1 CalVal status on the Envisat V2.1 reprocessing impact on main altimetric parameters - A. Ollivier - J.F. Legeais - N. Granier - Y. Faugere - F-PAC Calval Team

2 Introduction

This comparison analysis was conducted between **V2.1 (IPF V6.04 and CMA 9.3_05)** reprocessing version and the previous version **(IPF V5.06 and CMA 9.2_03)**. It has been done on cycle 85 products and focuses on the main altimetric parameters over ocean.

All GDR and SGDR data are available on the following adress :
ftp://diss-nas-fp.eo.esa.int
under the directory : altimetry_dataset_v2.1.

No USO anomaly is noticed on that cycle and no S Band parameter is available (cycle 85 data are dated after January 17th, 2008). The associated parameters can therefore not be estimated (ex rain flag, bifrequency ionospheric correction...).

3 Major changes

Instrumental corrections impacting the range

Two major changes were performed in the new IPF chain :

- The introduction of USO correction directly in the range at the L1b level. Users are advised NOT to correct any more the range with the auxiliary data provided in the past.

- The improvement of the PTR resolution. This has 2 impacts on the data :
  - A direct impact on the Calibration factors included in the Level2 Instrumental Corrections :
  o On the range through the Time Delay Calibration Factor.
  o On the sigma0 through the Sigma0 Calibration Factor.
  - An undirect impact on the data provided that the retracking is performed on a slighlty modified waveform :
  o On all retracked parameters (Range through Epoch, SWH through SigmaC2, Wind through Sigma0, Mispointing, Peakiness)

Changes impacting SWH and SSB correction

2 changes were performed impacting the SSB correction :

- The Sea-State bias table has been recomputed (Labroue, 2007) accounting for the impact of the new orbit and the new geophysical corrections (MOG2D, GOT00 ocean tide correction with the S2 component corrected once only, new wind speed algorithm from Abdalla, 2006). The new SSB correction is shifted in average by +2.0 mm in comparison with the previous one.
- Furthermore, the improvement of the PTR SigmaC estimation has an impact on the SWH value ($SWH^2 = SigmaP^2 + SigmaC^2$). It has a mean impact of -13cm with a slight dependence in SWH.

New MWR

Changes were performed on the MWR characterisation files with an impact on the brightness temperatures. These changes have a small impact for users on the wet tropospheric correction.

New/Updates quality flags

- Updated Rain flag : In the algorithm the coefficients and look-up tables have been updated, in order to set the value of the flag. It is a 6 states flag using MWR, and Ku and S band inputs. It is thus not possible to validate this flag for cycle 85 (No S band data). Note that the method was presented in a paper ("Validation of Envisat Rain Detection and Rain Rate Estimates by Comparing With TRMM Data" N. Tran et al. IEEE Geoscience and Remote Sensing Letters, oct 2008).
- New Sea-Ice algorithm includes a 2-state sea ice flag (ice-free ocean and sea-ice) and 4 values indicating the membership of the pixel to each class (ice-free ocean, first-year ice, multi-year ice and wet ice). They are provided as percentages between 0 and 100 in the product.

Ocean Tide and Tidal Loading

Evolution on FES2004 : new loading tide + K2 and S1 coefficients. This has no impact on our analysis as we used the GOT tidal model.

Slope model used over ice sheets

New slope models have been implemented. This has no impact on our analysis as this is only applicable over ice sheets.

4 Total bias evaluated on the SLA monitoring

The global impact noticed on the SLA monitoring due to the new IPF+CMA versions consists of the sum of :

- Around **-6.4mm** due to the increase of the PTR resolution (included in the range instrumental correction)
- Around **-4.3mm** due to the new SSB solution (algorithm part : +2mm and 4 to 5% of 13cm SWH bias part)

==> Resulting in a **-10.7 mm jump** with geographical patterns (see map of figure **??**).

Note that those statistics result from the comparison of the previous SLA corrected from USO with auxiliary files with a SLA using a range now directly corrected from USO.

Impact is also noticed on SWH monitoring :
- Around **-13cm** biais on the SWH due to the PTR width modification

Due to this global reduction of SWH, the population of null SWH increases. The managing of those null values has slighly changed between the previous and new SSB model. Users must be advised that this might cause a slight over editing due to the SSB if thresholds are not updated accordingly.
Thus,we suggest to relax the thresholds on this parameter (ex, for DUACS processing, this threshold was relaxed from [-50cm,0] to [-50cm,1cm]).

Other parameters are not or slighly impacted (weak impact on the range of the MWR new caracterisation files).

Sigma0 :	+0.016dB through Atmospheric attenuation + resolution noise from the sigma0 calibration factor.
Atmospheric attenuation :	+0.016dB
Wind :	-0.05m/s
Brightness Temperature 23.8 GHz :	+0.9K (0.5K expected on all surfaces)
Brightness Temperature 36.5 GHz :	+2.7K (1K expected on all surfaces)
Radiometer wet correction :	+0.3mm

5 Geographic and temporal differences of New and Old versions

This part shows the temporal difference of daily statistics. Note that these statistics do not take into account the fact that the number of point might not be the same in both versions.
However, the difference is minor and does not affect the statistics in a significant way.
Note that the first and last days of daily differences monitorings are systematically excluded since they are not associated with the same number of data (the previous version included data for the days across the previous and following cycles). Moreover, maps of geographic differences are point to point differences. The statistics enlighted are read from the point to point differences (sometime different from the difference of daily average due to slight discrepencies in the data coverage).

Impact of IPF/CMA version on Sea Level and range related parameters

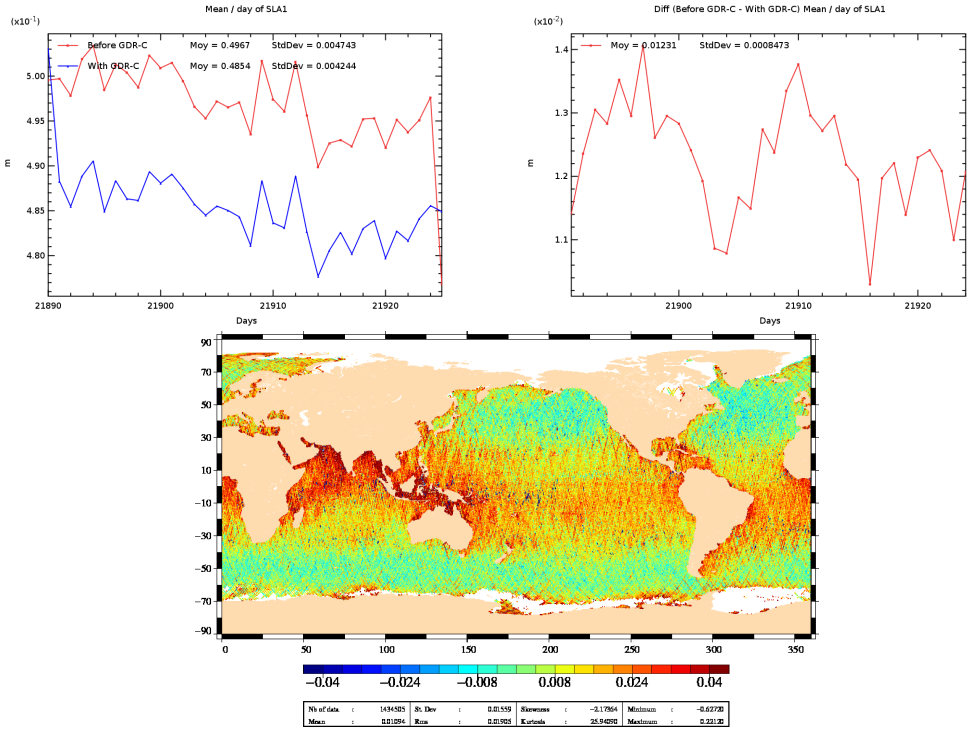

FIG. 1 – **Total Corrected SLA : Monitoring per day of each version (left)/ Difference Old - New version (right) in meters. Bottom : Geographical difference. Total of -10.9mm global bias (average on the geographical point to point difference : map).**

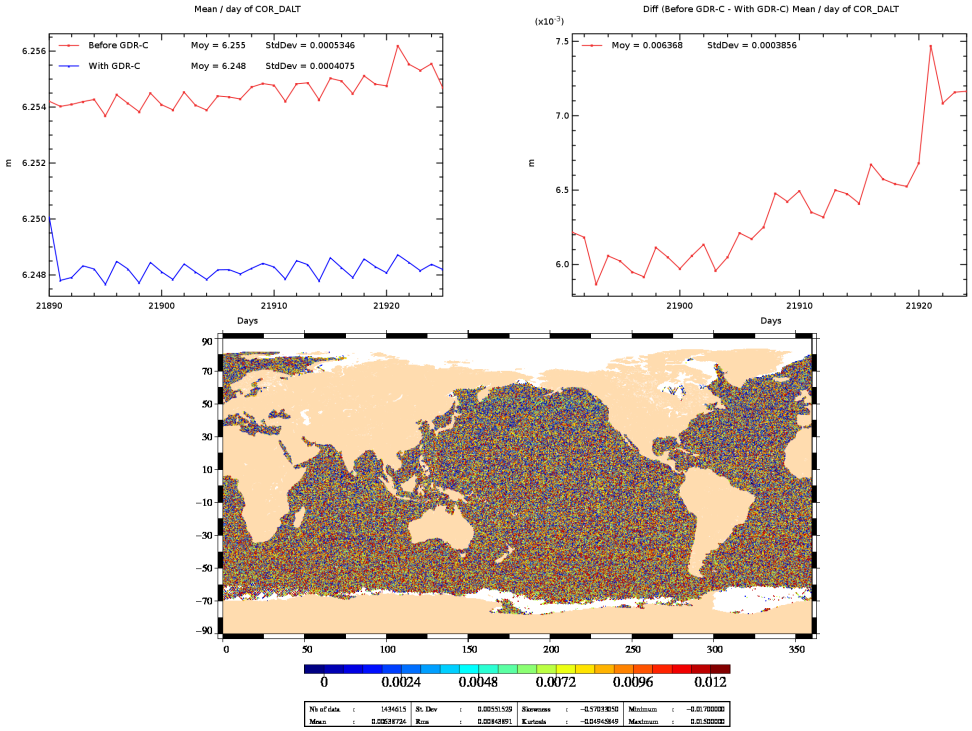

FIG. 2 – **Instrumental Range Correction : Monitoring per day of each version (left)/ Difference Old - New version (right) in meters. Bottom : Geographical difference. Global bias of -6.4mm - related to PTR processing evolution.**

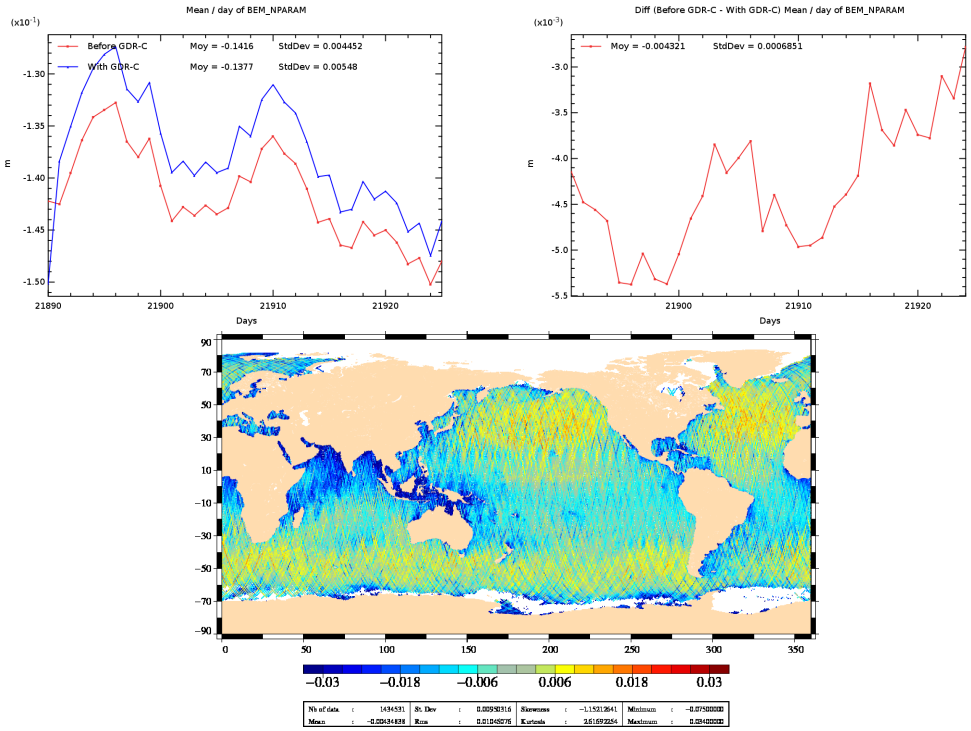

FIG. 3 – **Sea State Bias : Monitoring per day of each version (left)/ Difference Old - New version (right) in meters. Bottom : Geographical difference. Global bias of +4.3mm on sea level height.**

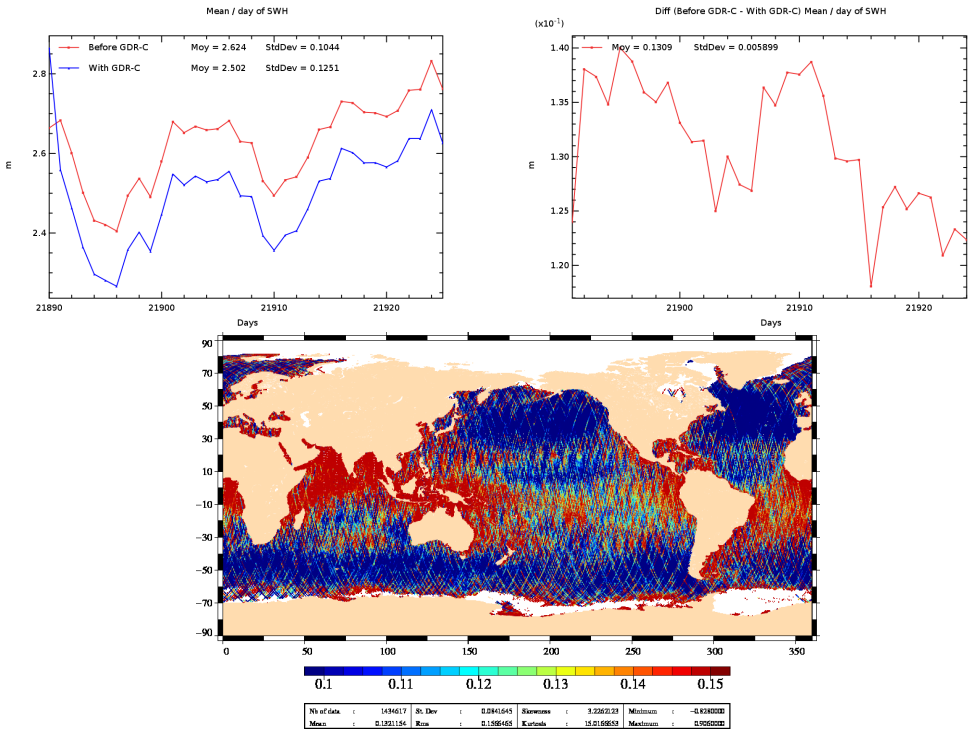

FIG. 4 – **SWH : Monitoring per day of each version (left)/ Difference Old - New version (right) in meters. Bottom : Geographical difference. The global -13.1cm bias observed explains a part of the SLA jump through SSB (theoretical 4 to 5% of SWH bias).**

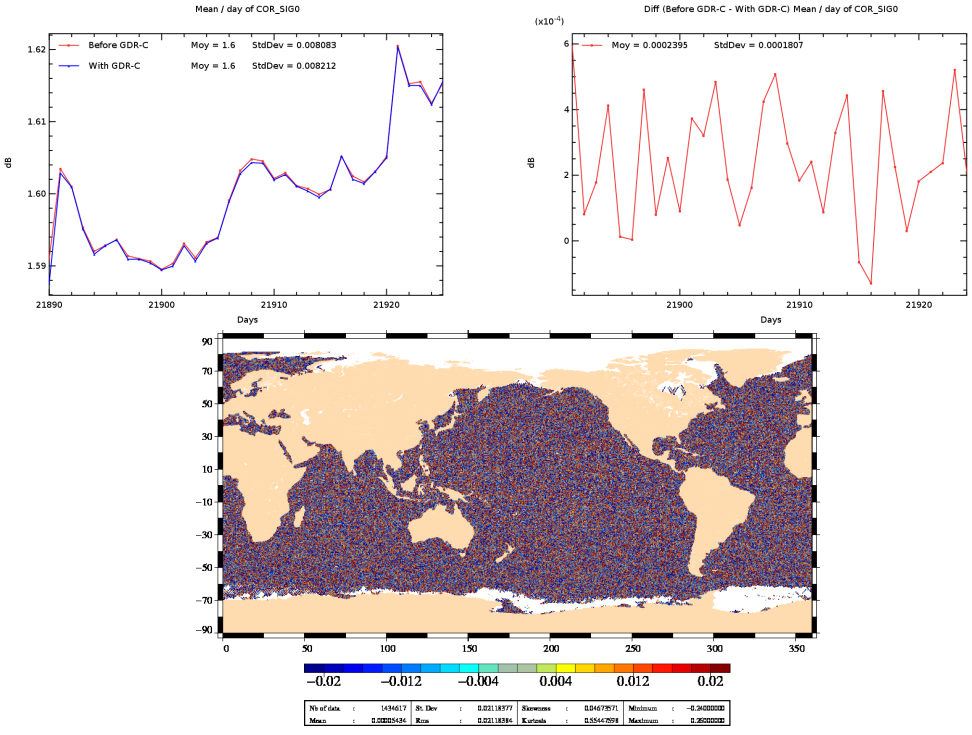

FIG. 5 – **Instrumental Sigma0 corrections : Monitoring per day of each version (left)/ Difference Old - New version (right) in dB. Bottom : Geographical difference. No bias detected but the resolution has increased.**

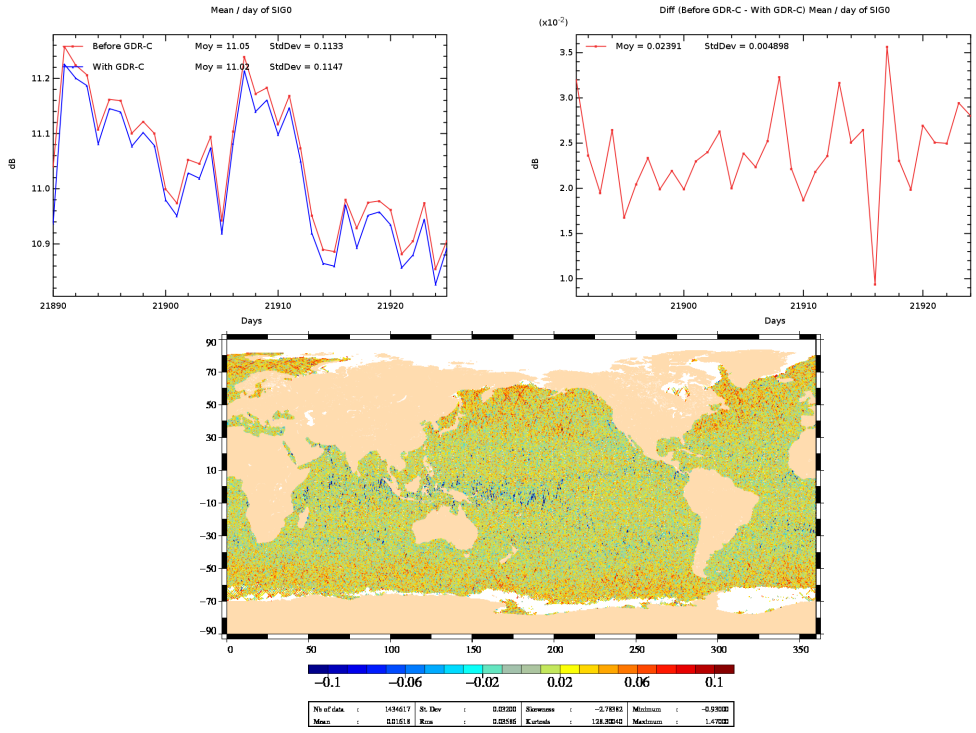

FIG. 6 – **Sigma0 : Monitoring per day of each version (left)/ Difference Old - New version (right) in dB. Bottom : Geographical difference. Weak -0.024dB global bias.**

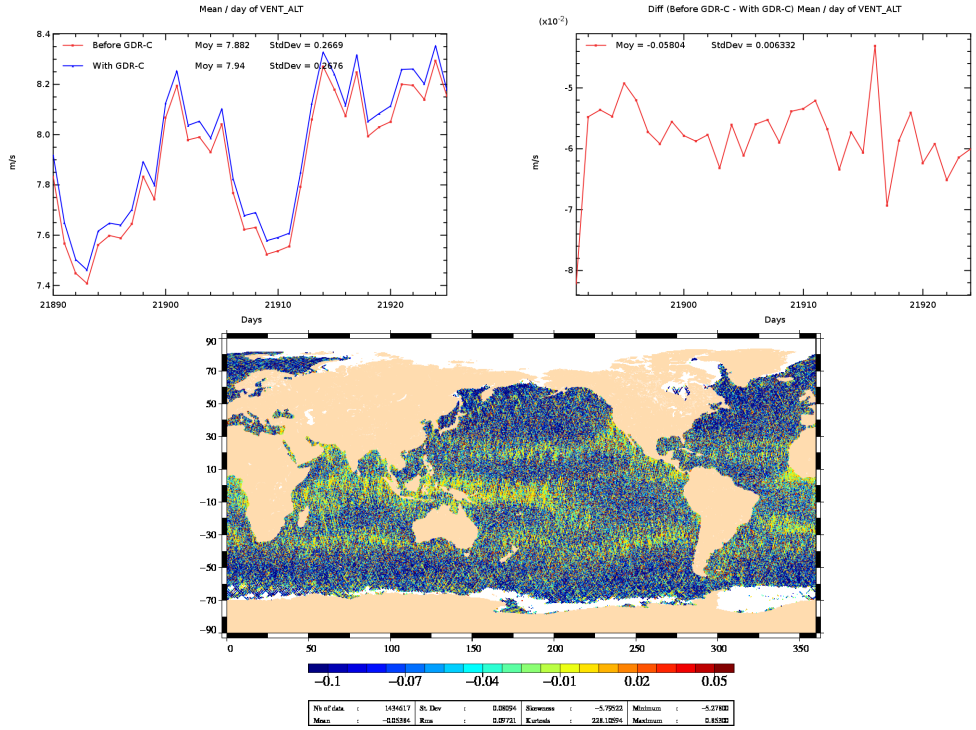

FIG. 7 – **Wind : Monitoring per day of each version (left)/ Difference Old - New version (right) in m/s.Bottom : Geographical difference. Weak 0.06m/s global bias.**

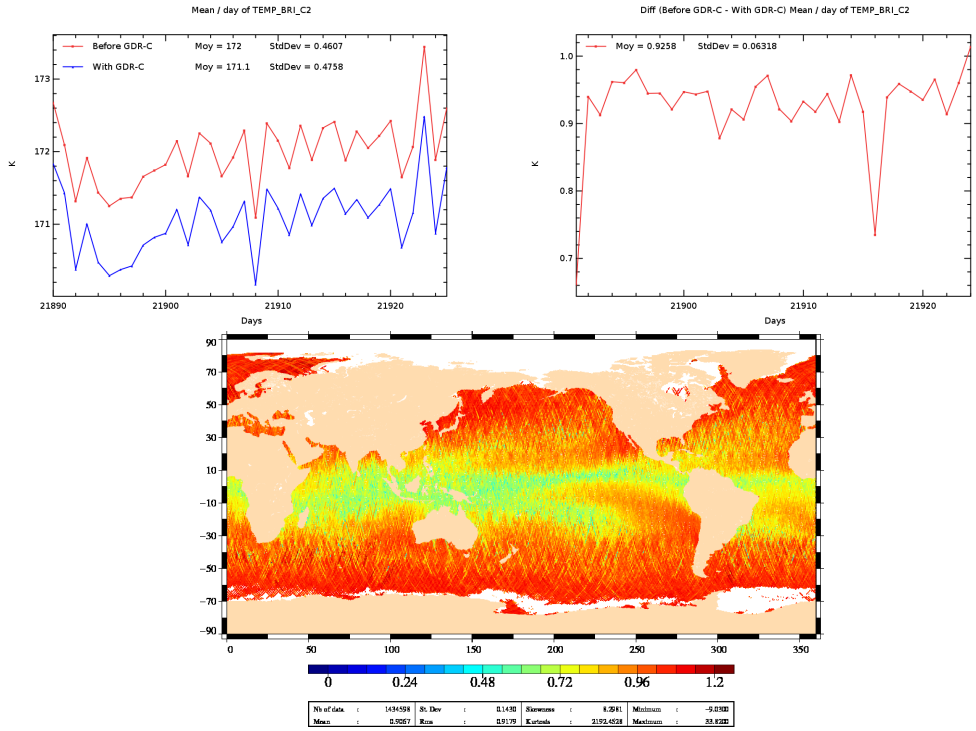

FIG. 8 – **Brightness Temperature 23.8GHz : Monitoring per day of each version (left)/ Difference Old - New version (right) in Kelvin. Bottom : Geographical difference. -0.9K global bias.**

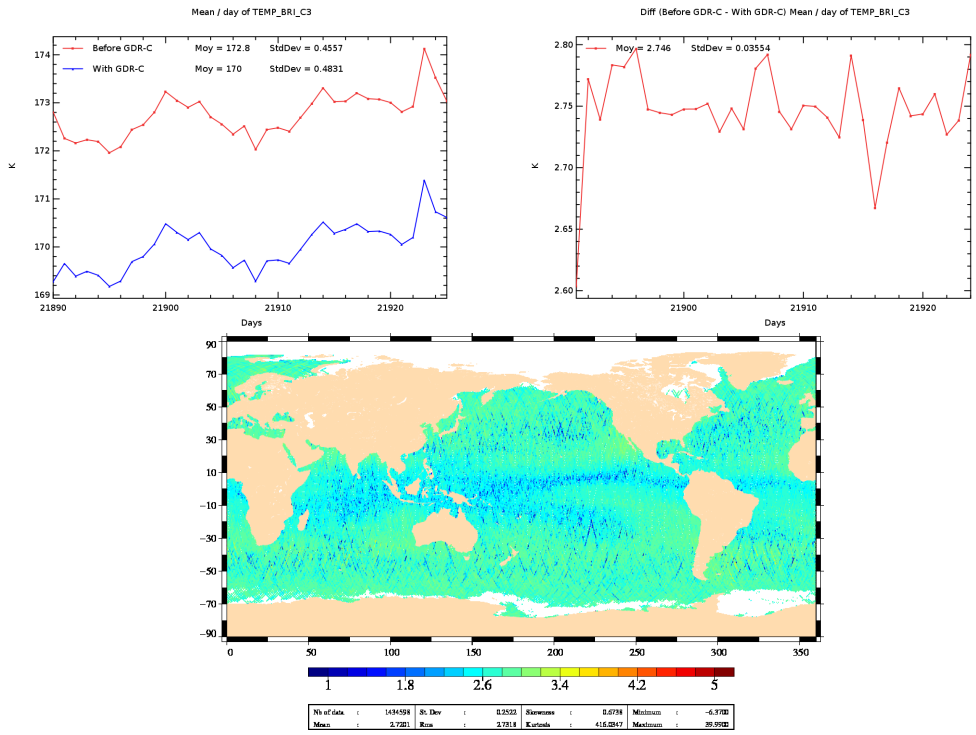

FIG. 9 – **Brightness Temperature 36.5GHz : Monitoring per day of each version (left)/ Difference Old - New version (right) in Kelvin. Bottom : Geographical difference. -2.7K global bias.**

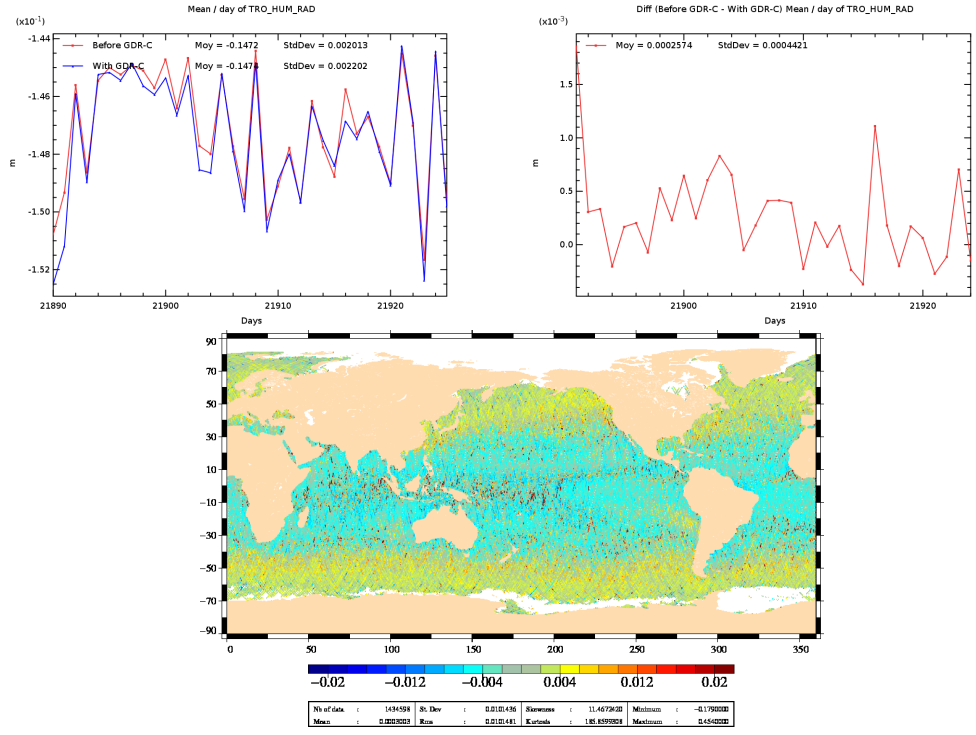

FIG. 10 – **MWR Wet Tropospheric Correction : Monitoring per day of each version (left)/ Difference Old - New version (right) in m. Bottom : Geographical difference. Weak submilimetric global bias (-0.3mm).**