CalVal Saral/ Altika

SARAL/Altika validation and cross calibration activities

Executive Summary

2019

This is a synthesis of the annual report concerning validation activities of SARAL/AltiKa GDRs in 2019 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). 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 the mission performance was performed in 2014 after the reprocessing of the seven first cycles (see 2014's reprocessing report).

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/data/calval/systematic-calval/annual-reports/saral.html.

Hereafter a brief summary of the main results of the validation activities run in 2019 on SARAL/AltiKa.

Data coverage and parameters monitoring

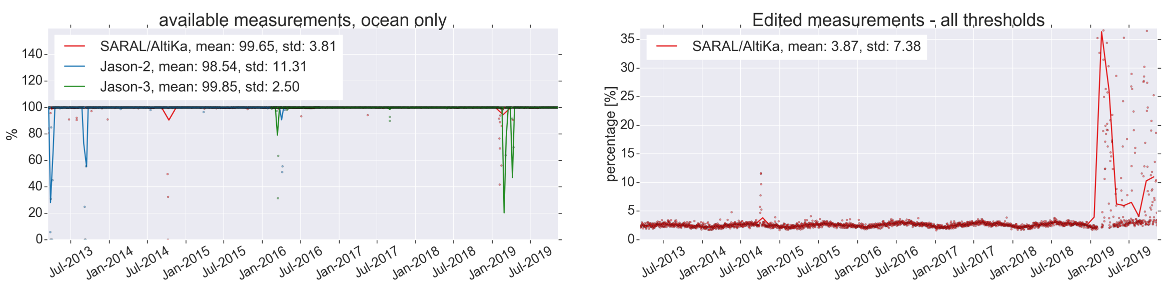

Figure 1: *Monitoring of GDR data since the beginning of mission (cycles 1 to 134). Percentage of available (left) and edited (right) measurements (on thresholds critiria).*

Considering all surface types, SARAL/AltiKa has an average of 97.59% of available data over its lifetime (March 2013 - November 2019). 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 the rejected measurements trough the validation process, an average of 21% of ocean measurements are removed, the majority of which is due to the sea ice flag $\approx$ 17% while only $\approx$ 3.9% are removed by threshold criteria. A higher percentage of rejected measurements is observed since 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

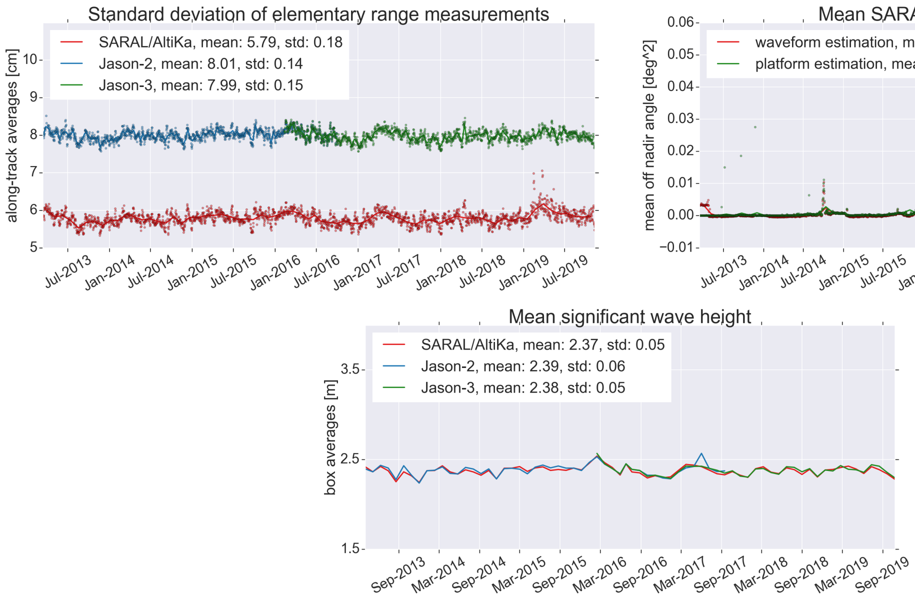

Figure 2: *Monitoring of along track averages of standard deviation of range measurements (left), of retracking and platform mispointing (right), and latitude weighted box average of significant wave height(bottom).*

February 2019. Please keep in mind that only valid data is used to compute the following metrics, hence all mispointing events are properly discarded during the validation process and do not skew the statistics.
The main parameters of SARAL/AltiKa are routinely monitored since the beginning of the mission and have been updated until cycle 134. Note that the monitorings of all parameters includes now both Jason-2 and Jason-3 to have a continuous comparison over SARAL/AltiKa's lifetime.

Crossovers analysis

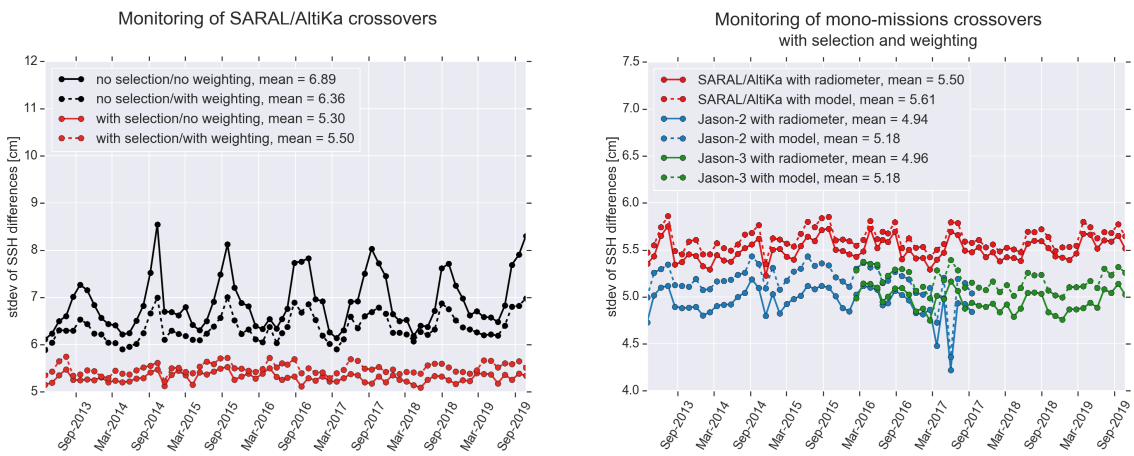

Figure 3: *Cycle per cycle monitoring of standard deviation of SSH differences at mono-mission crossovers - cycles 1 to 134.*

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 ($|lat| < 50\,\mathrm{deg}$). 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.

Sea level anomaly

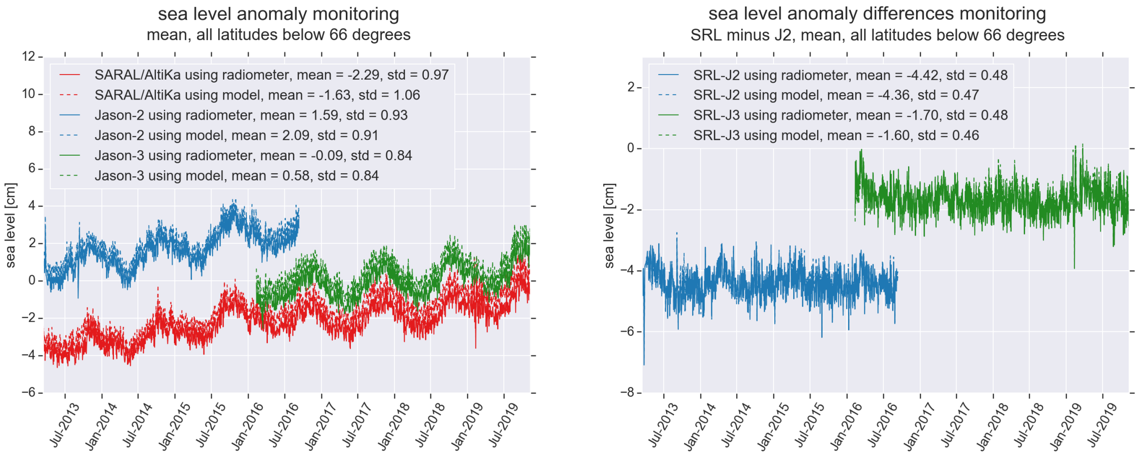

Figure 4: *Monitoring of daily mean (left) of SLA of GDR data using the radiometer (plain lines) and the model (dotted lines) wet tropospheric corrections. Global statistics are estimated for all latitudes between* -66 *and* $66\,\mathrm{deg}$

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 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.