SERVICE ALTIMETRIE & LOCALISATION PRECISE

CalVal Saral/ Altika

SARAL/Altika validation and cross calibration activities

Executive Summary

2020

This is a synthesis of the annual report concerning validation activities of SARAL/AltiKa GDRs in 2020under 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-3,

The results presented in the document are mainly based on the current version of GDR data (GDR-F). The content of the GDR-F standard for SARAL/AltiKa data can be found in SARAL's Product Handbook https://www.aviso.altimetry.fr/fileadmin/documents/data/tools/SARAL_Altika_products_handbook.pdf. A detailed evaluation of the impact of the full dataset's reprocessing has been synthetized in a dedicated report (will be available shortly).

Feel free to check out all of SARAL/AltiKa's annual reports available on the Aviso website under the following link : https://www.aviso.altimetry.fr/en/data/calval/systematic-calval/annual-reports/saral.html.

Please note that there was no incident on the platform nor the instrument in 2020.
The main parameters of SARAL/AltiKa are routinely monitored since the beginning of the mission and have been updated until cycle 145.
Hereafter a brief summary of the main results of the validation activities run in 2020 on SARAL/AltiKa.

Data coverage and parameters monitoring

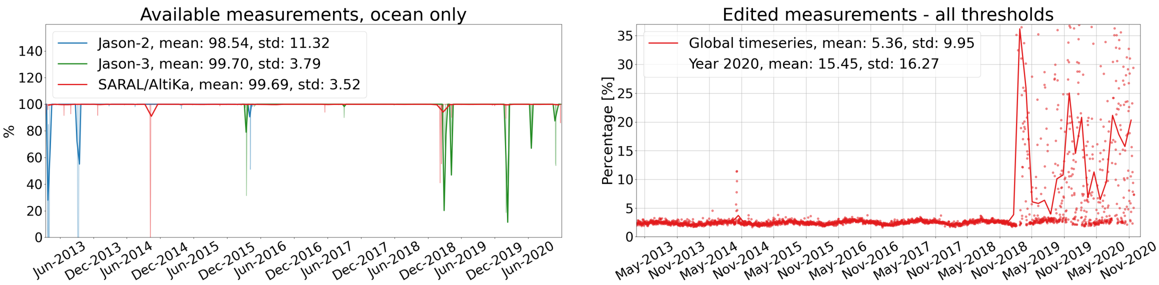

Figure 1: *Monitoring of GDR data since the beginning of mission (cycles 1 to 145). Percentage of available (left) and edited (right) measurements (on thresholds critiria).*

Considering all surface types, SARAL/AltiKa has an average of **97.79%** of available data over its lifetime (March 2013 - November 2020). When considering only the ocean surface, the mean value of available measurements for SARAL/AltiKa is around **99.69%.** SARAL/AltiKa had some periods with reduced data availability.
In any case, these figures largely exceed 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 rejected measurements trough the validation process, an average of **22.1%** of ocean measurements are removed, the majority of which is due to the sea ice flag $\approx$ **17.4%** while $\approx$ **5.4%** are removed by threshold criteria. A higher percentage of rejected measurements is observed since

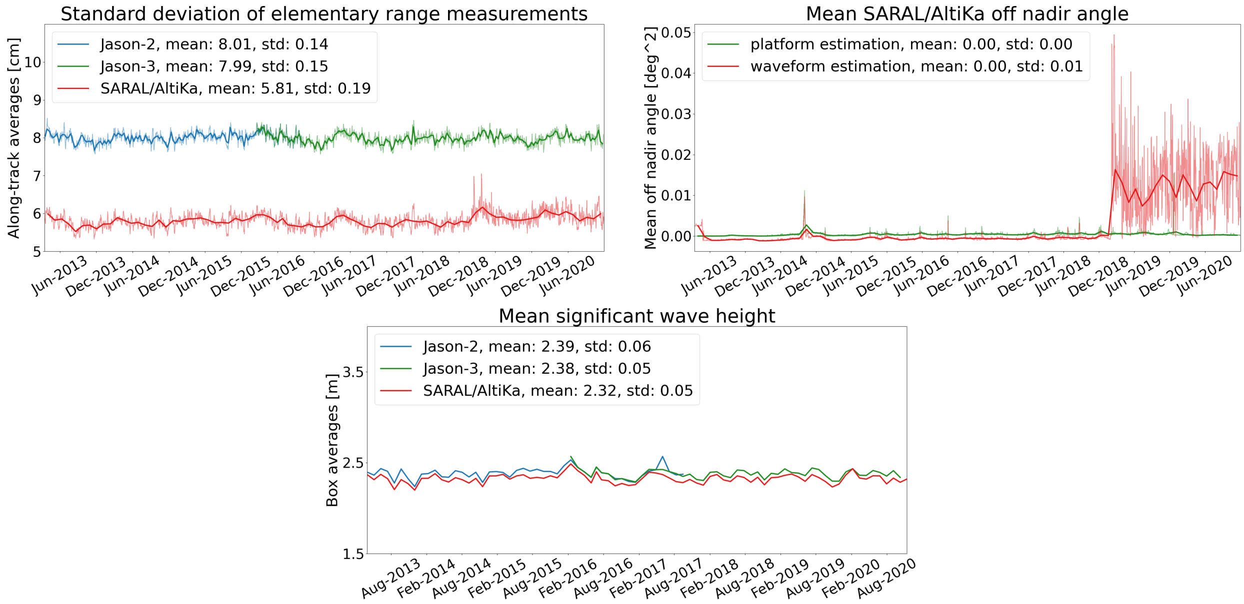

Figure 2: *Monitoring of along track averages of standard deviation of range measurements (left), of retracking and platform mispointing (right), and latitude weighted box average of significant wave height(bottom).*

the begining 2019, it is mainly due to out of threshold off nadir values. These values are the result of attitude deviations experienced by the spacecraft since the star sensor anomaly, starting early February 2019. Please keep in mind that only valid data is used to compute the following metrics, hence all mispointing events (square off-nadir angle $> 0.09 deg^2$) are properly discarded during the validation process and do not significantly skew the statistics.

Crossovers analysis

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 ($|lat| < 50\,\text{deg}$). 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: SARAL/AltiKa's performance is excellent and slightly below Jason's. Please note that the late mispointing events have as expected no visible impact over SARAL/AltiKa's crossovers' accuracy.

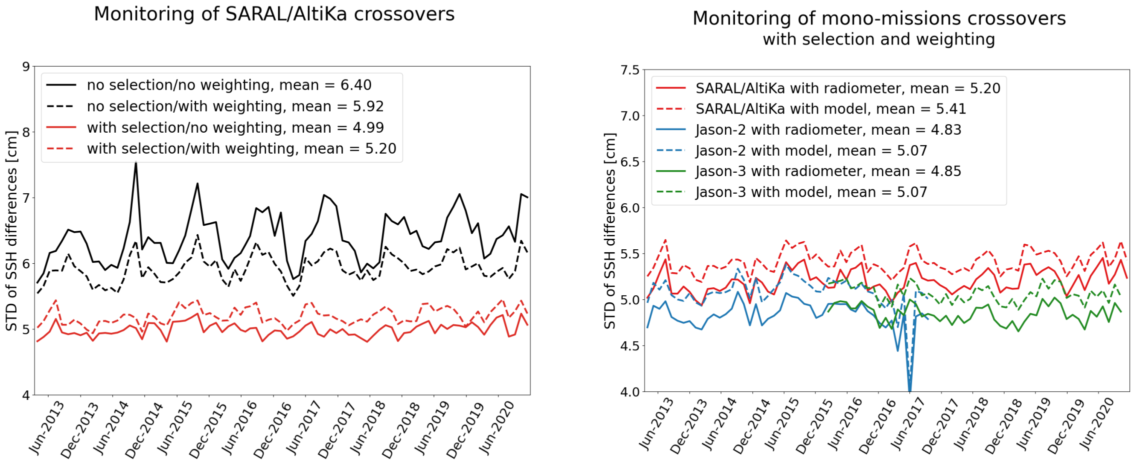

Figure 3: *Cycle per cycle monitoring of standard deviation of SSH differences at mono-mission crossovers - cycles 1 to 145.*

Sea level anomaly

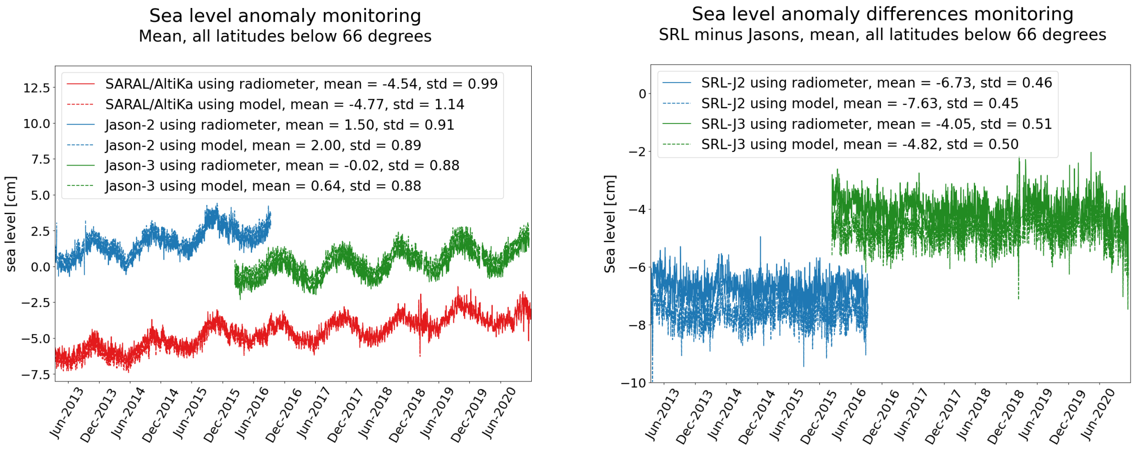

Figure 4: *Monitoring of daily mean (left) of SLA of GDR data using the radiometer (plain lines) and the model (dotted lines) wet tropospheric corrections. Global statistics are estimated for all latitudes between* -66 *and* $66\,\mathrm{deg}$

Looking at along-track SLA provides additionnal 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 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 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-3.

GDR-F reprocessing

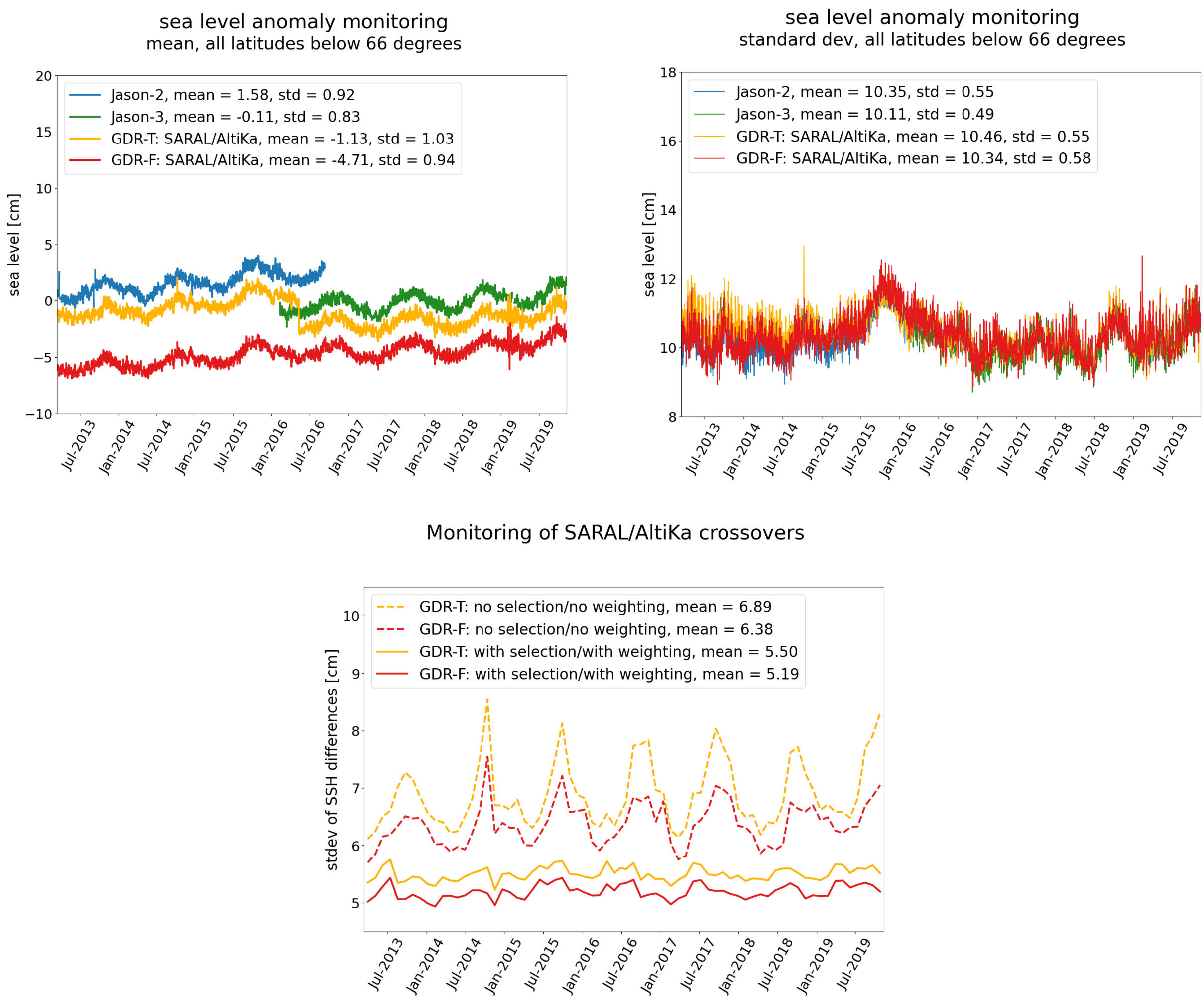

Figure 5: *Monitoring of daily mean (left) and daily standard deviation (right) of SLA of GDR data. Global statistics are estimated for all latitudes between* $-66°$ *and* $66°$*. Cycle by cycle standard deviation of SSH crossover differences for SARAL/AltiKa using different selections and averaging methods (botom).*

Thanks to the GDR-F reprocessing, GDR dataset is now homogeneous over SARAL's timeserie. With the new standard, SLA shows quite similar signals and patterns as GDR-T and reference missions. Please note the biais of **-5cm** before cycle 33 and **-2.5cm** after. The standard deviation of crossovers differences is reduced from **5.50cm** to **5.19cm** which proves the overall improvement thanks to the newly reprocessed GDR-F dataset.