

The Sentinel-3A SRAL Instrument Calibration Monitoring

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ABSTRACT

The Sentinel-3A is the most recent altimetric mission of a long historical series, and the first altimeter of the Copernicus constellation.

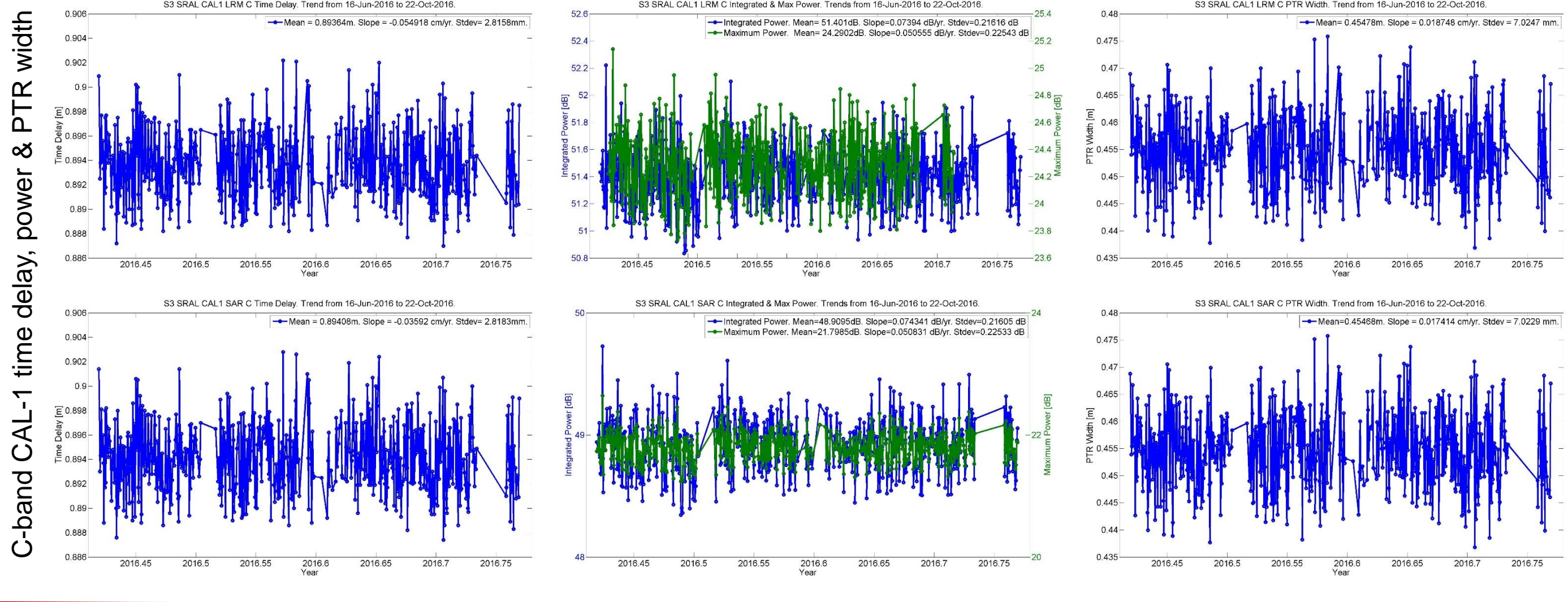
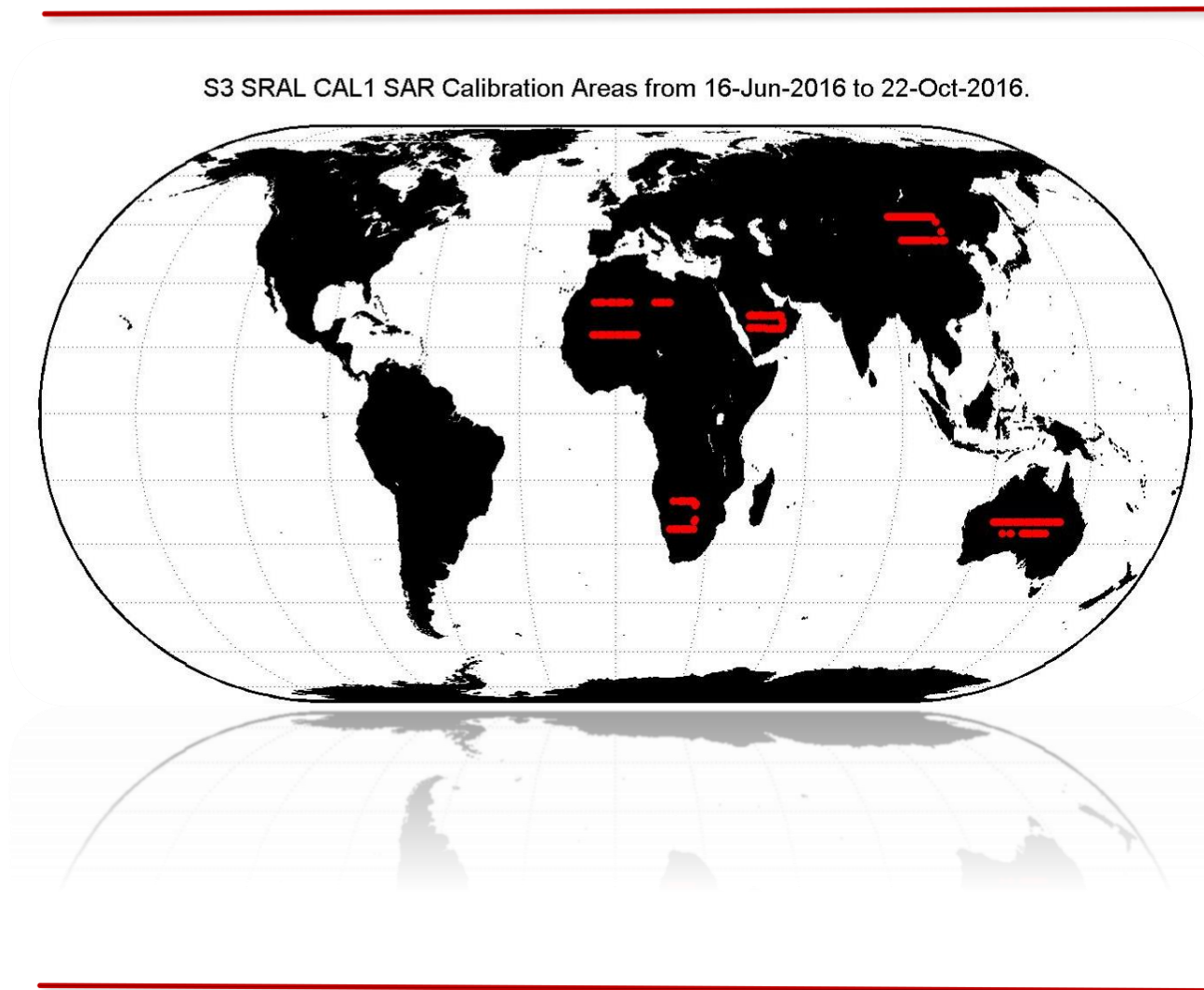
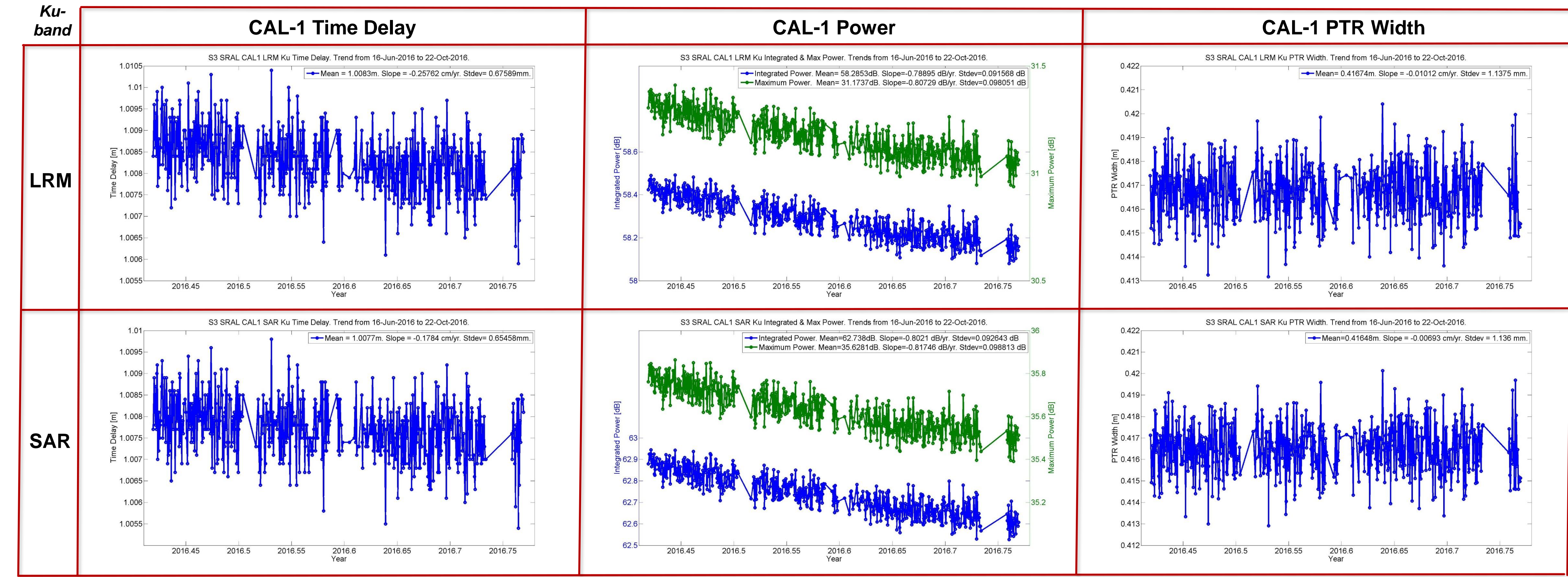
It is well known the crucial importance of the instrumental calibration when processing the altimeter data, in order to produce reliable and accurate L2 geophysical retrievals, such as sea surface height, significant wave height, or wind speed over the oceans.

isardSAT, as ESA Expert Support Laboratory within the Sentinel-3A Mission Performance Centre team, is responsible for monitor the calibration parameters during the Sentinel-3A mission. This poster presents the first cycles of Calibration Monitoring data acquired during the Commissioning Phase of the Sentinel-3A SRAL instrument.

The SRAL altimeter permits to operate in two modes, LRM (low resolution) and SAR (high resolution) in two frequency bands, Ku and C. For the 4 combinations, CAL-1, CAL-2 and Autocal calibration modes are monitored and analysed from L1b data. Also the on-board thermal variations are monitored from L0 data. The tracker performance is studied from L2 data.

CAL-1

All calibration parameters impacting the L2 science data and a large set of secondary parameters are weekly monitored. These are the main: CAL-1Time Delay → direct impact on the range (hence, the L2 variable Sea Surface Height), as an additive term. CAL-1Power → The winds (sigma naught) and waves (Significant Wave Height) estimates at L2 are impacted by this calibration parameter. CAL-1PTR width → The main L2 variable impacted is the Significant Wave Height, through the retracking processing.



Also the CAL-1burst corrections are fundamental for the calibration of the SAR mode data. They are:

CAL-1Burst Power → Corrects for the power variations along the burst.
CAL-1Burst Phase → Corrects for the phase variations along the burst.

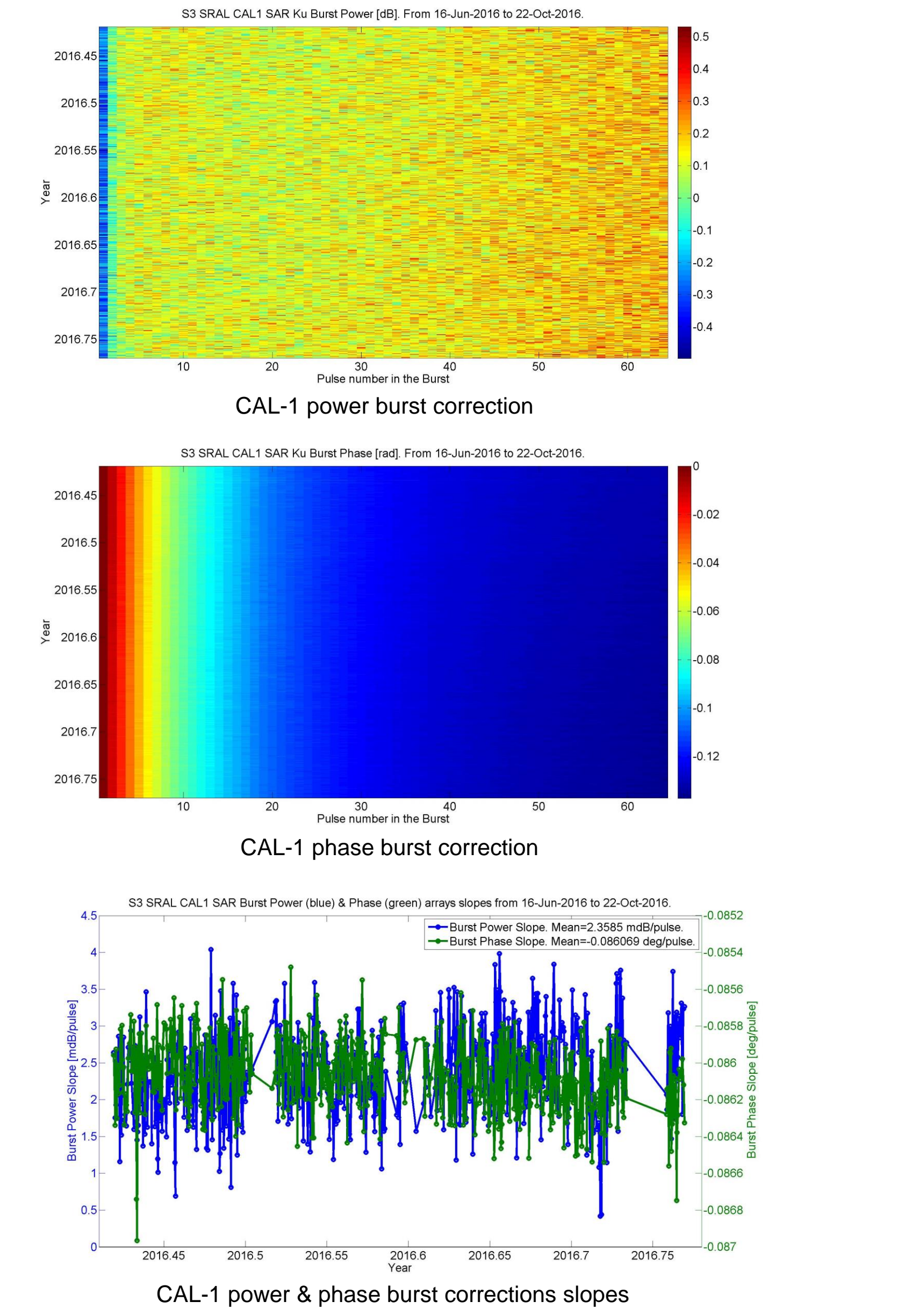


Table for checking the whole mission CAL-1 parameters statistics:

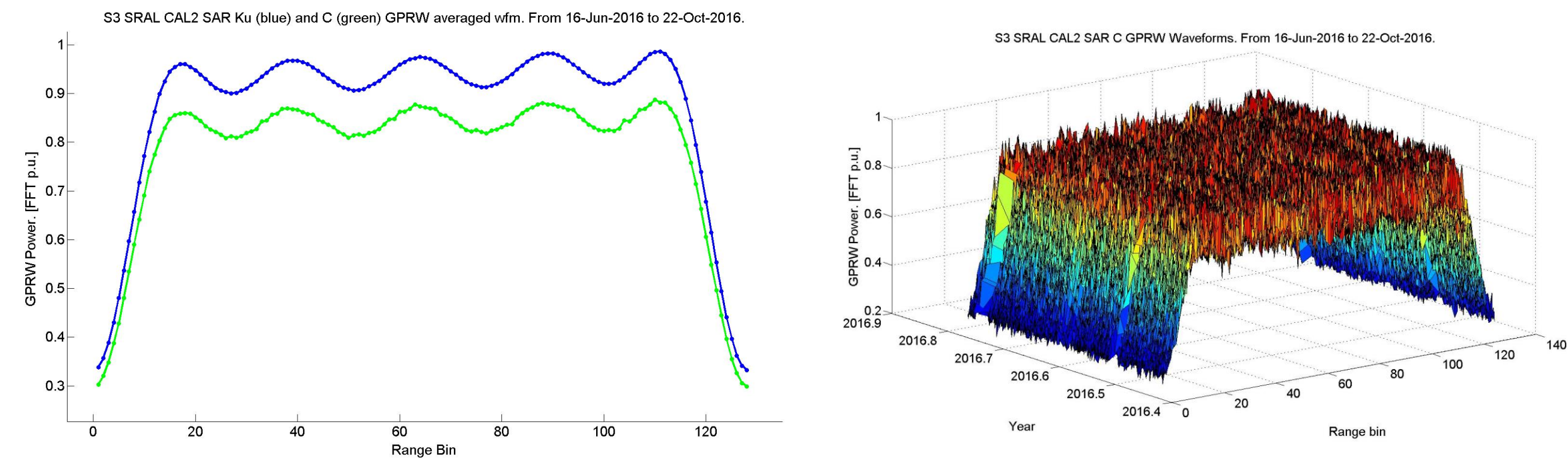
Calibration Parameter	Ku band			C band		
	mean	annual slope	standard deviation	mean	annual slope	standard deviation
LRM CAL1 time delay	1.0083 m	-2.70 mm	0.67 mm	0.8937 m	-0.06 mm	2.81 mm
SAR CAL1 time delay	1.0077 m	-1.90 mm	0.65 mm	0.8941 m	0.13 mm	2.81 mm
LRM CAL1 power	58.29 dB	-0.80 dB	0.09 dB	51.40 dB	0.07 dB	0.22 dB
SAR CAL1 power	62.74 dB	-0.81 dB	0.09 dB	48.91 dB	0.07 dB	0.22 dB
LRM CAL1 PTR width	0.4167 m	0.01 mm	1.13 mm	0.4548 m	1.85 mm	6.98 mm
SAR CAL1 PTR width	0.4165 m	0.01 mm	1.13 mm	0.4547 m	1.84 mm	6.98 mm

It is notable the better performance of the main band, the Ku band.
Similar results for both modes in each of the bands

CAL-2

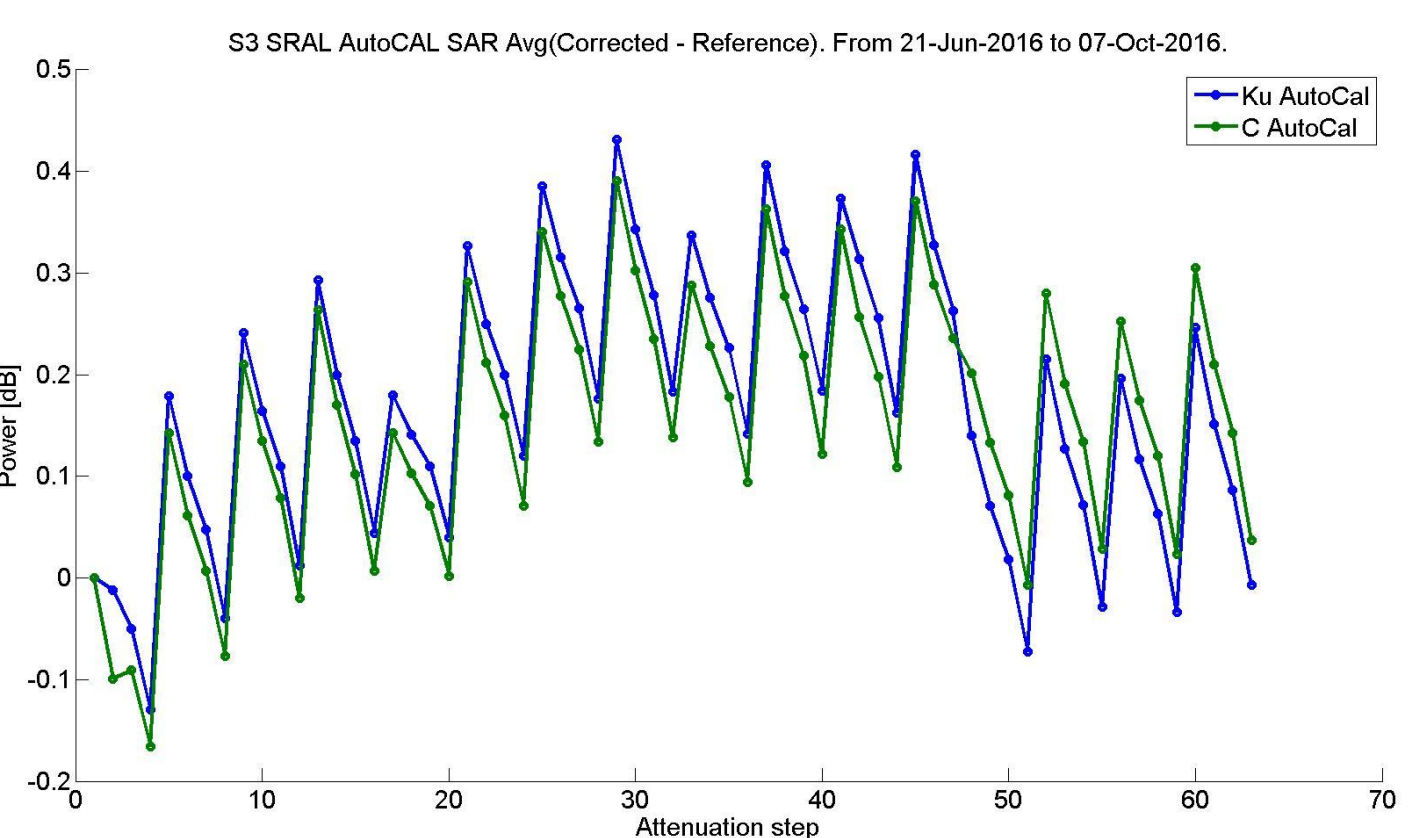
The CAL-2 waveform represents the System Transfer Function of the instrument.

Here below are the CAL-2 waveforms of both bands (green is C-band, blue is Ku-band) averaged along the mission. The right hand side figures represent a mesh of the whole mission CAL-2 waveforms for Ku-band (top) and C-band (bottom).



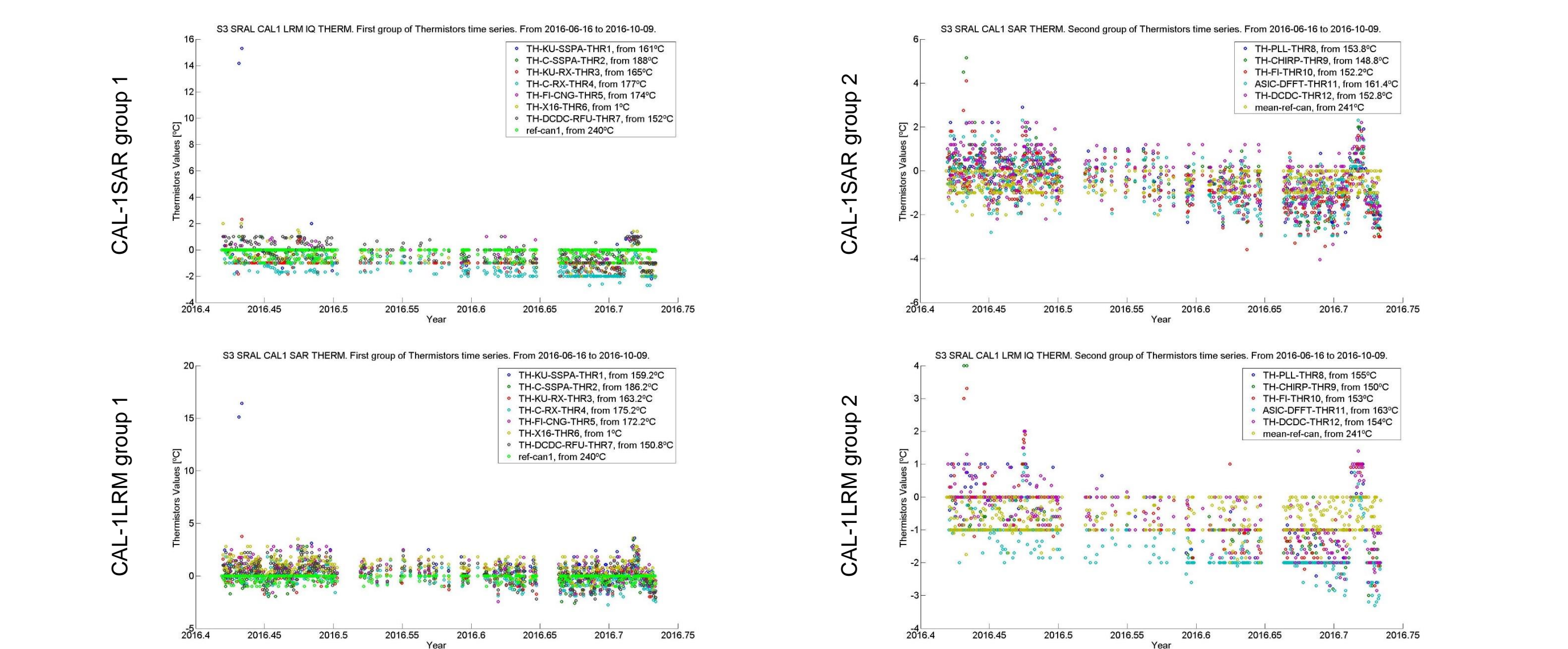
AUTOCAL

The ideal and real attenuation tables are present in the L1b products for the two bands, Ku and C. If we subtract one table to the other, we can observe how far the real attenuation values are from the ideal values. An average of this subtraction during the analysis period is shown in the figure.



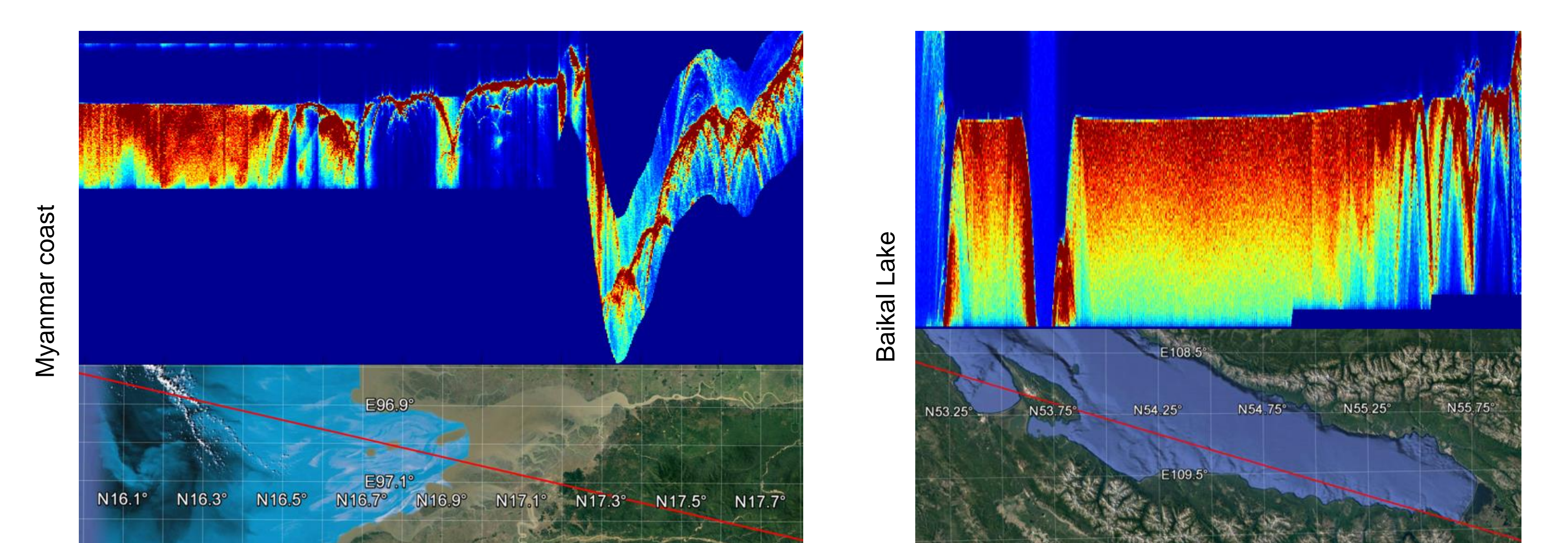
THERMAL BEHAVIOUR

Temperatures retrieved from the thermistors located in the different sections of the on-board HW, are analysed in order to check the relation of any calibration parameters anomaly with the thermal behaviour, and find solutions for modelling the instrument characterisation (for instance orbital oscillations) if needed.



TRACKER PERFORMANCE

L2 enhanced products (PLRM waveforms) have been used for this study about the performance of the surface tracking. Different scenarios are analysed over inland waters and over coastal regions, where the on-board tracking is specially interesting to be assessed, regarding a potential loss of track or the tracking of non expected targets (e.g. off-nadir targets, farther specular surfaces, backward locked facets).



CONCLUSIONS

All Calibration parameters are monitored during the Ramp-Up phase. Weekly reporting is made to the S3-MPC team after a check of each particular variable. More detailed Monitoring Reports are prepared just after each cycle ends, analysing cyclic and whole mission instrument performances.

- CAL-1 parameters show a nominal behaviour, showing at Ku-band better data stability (lower standard deviation) and also more signs of ageing (higher trends in absolute terms).
- CAL-1 power is the only variable with a remarkable long term drift, the power is decreasing. At BOM the trend was steeper, and in the last cycles it starts to become more stable.
- The transfer function CAL-2 waveform shows a nominal status, with a similar shape with respect to the one measured on ground.
- The thermal data gathered contains some temperature spikes and bumps. They were not correlated to any calibration parameter values deviation.
- The on-board tracker performance shows a normal behaviour, although more parameters of the on-board tracker would be necessary for a more thorough study.

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