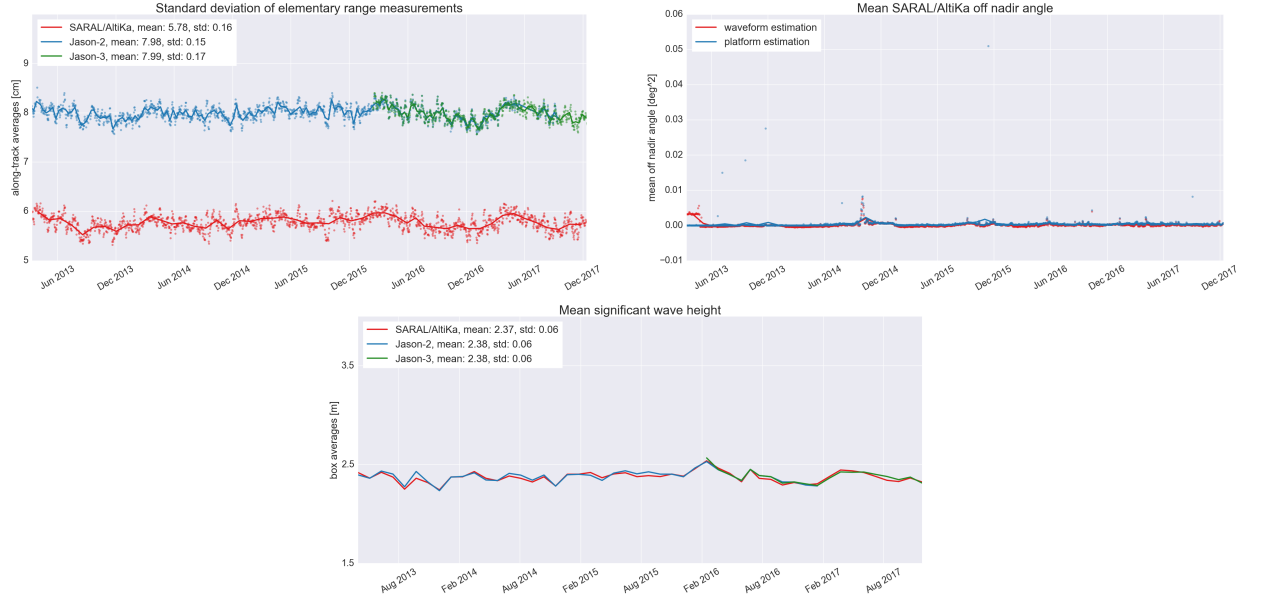


Figure 2: *Monitoring of along track averages of standard deviation of range measurements (left), of retracking and platform mispointing (right), and latitude weighted box average of significant wave height(bottom).*

Crossovers analysis

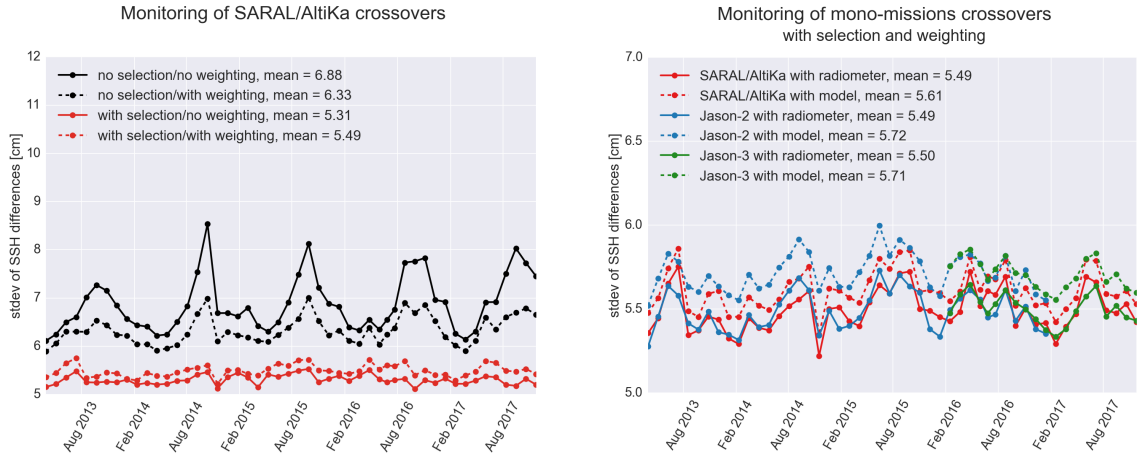


Figure 3: *Cycle per cycle monitoring of standard deviation of SSH differences at mono-mission crossovers - cycles 1 to 114.*

At each crossover, the observed difference of SSH measurements between ascending and descending arcs results from the sum of errors in the system and ocean variability. In order to reduce the impact of ocean variability, an additional selection can be applied to remove shallow waters (bathymetry above -1000 m), areas of high ocean variability (variability above 20 cm rms) and high latitudes ($|lat| < 50$ deg). To account for the uneven distribution of crossover points, we estimate weighted statistics (figure 3) where the weights applied are based on the crossovers density. This allows to better compare two missions that do not share the same ground track. Similar results are

obtained with these weighted statistics: Similar results are obtained with these weighted statistics: SARAL/AltiKa's performance is excellent and slightly below Jason's.

Sea level anomaly

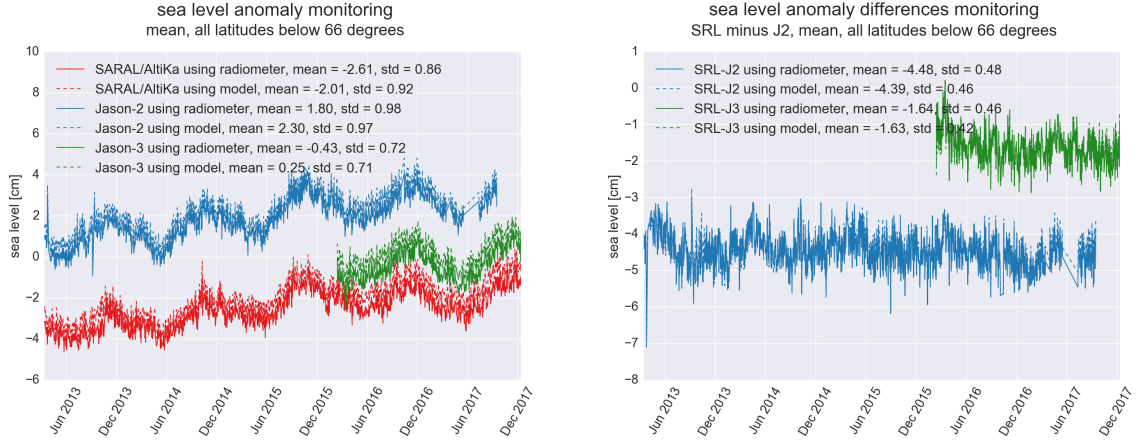


Figure 4: *Monitoring of daily mean (left) of SLA of GDR data using the radiometer (plain lines) and the model (dotted lines) wet tropospheric corrections. Global statistics are estimated for all latitudes between -66 and 66 deg*

Looking at along-track SLA provides additional metrics to estimate the altimetry system performances. The evolution of the mean SLA allows the detection of shifts, drifts or geographically correlated biases, while looking at the SLA variance may also highlight changes in the long-term stability of the altimeter's system performance.

SARAL/AltiKa Jason-2 and Jason-3 daily mean of SLA show similar signals and evolution. The standard deviation of daily averages of SLA differences is below 5 mm. No statistically significant drift is observed between the missions and switching from the radiometer to the model wet tropospheric correction has little impact on daily averages of SLA differences between SARAL/AltiKa and Jason-2 or Jason-3.

Particular Investigation : Ocean error budget

The following table summarizes the study on SARAL/AltiKa's ocean error budget detailed in the annual report (2018).

Error type	Req	Goals	Short scales (< 7km)	Large wavelength short time scales (> 50 km, < 10 days)
Altimeter Noise	1.5 cm	1 cm	0.83 cm	-
Sea state bias	2 cm	2 cm	0.14 cm	TBI
Wet troposphere	1.2 cm	1 cm	TBI	1.1 cm
Dry troposphere	0.7 cm	0.7 cm	-	0.7 cm
Ionosphere	0.3 cm	0.3 cm	-	0.3 cm
Altimeter range after corrections	2.9 cm (RSS)	2.6 cm (RSS)	0.73 cm	TBI
Orbit radial component	3 cm	2 cm	-	1.3 cm
Total sea surface height	4.2 cm	3.2 cm	0.73 cm	3.7 cm
Significant wave height	6.3 cm	3.9 cm	5.1 cm	-
Sigma naught Absolute Value after in-flight calibration	0.7 dB	0.5 dB	0.016 dB	-
Wind speed	1.7 m/s	1 m/s	0.15 m/s	-

Table 1: *GDR-T estimated error budget*