Monitoring Sentinel-3A: S3MPC activities to ensure a consistent accurate dataset

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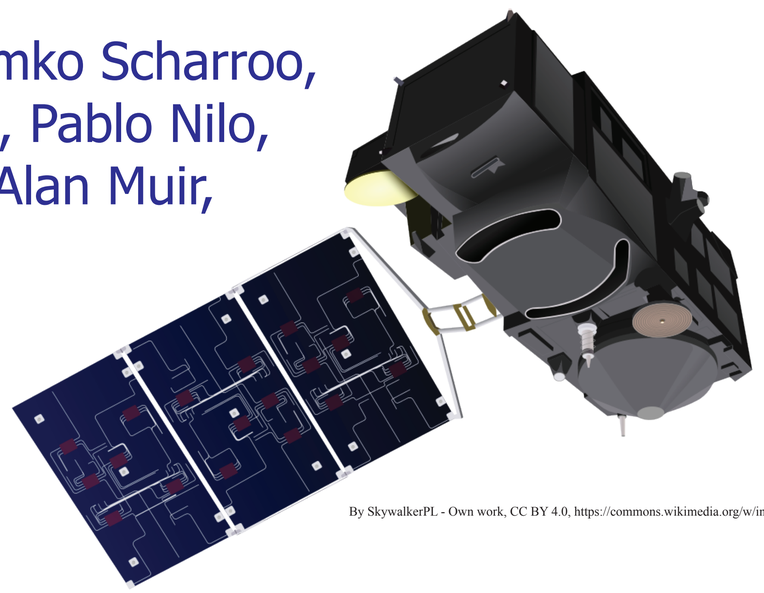

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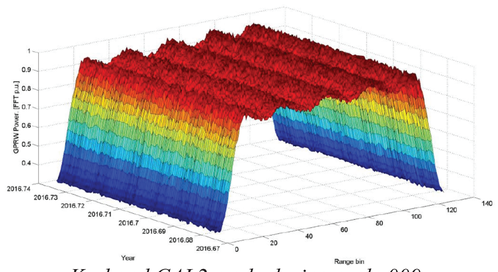
Project led by ACRI-ST

Abstract

Sentinel-3A was launched on 18th Feb 2016, with switch on of instruments at the beginning of March. What has happened since then? Well, the Sentinel-3 Mission Performance Centre (S3MPC), along with ESA and EUMETSAT have been evaluating the processing and the products, and making the necessary changes as anomalies are identified. This has included assessment of the internal operation of the SRAL and MWR, evaluation of the algorithms in the processing chain, and comparison of geophysical retrievals with data from other satellites or with models

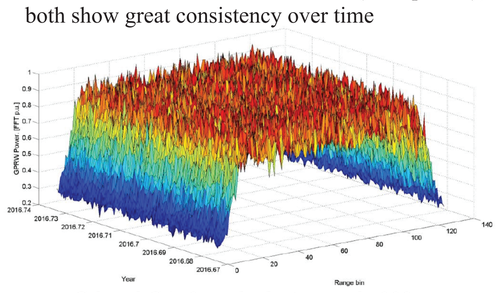
Internal Calibration

isardSAT are responsible for monitoring the performance of SRAL, examining the various housekeeping data and the output of the regular CAL1 and CAL2 modes.

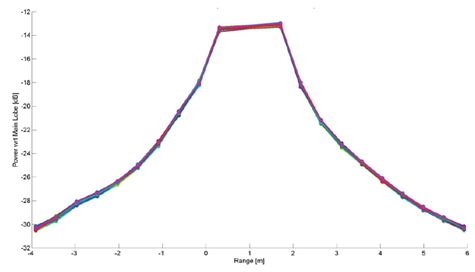


Ku-band CAL2 mode during cycle 009

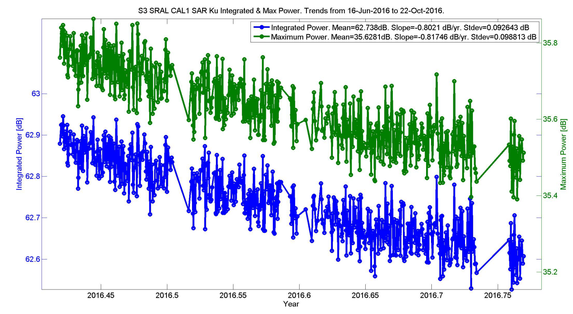
The CAL2 modes show the response of the filters at both Ku- and C-band. Illustration is for Cycle 009, but these have been run regularly throughout mission to-date. C-band is noisier (as expected), but both show great consistency over time



C-band CAL2 mode during cycle 009



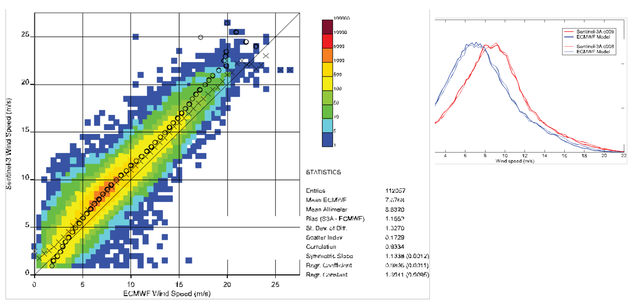
The CAL1 mode shows the characteristics of the PTR (point target response). The figure shows the strength of the side lobes recorded at Ku-band for each of the tests.



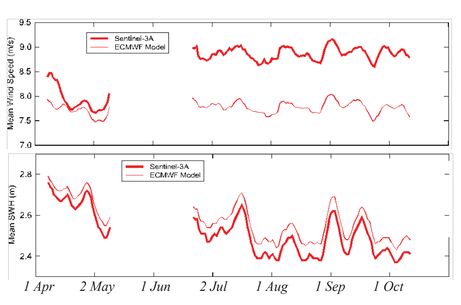
However, in absolute terms, there has been a clear reduction in signal power over the mission, at a rate close to 1 dB/year. This is being carefully monitored, so that products will provide a high self-consistency.

Wind-Wave Validation

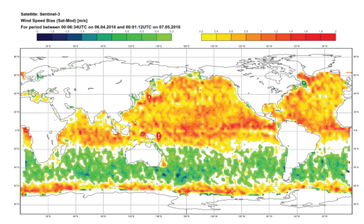
Saleh Abdalla (ECMWF) has been routinely comparing output of S3A with operational wind and wave models. The wave comparisons are generally very good (r.m.s. diff. of 0.3m); there are more marked differences for **wind speed which are detailed here.** [Note, in these comparisons we believe the errors lie with the Sentinel-3 data/processing as the model agrees well with other altimeters.]



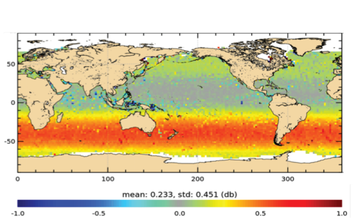
A 2-D histogram plot shows that the overall wind speed agreement is good, but there is a clear difference at low winds. Simple 1-D histograms comparing S3A data for cycles 008 & 009 with co-located model data show the satellite data to be biased high and have bumps in the distribution.



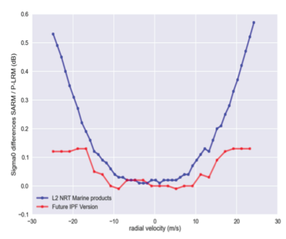
Time series of the determined biases show a significant change early in the mission. A map of the bias shows it to be particularly associated with the region 20°-45°S. Work by CLS (& discussions with S. Dinardo) has shown this to be related to the number of looks used in the stack for SAR processing. This number has varied significantly with the radial velocity; a new change to the processor should limit this problem.



Map of wind speed error (S3 - model)

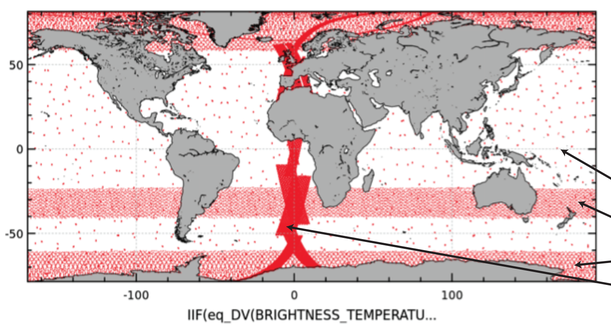


Map of σ^0 difference (SAR - PLRM)



σ^0 error as a function of radial velocity (red indicates reduced effect after processing change)

Microwave Radiometer



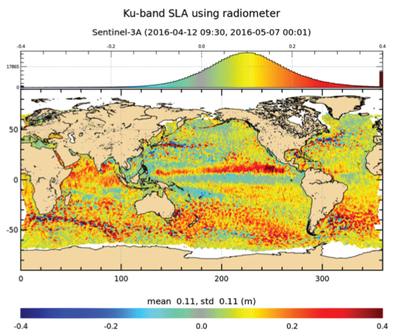
Marie-Laure Frery (CLS) is overseeing the assessment of the MWR, and has noted some problems with the brightness temperatures, and a glitch often producing default value in the data stream where there should be good records. This is being resolved in the processing chain.

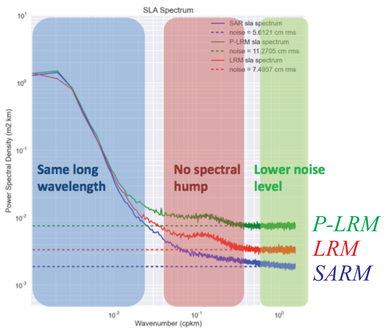
MWR calibration

Interpolation error of MWR to altimeter time

Error code

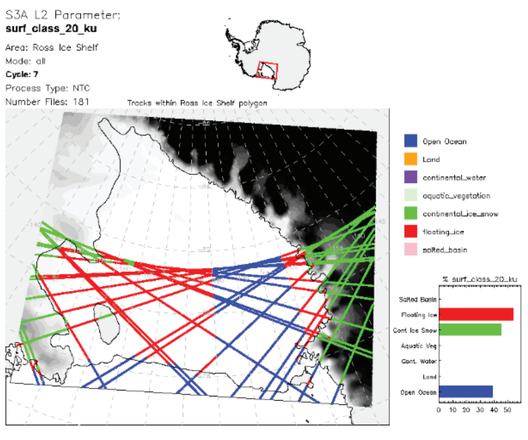
Ocean Performance

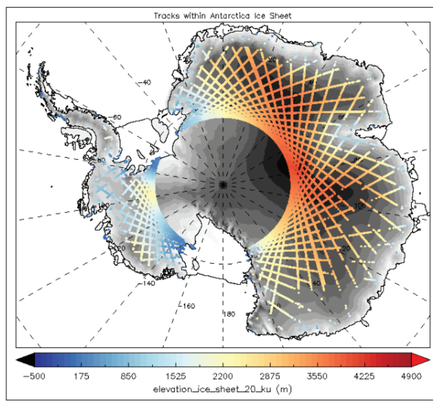


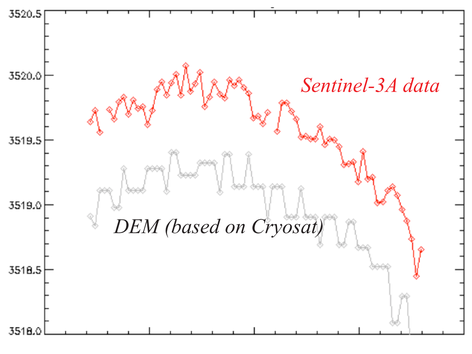


CLS are the principal agent for validation of Sea Surface Height (SSH). The overall recovery of SSH agrees well with that for Jason-2; however the SAR altimetry mode of S3A reduces the short-scale noise considerably, and removes the "spectral bump" noted for most conventional altimeters.

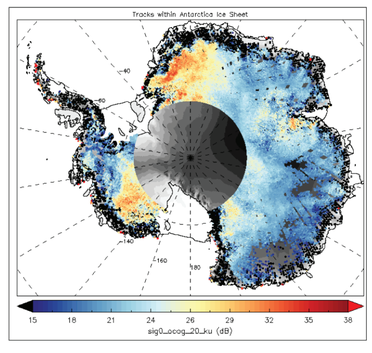
Antarctica







Profile of Ice height over Lake Vostok



Structure can be seen in the map of backscatter coefficient

The evaluation of S3A over land and sea-ice has been carried out by CPOM. At early stages there were problems with the retrackers, with that for sea-ice having the wrong bin numbers specified. This has now been fixed. There has also been an issue with the mode mask controlling S3A operations, with a sector of the Ross Sea classified as "open ocean" instead of "sea-ice".

There is now good tracking performance over the Antarctic Plateau, although recovery over steep topography is yet to be optimized. The values recorded over Lake Vostok agree well with Cryosat-2 data. [Note the offset of 70 cm is principally due to the S3A data in this comparison being referenced to a different datum, which differs by 60 cm from that used for Cryosat-2.]

Disclaimer

The work performed in the frame of this contract is carried out with funding by the European Union. The views expressed herein can in no way be taken to reflect the official opinion of either the European Union or the European Space Agency.