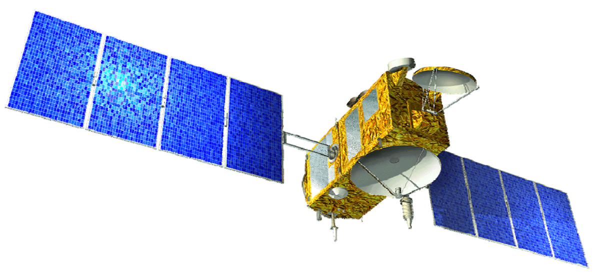
(A) GLOBAL Statistical Jason-2 assessment and cross-calibration with Jason-1 Parameter Analysis



S.Philipps[1], M. Ablain[1], P.Thibaut[1], N.Picot[2]

[1]CLS, Space Oceanography Division, Toulouse, France

[2]CNES, Centre National d'Etudes Spatiales, Toulouse, France

1 Overview

The OSTM/Jason-2 (JA2) satellite was successfully launched on June, 20th 2008. From July, 4th 2008 to January, 26th 2009, Jason-2 was flying in tandem with Jason-1 (JA1), only 55s apart, before JA1 was moved to its new interleaved orbit. This poster assesses the JA2 data quality. Missing and edited measurements are monitored (part 2). Furthermore relevant parameters derived from instrumental measurements and geophysical corrections are analyzed (part 3 to 8). Analyzes are focused on JA1/JA2 cross-calibration since both missions were on the same orbit during the Calibration/Validation phase. This allows us to precisely assess parameter discrepancies between both missions in order to detect geographically correlated biases, jumps or drifts. The SLA performances and consistency with JA1 are described in poster (B).

Used data

The study is conducted for JA2 cycles 1 to 20, corresponding to JA1 cycles 240 to 259. For both satellites GDR (Geophysical Data Records) 1 Hz data are used. For some parameters results from IGDR (Interim Geophysical Data Records) are also presented.

IGDR/GDR

The main differences between Jason-2 IGDR and GDR products are:

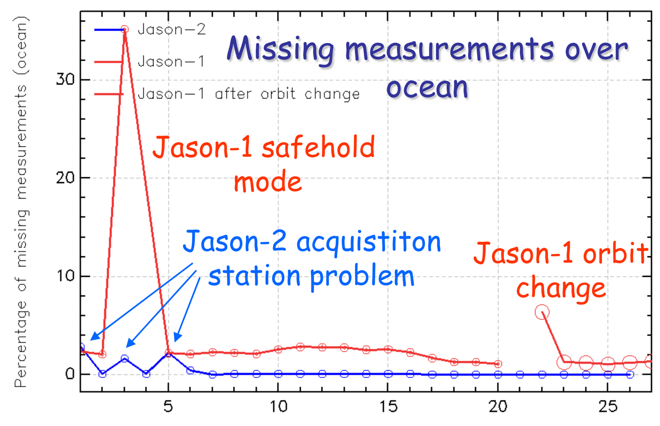
	IGDR	GDR
Orbit	MOE (Medium Orbit Ephemeris)	POE (Precise Orbit Ephemeris)
DAC (Dynamical Atmospheric Correction)	Uses non-centered window for filtering	Uses centered window for filtering
Radiometer wet troposphere correction	New AMR characterization file since cycle 023	Same AMR characterization file for entire period
Poseidon-3 AGC tables	New Poseidon-3 characterization file since cycle 023	Same Poseidon-3 characterization file for entire period

Altimeter tracking modes

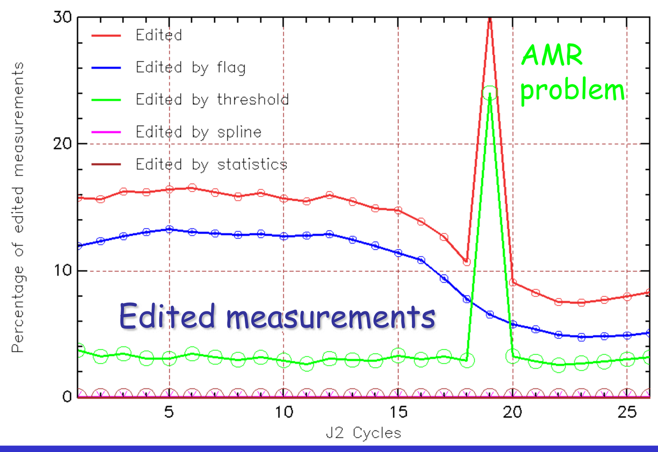
For Jason-2, two modes of on board tracking are used: Median tracker (for cycles 1,2,4,6,8,9,10,…) and Diode/DEM tracker (for cycles 3,5,7). Cycle 0 and half of cycle 1 was in SGT mode. Most of the following plots integrate all the cycles from 1 to 20. Indeed analysis of parameters obtained during cycles with different tracking modes does not reveal any particular behavior linked to the tracking mode.

2 Missing and Edited measurements

Over open ocean, JA2 and JA1 data coverage are very similar. Few missing measurements are however detected for Jason-2 over ocean, mostly due to station acquisition problems (cycle 003 pass 44-46, cycle 003 pass 33-34, cycle 005 pass 237-240). Note that from 7th to 20th of August 2008 and 26th of January to 10th of February 2009, no measurements are available for Jason-1. Over ice, coastal and hydrological zones, JA2 is much better than JA1 due to new tracker algorithms (Median and Diode/DEM).

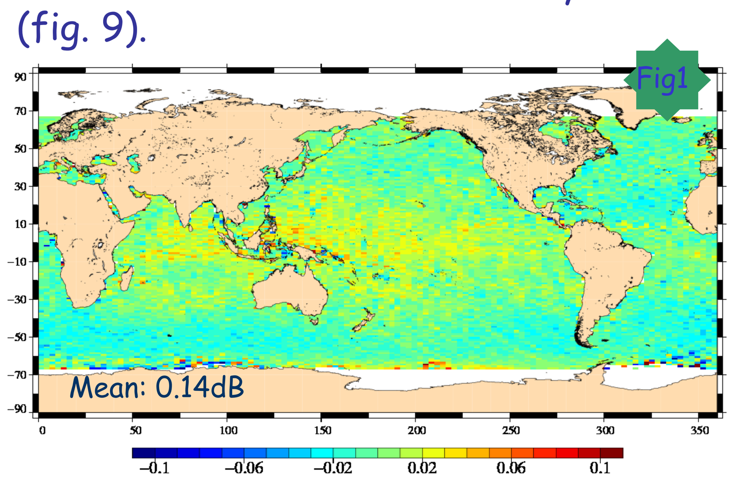


For open ocean calval, the same editing procedure is applied for both satellites. Percentage of edited measurements is very similar, since approximately 16% (~12% due to ice flag and ~3% due to parameters out of thresholds) of ocean Jason-2 measurements are edited for each cycle. Till upload (during cycle 016) of correction for low signal tracking anomaly, small portions of a pass were sometimes edited in median mode, due to AGC, Sigma0, waves and apparent mispointing out of threshold.

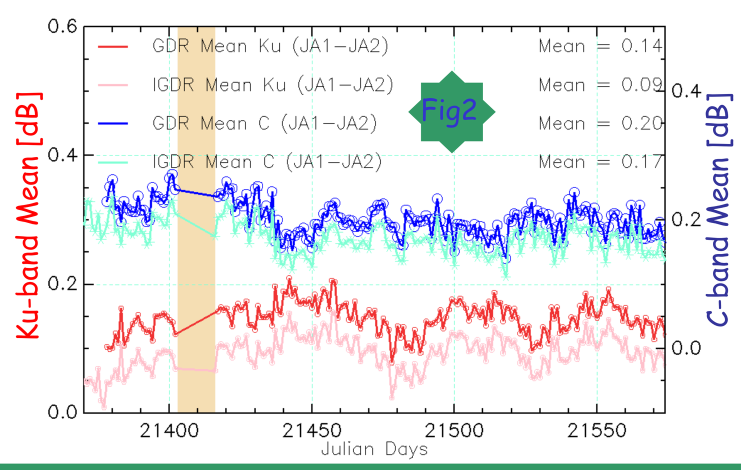


3 Backscattering coefficient

The JA2 backscattering coefficient (Sig0) shows good agreement with JA1 in Ku and C bands as plotted in map of mean differences (fig. 1) and in daily monitoring (fig. 2). The global bias with JA1 is weak (0.14 dB in Ku-band and 0.2 dB in C-band). Bias is slightly higher for GDR than for IGDR, as altimeter characterization file has changed (part 1). In comparison, the global bias between JA1 and T/P was about 2.4 dB. Notice that a small signal (0.1 dB) in both Ku- and C-band differences is detected in daily monitoring (fig. 2). It is correlated to increased JA1 mispointing (fig. 9).

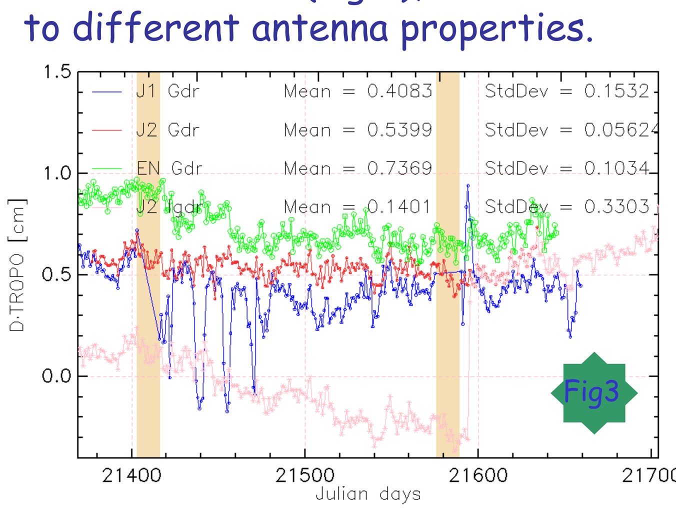


Map of JA1-JA2 Ku-band Sigma0 differences (mean over cycles 1 to 20) (fig. 1). Daily monitoring showing mean of JA1 - JA2 Sig0 difference (fig. 2).

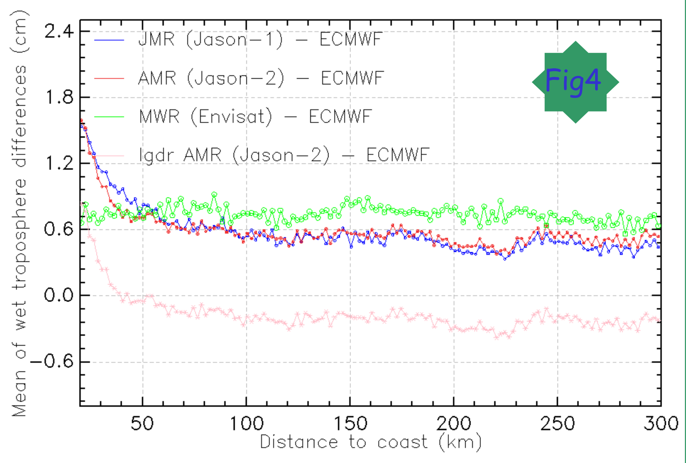


4 Wet troposphere correction

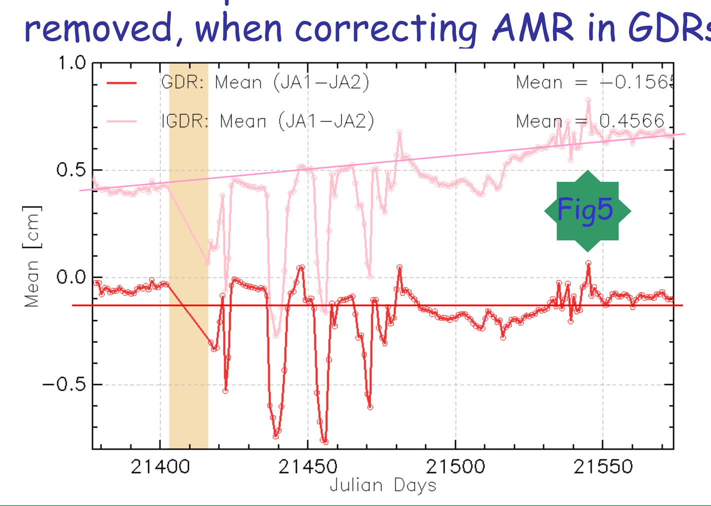
JA2 radiometer wet troposphere correction in GDR product is very stable and without drift versus ECMWF model, as visible on fig. 3. Behavior of AMR (JA2) and JMR (JA1) far away from coast is similar (fig.4), with AMR staying more stable than JMR when approaching coast related to different antenna properties.



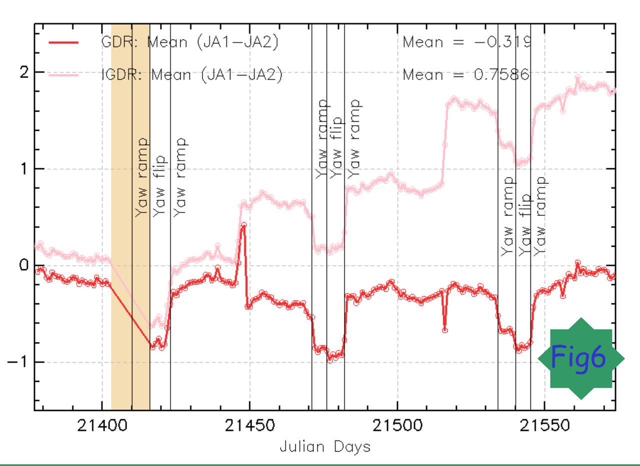
Mean of radiometer – model wet troposphere correction per day (fig.3) and in function of coast distance (fig.4).



After the Jason-1 safehold, difference of JMR – AMR radiometer wet troposphere correction (fig. 5) shows a signal up to 7 mm amplitude. The reason is unknown, but caused by JMR, as visible when comparing with ECMWF model (fig. 3). For IGDR, JMR-AMR difference showed a drift, which was probably caused by AMR 34 GHz channel (fig. 6). 34 GHz JA1 –JA2 difference shows jumps which are often, but not always correlated with yaw maneuvers. In GDR products, a different AMR characterization file than for 22 first IGDR (part 1), as well as ARCS system was used. Therefore drift of 34 GHz channel is removed and AMR radiometer wet troposphere correction put at the level of JMR. But there might be a risk that real geophysical signals are removed, when correcting AMR in GDRs.

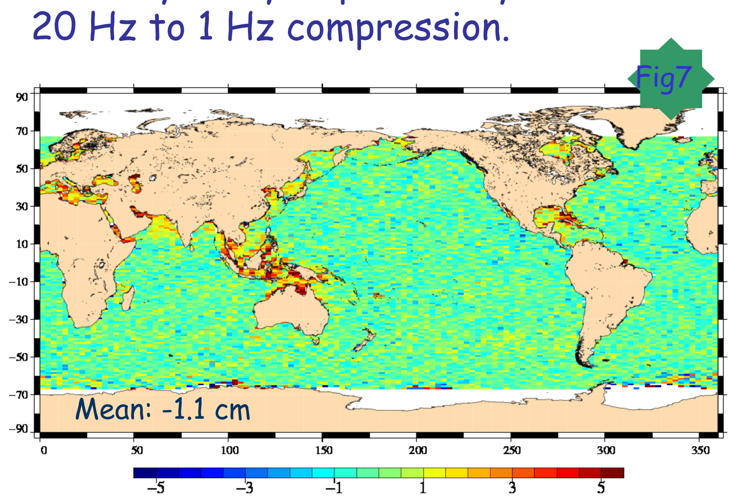


Daily monitoring of JA1-JA2 radiometer correction (fig.5) and JA1-JA2 34GHz brightness temperature (fig. 6).

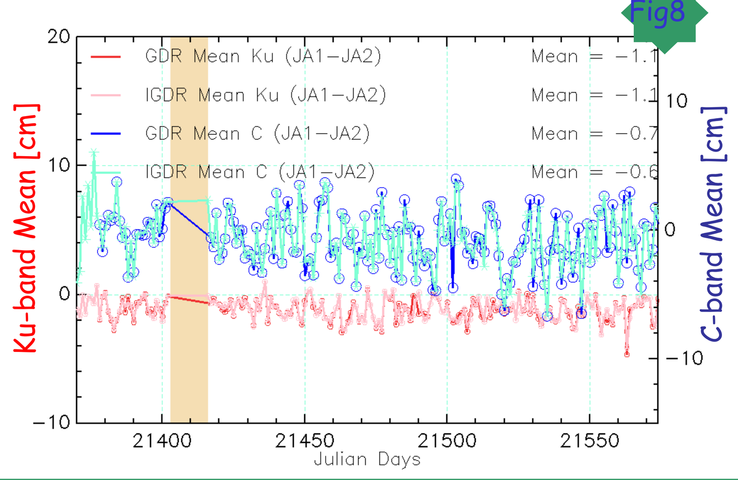


5 Significant Wave Height

The Significant Wave Height (SWH) shows very good agreement between JA2 and JA1 (fig. 7). Daily monitoring (fig. 8) of mean and std of JA1-JA2 SWH differences shows no drift neither for Ku-band nor for C-band. Waves between JA1 and JA2 are more coherent in Ku-band than in C-band. Mean of JA1-JA2 SWH differences are : -1.1 cm (Ku-band) and -0.7 cm (C-band). Std of JA1-JA2 SWH differences are : 17.2 cm (Ku-band) and 43.2 cm (C-band). Mean Ku-band SWH difference between T/P and JA1 was 8.9 cm. Weak regional differences around Indonesia (fig. 7) are very likely explained by the difference of MQE editing criteria used for both missions during 20 Hz to 1 Hz compression.

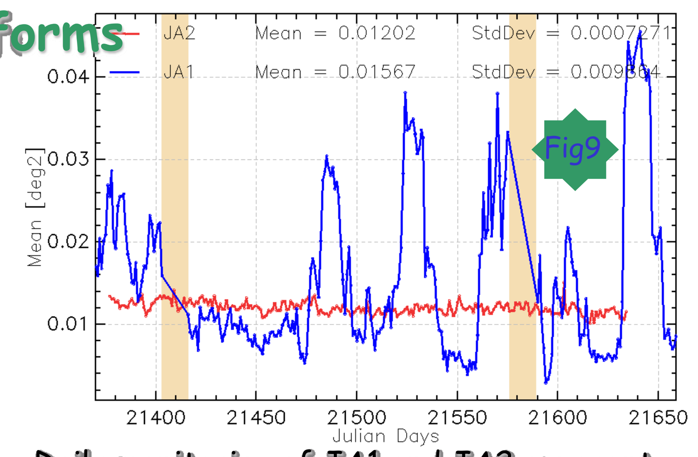


Map of JA1-JA2 Ku-band Sigma0 differences (mean over cycles 1 to 20) (fig.7). Daily monitoring showing mean of JA1 - JA2 SWH difference (fig.8).



6 Apparent squared mispointing from waveforms

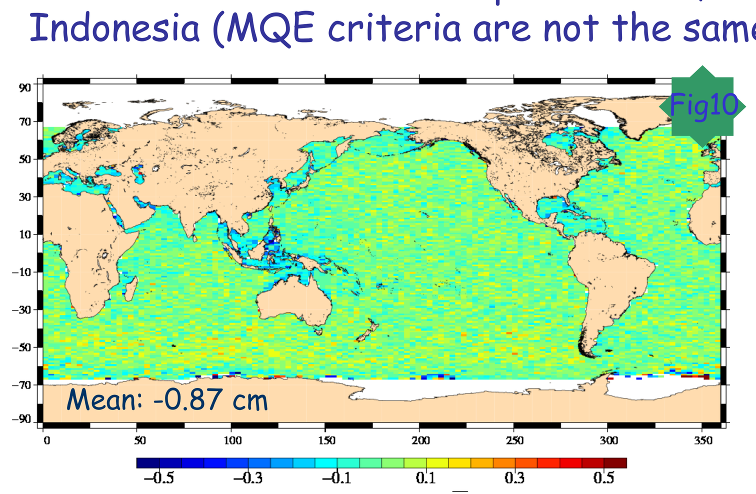
Daily monitoring of apparent squared mispointing from JA2 waveforms is much more stable than JA1 (see fig.9). This is due to reduced star tracker availability for JA1 which leads to a poorer pointing of the satellite. The JA2 satellite has no real mispointing, but mean value of apparent squared mispointing is around 0.012 deg2 (0.11 deg). This value is understood and can be updated in a next product version (see P.Thibaut talk: Jason-2 instrumental and processing status)



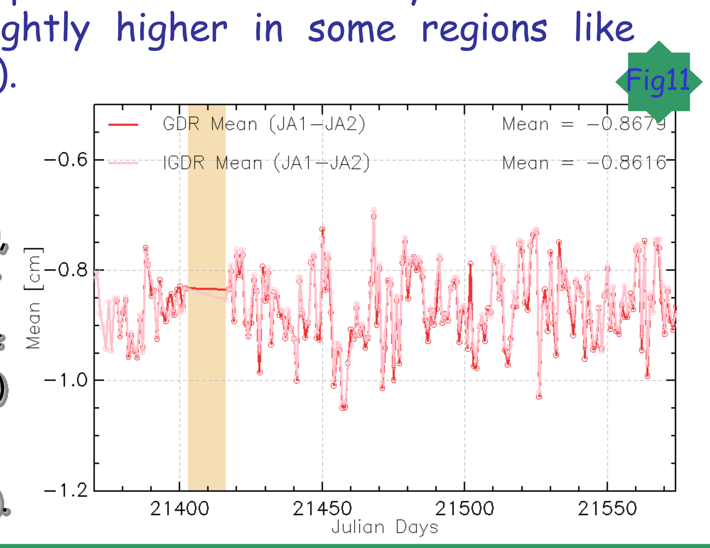
Daily monitoring of JA1 and JA2 apparent squared mispointing (from waveforms) (fig. 9).

7 Altimeter ionospheric correction

The map of mean differences over cycles 1 to 20 (fig. 10) shows that altimeter ionospheric correction of JA1 and JA2 are in good agreement. Note that the global bias is -0.9 cm (under investigation), but it is stable (fig. 11) with small variations up to 2 mm from one day to another. As for other altimeter parameters, differences are slightly higher in some regions like Indonesia (MQE criteria are not the same for JA1 and JA2).

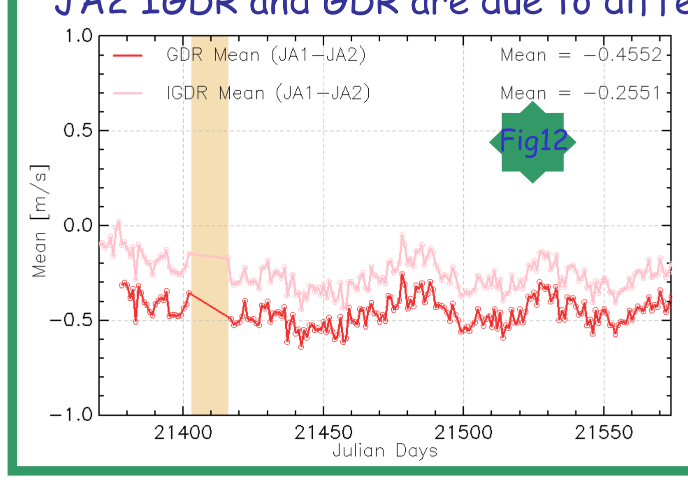


Map of JA1 - JA2 ionospheric correction, mean over cycles 1 to 20, except for cycle 4 (fig. 10). Daily monitoring of JA1-JA2 (filtered) altimeter ionospheric correction (fig. 11).

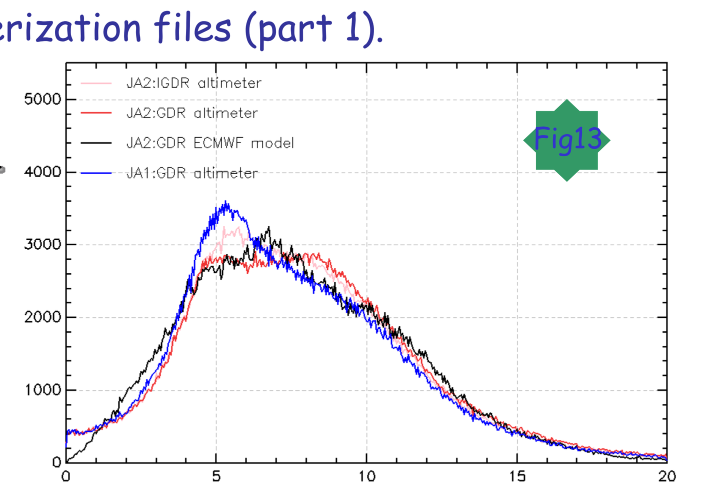


8 Altimeter wind speed

Difference of JA1-JA2 altimeter wind speed is quite stable with only small variations (fig.12). But wind speed histograms for JA1, JA2 altimeter and ECMWF model show different shapes (fig.13). JA1 and JA2 have slightly different backscattering coefficients (part 3), which impacts altimeter wind speed. This behavior should be investigated in more detail. Note that differences between JA2 IGDR and GDR are due to different altimeter characterization files (part 1).



Daily monitoring of JA1-JA2 altimeter wind speed (fig. 12). Histogram of JA1, JA2 altimeter and ECMWF model wind speed for JA2 cycle 20 (fig.13)



Conclusion

This study, using 20 cycles of Jason-2 flying in tandem with Jason-1, shows the very good consistency between altimetric parameters of JA1 and JA2.

Thanks to new AMR characterization files and ARCS system, drifts in JA2 radiometer (AMR) are corrected in GDRs, improving the stability of radiometer wet troposphere correction. Nevertheless, there is a risk that real geophysical signals might be removed. Furthermore, the new JA2 DEM tracking mode (used during cycles 3, 5, and 7) shows no impact on parameter analysis of 1 Hz ocean measurements. The very small differences observed do not impact the SSH computation (see poster B).

Finally, from the Cal/Val parameter analysis point of view, JA2 has excellent data quality.

Collecte Localisation Satellites
8-10 rue Hermes
31520 Ramonville Saint-Agne - France

OSTST

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