S3-A MWR Cyclic Performance Report

Cycle No. 013

Start date: 03/01/2017
End date: 30/01/2017
Customer: ESA  
Document Ref.: S3MPC.CLS.PR.05-013
Contract No.: 4000111836/14/I-LG  
Date: 08/02/2017
Issue: 1.0

Project: PREPARATION AND OPERATIONS OF THE MISSION PERFORMANCE CENTRE (MPC) FOR THE COPERNICUS SENTINEL-3 MISSION
Title: S3-A MWR Cyclic Performance Report
Author(s): MWR ESLs
Approved by: G. Quartly, STM ESL Coordinator  
Authorized by: Sylvie Labroue, STM Technical Performance Manager

Distribution: ESA, EUMETSAT, S3MPC consortium
Accepted by ESA: P. Féménias, MPC TO

Filename: S3MPC.CLS.PR.05-013 - i1r0 - MWR Cyclic Report 013.docx

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.
## Changes Log

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>08/02/2017</td>
<td>First Version</td>
</tr>
</tbody>
</table>

## List of Changes

<table>
<thead>
<tr>
<th>Version</th>
<th>Section</th>
<th>Answers to RID</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Table of content

1 **INTRODUCTION** ....................................................................................................................... 1

2 **OVERVIEW OF CYCLE 013** .................................................................................................... 2
  2.1 **STATUS** .................................................................................................................................. 2
  2.2 **IPF PROCESSING CHAIN STATUS** ......................................................................................... 3
    2.2.1 **IPF version** ...................................................................................................................... 3
    2.2.2 **Auxiliary Data files** .......................................................................................................... 4

3 **MWR MONITORING OVER CYCLE 013** .................................................................................. 5
  3.1 **OPERATING MODES** ............................................................................................................... 5
  3.2 **CALIBRATION PARAMETERS** .................................................................................................. 6
    3.2.1 **Gain** .................................................................................................................................. 6
    3.2.2 **Noise Injection Temperature** ............................................................................................ 7
  3.3 **BRIGHTNESS TEMPERATURES** .............................................................................................. 8
  3.4 **GEOPHYSICAL PRODUCTS MONITORING** ............................................................................. 9
    3.4.1 **Wet Tropospheric Correction** ........................................................................................... 9
    3.4.2 **Atmospheric Attenuation** .................................................................................................. 11

4 **LONG-TERM MONITORING** ....................................................................................................... 12
  4.1 **INTERNAL CALIBRATION PARAMETERS** ............................................................................. 12
    4.1.1 **Gain** .................................................................................................................................. 12
    4.1.2 **Noise Injection temperature** ............................................................................................. 13
  4.2 **VICARIOUS CALIBRATION** .................................................................................................... 14
    4.2.1 **Coldest ocean temperatures** .............................................................................................. 14
    4.2.2 **Amazon forest** .................................................................................................................. 16
    4.2.3 **References** ...................................................................................................................... 17
  4.3 **GEOPHYSICAL PRODUCTS** ................................................................................................... 18
    4.3.1 **Monitoring of geophysical products** ............................................................................... 18
    4.3.2 **Comparison to insitu measurements** .............................................................................. 19

5 **SPECIFIC INVESTIGATIONS** ..................................................................................................... 20
List of Figures

Figure 1: Distribution of operating mode ................................................................. 5

Figure 2: Map of measurements with DNB processing for 36.5GHz channel (red) and safety mode for both channels over KREMS (blue) ........................................................................................................ 6

Figure 3: Monitoring of receiver gain for both channels: 23.8GHz (left) and 36.5GHz (right) .......................................................... 7

Figure 4: Monitoring of Noise Injection temperature for both channels: 23.8GHz (left) and 36.5GHz (right) .......................................................... 7

Figure 5: Map of Brightness temperatures of channel 23.8GHz for ascending (right) and descending (left) passes ........................................................................................................ 8

Figure 6: Map of Brightness temperatures of channel 36.5GHz for ascending (right) and descending (left) passes ........................................................................................................ 8

Figure 7: Histograms of MWR-ECMWF difference of wet tropospheric correction for SARAL/MWR, Jason2/AMR and Sentinel-3A/MWR SAR and PLRM ........................................................................................................ 10

Figure 8: MWR-ECMWF difference of wet tropospheric correction: using SAR (left) and PLRM altimeter backscatter (right) ........................................................................................................ 10

Figure 9: Jason2/AMR MWR-ECMWF difference of wet tropospheric correction ........................................................................................................ 11

Figure 10: Ku band Atmospheric attenuation of the Sigma0 Left: Histograms for Sentinel-3A/MWR, Jason2/AMR; Right: Map of atmospheric attenuation for Sentinel-3A ........................................................................................................ 11

Figure 11: Daily mean of the gain for both channels: 23.8GHz (left) and 36.5GHz (right) ........................................................................................................ 12

Figure 12: Daily mean of the noise injection temperature for both channels: 23.8GHz (left) and 36.5GHz (right) ........................................................................................................ 13

Figure 13: Coldest temperature over ocean at 23.8GHz for Sentinel-3A, SARAL/AltiKa, Jason2, and MetopA/AMSUA ........................................................................................................ 15

Figure 14: Coldest temperature over ocean for the liquid water channel Sentinel-3A, SARAL/AltiKa, Jason2, and MetopA/AMSUA ........................................................................................................ 15
Figure 15 : Average temperature over Amazon forest at 23.8GHz channel for Sentinel-3A, SARAL/AltiKa, Jason2, and MetopA/AMSUA

Figure 16 : Average temperature over Amazon forest at 36.5GHz channel for Sentinel-3A, SARAL/AltiKa, Jason2, and MetopA/AMSUA

Figure 17 : Monitoring of difference MWR-ECMWF correction : daily average (left) and standard deviation (right)

List of Tables

Table 1 : General overview of the MWR quality assessment
1 Introduction

This document aims at providing a synthetic report on the behaviour of the radiometer in terms of instrumental characteristics and product performances as well as on the main events which occurred during cycle 13.

This report covers the short term monitoring of internal calibration and brightness temperatures based on NRT products generated at Svalbard (SVL) core ground station and monitoring of geophysical products based on STC (Slow Time Critical) since cycle 13. The long term monitoring section provides a view of the internal calibration monitoring as well as two subsections covering the monitoring of vicarious calibration targets and geophysical parameters.

The long term internal calibration monitoring covers the period from cycle 1 to cycle 13. To this aim, the data from the recent reprocessing (using IPF v6.5) are used to cover the period from cycle 1 to cycle 9, the NRT product are used only from 26/10/2016 allowing an homogeneous time series. The vicarious calibration monitoring is presented using reprocessing data and on-line data, again for homogeneity. The geophysical long term monitoring will be completed as soon as the amount of data will be sufficient.

This document is split in the following sections:

- Section 2 gives an overview on the status of the current cycle
- Section 3 addresses the monitoring of the MWR of the current cycle
- Section 4 addresses the long term monitoring from the beginning of the mission
2 Overview of Cycle 013

2.1 Status

The Table 1 gives a summary of the instrument behavior during this period.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Status</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument</td>
<td>Nominal</td>
<td></td>
</tr>
<tr>
<td>Internal Calibration</td>
<td>Nominal</td>
<td></td>
</tr>
<tr>
<td>Geophysical products</td>
<td>Nominal</td>
<td></td>
</tr>
<tr>
<td>Long-term monitoring</td>
<td>Nominal</td>
<td>Nominal - geophysical monitoring switch on for wet tropospheric correction</td>
</tr>
</tbody>
</table>

Table 1: General overview of the MWR quality assessment

Color legend:

- **OK**
- **Warning**
- **NOK**
- **Not available**
2.2 IPF processing chain status

2.2.1 IPF version

This section gives the version of the IPF processing chain used to process the data of the current cycle.

If a change of IPF version occurs during the cycle, the table gives the date of last processing with the first version and the date of first processing with the second version:

- : first date of processing

- : last date of processing

### MWR L1B CAL

<table>
<thead>
<tr>
<th></th>
<th>NRT from Svalbard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>06.02</td>
</tr>
</tbody>
</table>

### MWR L1B

<table>
<thead>
<tr>
<th></th>
<th>NRT from Svalbard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>06.02</td>
</tr>
</tbody>
</table>

### SRAL/MWR Level 2

<table>
<thead>
<tr>
<th></th>
<th>NRT from Marine Center</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>06.05</td>
</tr>
</tbody>
</table>
2.2.2 Auxiliary Data files

This section gives the version of the auxiliary data files used to process the data of the current cycle.

**Side Lobe Correction file (Svalbard Core Ground Station)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Side lobe</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3A_MW_1_SLC_AX_20000101T000000_20991231T235959_20160603T120000_________MPC_O_AL_002.SEN3</td>
<td></td>
</tr>
</tbody>
</table>

**MWR CCDB (Svalbard Core Ground Station)**

<table>
<thead>
<tr>
<th>Filename</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3A_MW___CHDNAX_20160216T000000_20991231T235959_20161014T120000_________MPC_O_AL_002.SEN3</td>
</tr>
</tbody>
</table>

**L2 Configuration file (Marine Center - STC)**

<table>
<thead>
<tr>
<th>Filename</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3__SR_2_CON_AX_20160216T000000_20991231T235959_20161224T120000_________MPC_O_AL_006.SEN3</td>
</tr>
</tbody>
</table>
3 MWR Monitoring over Cycle 013

This section is dedicated to the functional verification of the MWR sensor behaviour during cycle 13 (3 January 2017 – 30 January 2017). The main relevant of the parameters, monitored daily by the MPC team, are presented here.

3.1 Operating modes

The radiometer has several operating modes listed hereafter:

- Mode 0: Intermonitoring (Earth observation)
- Mode 1: Monitoring
- Mode 2: Noise Injection calibration
- Mode 3: Dicke Non-Balanced calibration (100% injection – hot point)
- Mode 4: Dicke Non-Balanced calibration (50% injection – cold point)

Figure 1 gives the distribution of the different modes in the data.

For measurements in the Intermonitoring mode, two kind of processing can be used according to the measured brightness temperature. If this temperature is smaller than the reference load inside the instrument, the NIR processing is used; if the temperature is greater, the DNB processing is used. The transition from one processing to the other will occur more or less close to the coast depending on the
internal temperature of the MWR. The internal temperature of the MWR is such that only a small percentage of measurements required a DNB processing in this cycle as shown by Figure 2.

This figure shows also the passage over the US KREMS radar facility in the Kwajalein atoll (9°23’47’’ N - 167°28’50’’ E) in the Pacific. For safety reasons, the MWR is switched to a specific mode about 50 km before the facility location and back to nominal mode 50km after.

![Map of measurements with DNB processing for 36.5GHz channel (red) and safety mode for both channels over KREMS (blue)](image)

**Figure 2 : Map of measurements with DNB processing for 36.5GHz channel (red) and safety mode for both channels over KREMS (blue)**

### 3.2 Calibration parameters

To monitor the instrument behavior during its lifetime, the relevant parameters of the MWR internal in-flight calibration procedure are presented in the following subsections. These parameters are:

- the gain: this parameter is estimated using the two types of Dicke Non-Balanced calibration measurements (100% and 50% of injection). This parameter is used by the DNB processing of the Earth measurements.
- the noise injection temperature: this parameter is measured during the Noise Injection calibration measurements. This parameter is used by the NIR processing of the Earth measurements.

#### 3.2.1 Gain

Figure 3 shows the monitoring of the receiver gain for the current cycle. The mean value over the cycle is 4.747mV/K and 4.548mV/K for channel 23.8GHz and 36.5GHz respectively. These values are close to
values estimated on-ground during characterization of the instrument (4.793mV/K and 4.665mV/K for channels 23.8GHz and 36.5GHz respectively). The gain of 23.8GHz channel is constant over the cycle while the 36.5GHz channel gain shows a slight decrease. Nominal behavior is observed since only 1 cycle of data is considered in this section.

Figure 3: monitoring of receiver gain for both channels: 23.8GHz (left) and 36.5GHz (right)

3.2.2 Noise Injection Temperature

Figure 4 shows the monitoring of the noise injection temperature for the current cycle. The noise injection temperature for the 23.8GHz channel is constant over the cycle around 314K. For the 36.5GHz channel, the diode shows a slow decrease along the cycle of less than 0.1K. Nominal behavior is observed since only 1 cycle of data is considered in this section. The monitoring will be pursued and data checked for any impact.

Figure 4: Monitoring of Noise Injection temperature for both channels: 23.8GHz (left) and 36.5GHz (right)
3.3 Brightness Temperatures

The two following figures show maps of brightness temperatures for both channels split by ascending (right part) and descending (left part) passes. The Figure 5 and Figure 6 concern the channels 23.8GHz and 36.5GHz respectively. These maps show a good contrast between ocean and land for both channels. No issue has to be reported from these figures.

**Figure 5**: Map of Brightness temperatures of channel 23.8GHz for ascending (right) and descending (left) passes

**Figure 6**: Map of Brightness temperatures of channel 36.5GHz for ascending (right) and descending (left) passes
3.4 Geophysical products monitoring

The inversion algorithms allow to retrieve the geophysical products from the measurements of the radiometer (brightness temperatures measured at two different frequencies) and the altimeter (backscattering coefficient ie sigma0). Four geophysical products are issued from the retrieval algorithms: the wet tropospheric correction, the atmospheric attenuation of the Sigma0, the water vapor content, the cloud liquid water content. This section provides an assessment of two of these retrievals used by the SRAL/MWR L2 processing: the wet tropospheric correction and the atmospheric attenuation of the Sigma0. The wet tropospheric correction is analysed through the MWR-ECMWF difference of this correction.

3.4.1 Wet Tropospheric Correction

The left part of Figure 8 presents the histograms of the MWR-ECMWF differences of wet tropospheric correction (ΔWTC) for cycle 13. For this cycle, STC products are used for Sentinel-3A for the first time as for previous cycles NRT products were used. In this figure, Sentinel-3A/MWR correction is compared to the correction retrieved by Jason2/AMR (IGDR) and SARAL/MWR (IGDR) over the same period.

The standard deviation of the difference MWR-ECMWF corrections for S-3A is about 1.45cm for both SAR and PLRM corrections while it is only 1.59cm for SARAL and 1.14cm for Jason-2. First Jason-2 benefits from its three channels radiometer (18.7GHz, 23.8GHz, 34GHz), providing a correction with a smaller deviation with respect to the model. SARAL/MWR is closer to S-3A/MWR in this context with its two channels (23.8GHz, 37GHz). Then the standard deviation for SARAL is the closest reference, even though the Sigma0 in Ka band raises some questions. With the use of STC products for S-3A, the ΔWTC for the three instruments are directly comparable since all use ECMWF analyses for the computation of the model correction. The standard deviation of ΔWTC for S-3A is smaller than for SARAL meaning that we have a better estimation of the correction for S-3A according to these metrics. Jason-2 gives the best performances with the smallest deviation. Moreover one can notice that both SAR and PLRM corrections have very similar performances: mean(std) of ΔWTC being close to 0.10cm(1.44cm) and 0.13cm(1.43cm) for SAR and PLRM respectively.

An issue was found with the Marine Center processing of STC products which did not use the correct LTM files (SIIIMPc-1330). This issue has been corrected the 10th of December. Then only one third the data of this cycle is impacted.

Figure 8 presents a map of the ΔWTC for Sentinel-3A only for SAR correction on the left and PLRM correction on the right. For this cycle, the maps show geographical patterns expected for this parameter. Note that the color scale is centered to the mean value. The comparison with Jason2 map of ΔWTC (Figure 9) shows similarities although Sentinel-3A ΔWTC is larger than Jason2 because of their different instrument configuration and the issue of processing stated before.
Figure 7: Histograms of MWR-ECMWF difference of wet tropospheric correction for SARAL/MWR, Jason2/AMR and Sentinel-3A/MWR SAR and PLRM.

Figure 8: MWR-ECMWF difference of wet tropospheric correction: using SAR (left) and PLRM altimeter backscatter (right).
3.4.2 Atmospheric Attenuation

The left part of Figure 10 presents the histograms of the Ku band atmospheric attenuation of the Sigma0 for cycle 13. In this figure, Sentinel-3A attenuation is compared to the attenuation retrieved for Jason2/AMR. The results of S-3A are very similar to Jason-2 results with an average attenuation close to 0.21 dB for S-3A and 0.2 dB for Jason2. The right part of Figure 10 shows a map of attenuation of Sentinel-3A.

Figure 10: Ku band Atmospheric attenuation of the Sigma0

Left: Histograms for Sentinel-3A/MWR, Jason2/AMR; Right: Map of atmospheric attenuation for Sentinel-3A
4 Long-term monitoring

In this section, a long-term monitoring of the MWR behaviour is presented.

4.1 Internal Calibration parameters

In this section, data from the recent reprocessing (using IPF v6.5) are used to cover the period from cycle 1 to cycle 9, MWR L1B data generated by PDGS at Svalbard core ground station are used from 26/10/2016 allowing a homogeneous time series. The period covered by the monitoring will start at cycle 1 until cycle 13.

4.1.1 Gain

Figure 11 shows the daily mean of the receiver gain for both channels. This calibration parameter is used in the DNB processing of the measurements. As seen previously in section 3.1, only a small part of the measurements are processed in DNB mode. The first part of the monitoring of the calibration parameters is performed using NTC product generated during the recent reprocessing (IPF v6.5), the second part using NRT products from the day of the IPF update on the Svalbard ground station. The gap between the two datasets comes from the delay between the end of the reprocessed period and the implementation of the IPF on the station. This gap will be covered by a future reprocessing.

From the two panels of Figure 11, one can see that the receiver gain has a different behaviour for each channel. The gain for the 23.8GHz is slowly increasing continuously since the beginning of the mission showing two slopes and an inflexion point during cycle 7. The gain has increased of +0.02mv/K the beginning. For the 36.5GHz channel, the gain is increasing from cycle 1 and then starts to decrease at the beginning of cycle 4. The decreasing rate is slowly decreasing. Due to the small number of data processed using this parameter, it will be difficult to assess if this decrease has an impact on data quality. The monitoring will be pursued and data checked for any impact.

![Figure 11: Daily mean of the gain for both channels: 23.8GHz (left) and 36.5GHz (right)](image-url)
4.1.2 Noise Injection temperature

Figure 12 shows the daily mean of the noise injection temperature for both channels. This calibration parameter is used in the NIR processing of the measurements. As seen previously in section 3.1, the main part of the measurements are processed in NIR mode. Moreover the first part of the monitoring of the calibration parameters is performed using NTC product generated during the recent reprocessing (IPF v6.5), the second part using NRT products from the day of the IPF update on the ground station. The gap between the two datasets comes from the delay between the end of the reprocessed period and the implementation of the IPF on the station. This gap will be covered by a future reprocessing.

From the two panels of Figure 12, one can see that the noise injection parameter has a different behaviour for each channel. For the 23.8GHz channel diode, the noise injection temperature has decrease of 0.5K during the first 2 cycles, after what there has been no significant change of behaviour until cycle 13. During this cycle, the noise injection temperature seems to start a decrease. For the channel 36.5GHz, one can see that the diode is not stabilized: the injection temperature has increased from cycle 1 to 5 followed by a stabilization period from beginning of June (cycle 5) to mid-July (end of cycle 6) when the noise injection temperature for the 36.5GHz channel starts to decrease. The decreasing rate is increasing since cycle 9. The monitoring will be pursued and data checked for any impact.

Some peak values are noticeable at the end of cycle 4 (mainly channel 23.8GHz), at the end of cycle 6, during cycle 9, 10, 12. Some of these peaks concerns both channels at the same time, while a small part of them only one of them. The investigations performed in the cycle 6 report has shown that these measurements are localized around a band of latitude that may change along the time series. The source is not yet clearly identified but a intrusion of the Moon in the sky horn is suspected.

![Figure 12: Daily mean of the noise injection temperature for both channels: 23.8GHz (left) and 36.5GHz (right)](image-url)
4.2 Vicarious calibration

The assessment of the brightness temperatures quality and stability is performed by the use of vicarious calibrations. Two specific areas are selected.

4.2.1 Coldest ocean temperatures

The first area is the ocean and more precisely the coldest temperature over ocean. Following the method proposed by Ruf [RD 1], updated by Eymar [RD 3] and implemented in [RD 7], the coldest ocean temperatures is computed by a statistic selection. Ruf has demonstrated how a statistical selection of the coldest BT over ocean allows detecting and monitoring drifts. It is also commonly used for long-term monitoring or cross-calibration [RD 4] [RD 5] [RD 6].

The Figure 13 presents the coldest ocean temperature computed following method previously described at 23.8GHz channel for Sentinel-3A/WMR and three other microwave radiometers: AltiKa/MWR, Jason2/AMR and Metop-A/AMSUA. For AMSUA, the two pixels of smallest incidence (closest to nadir) are averaged. The Figure 14 presents the same results for the liquid water channel of the same four instruments: 36.5GHz for Sentinel-3A, 37GHz for AltiKa, 34GHz for Jason2 and 31.4GHz for MetopA. For Sentinel-3A, the results are shown for:

- data from the recent processing (using IPF v6.5): L2 STC data from 06 April to 06 May, L2 NTC data from 15 June to 30 September.
- NRT data from June 2016 to December 2016
- STC data since December 2016

Concerning the 23.8GHz channel presented on Figure 12, one can see the impact of the calibration of the MWR with the increase of the coldest ocean brightness temperature: around 136K with NRT products, around 140K for the STC and NTC products. A jump in NRT products can be seen during December with the correction of the processing issue (SIIIMPC-1276). The temperature of the coldest ocean points is now closer to the other sun-synchronous missions (Metop-A, SARAL/AltiKa). The STC products have also encountered a series of processing issues. The results for these products shall not be accounted for before the 10th of January after correction of the latest issue.

The analysis for the liquid water channel (Figure 14) is more complicated due to the different frequency used by these instruments for this channel: 36.5GHz for Sentinel-3A, 37GHz for AltiKa, 34GHz for Jason2 and 31.4GHz for AMSU-A. But the coldest temperature can be used relatively one with another. For instance, one can see that the difference between AltiKa and Jason-2 is about 6K which is in line with the theoretical value estimated by Brown between the channel 34 GHz of JMR and the channel 37 GHz of TMR (-5.61 K ± 0.23 K) [RD 8]. Then we can expect that Sentinel3 should be closer to AltiKa than Jason2 due to the measurement frequency. This is observed for the STC and NTC products processed with the new MWR characterisation file. As for the first channel, a jump in NRT products can be seen during December (correction of SPR SIIIMPC-1276) and the STC results are invalid before the 10th of January.
The period is too short to allow a drift analysis but it is reassuring to see that Sentinel-3A/MWR has the same behaviour than the other radiometer.

Figure 13: Coldest temperature over ocean at 23.8GHz for Sentinel-3A, SARAL/AltiKa, Jason2, and MetopA/AMSUA

Figure 14: Coldest temperature over ocean for the liquid water channel Sentinel-3A, SARAL/AltiKa, Jason2, and MetopA/AMSUA
4.2.2 Amazon forest

The second area is the Amazon forest which is the natural body the closest to a black body for microwave radiometry. Thus it is commonly used to assess the calibration of microwave radiometers [RD 2][ RD 3]. The method proposed in these papers have been used as a baseline to propose a new method implemented in [RD 7]. In this new approach, a mask is derived from the evergreen forest class of GlobCover classification over Amazon. The average temperature is computed here over a period of 10 days except for Jason2 for which a period of one month is required. Due to the orbit of Jason2, a longer period is required to reach a significant number of measurements falling within the mask.

For Sentinel-3A, the results below are shown for NRT data from Svalbard core ground station (MWR L1B products), for STC data (also SVL) and for data from the recent processing using IPF v6.5 (L1B NTC data from 15 March to October).

The averaged temperature over the Amazon forest is shown on Figure 15 and Figure 16 for water vapor channel (23.8GHz) and liquid water channel respectively. These two figures show the very good consistency of Sentinel-3A with the three other radiometers on the hottest temperatures: around 286K for the first channel, and 284K for the second channel. The mean value as well as the annual cycle is well respected. These results show the correct calibration for the hottest temperatures and the small impact of the MWR calibration for the hottest temperatures when comparing the NTC (updated calibration) and the NRT. As for the coldest ocean temperatures, the period is too short to allow a drift analysis.
Figure 15: Average temperature over Amazon forest at 23.8GHz channel for Sentinel-3A, SARAL/AltiKa, Jason2, and MetopA/AMSUA

Figure 16: Average temperature over Amazon forest at 36.5GHz channel for Sentinel-3A, SARAL/AltiKa, Jason2, and MetopA/AMSUA

4.2.3 References

Sentinel-3 MPC
S3-A MWR Cyclic Performance Report
Cycle No. 013

Ref.: S3MPC.CLS.PR.05-0013
Issue: 1.0
Date: 08/02/2017
Page: 18


RD 7 Estimation des dérives et des incertitudes associées pour les radiomètres micro-ondes. Revue des méthodes existantes, *SALP-NT-MM-EE-22288*


4.3 Geophysical products

4.3.1 Monitoring of geophysical products

4.3.1.1 Wet tropospheric correction

Figure 17 shows the monitoring of the MWR-ECMWF differences of wet tropospheric correction (ΔWTC) using Level2 STC products from the Marine Center. The consecutive evolutions of IPF version and auxiliary files make the monitoring difficult to analyze. The processing is stable since the correction of the LTM ADF issue at the beginning of January. Sentinel-3A correction is compared to Jason2/AMR and SARAL/MWR corrections. For SARAL (annotated AL in Figure 17) and Jason2 (J2), IGDR products were selected. The daily average of ΔWTC for Sentinel-3A is close to 0cm since 10th of January while it is around 0.6cm for SARAL and Jason2. This difference is small and results partially from the inversion algorithm.

The more relevant parameter to assess the performance of a correction is the standard deviation of ΔWTC. First Jason-2 benefits from its three channels radiometer (18.7GHz, 23.8GHz, 34GHz), providing a correction with a smaller deviation with respect to the model. SARAL/MWR is closer to S-3A/MWR in this context with its two channels (23.8GHz, 37GHz). Then the standard deviation for SARAL is the closest reference, even though the Sigma0 in Ka band raises some questions. With the use of STC products for S-3A, the ΔWTC for the three instruments are directly comparable since all use ECMWF analyses for the computation of the model correction. The standard deviation of ΔWTC for S-3A is smaller than for SARAL meaning that we have a better estimation of the correction for S-3A according to these metrics. Jason-2 gives the best performances with the smallest deviation. Moreover one can notice that both SAR and PLMR corrections have very similar performances.
4.3.2 Comparison to insitu measurements

The comparison of wet tropospheric correction to Radiosonde measurements will be addressed with 2 years of data.
5 Specific investigations

None.
6 Events

Add here the list of all MWR events happened during the cycle.
7 Appendix A

Other reports related to the STM mission are:

- S3-A SRAL Cyclic Performance Report, Cycle No. 013 (ref. S3MPC.ISR.PR.04-013)
- S3-A Ocean Validation Cyclic Performance Report, Cycle No. 013 (ref. S3MPC.CLS.PR.06-013)
- S3-A Winds and Waves Cyclic Performance Report, Cycle No. 013 (ref. S3MPC.ECM.PR.07-013)
- S3-A Land and Sea Ice Cyclic Performance Report, Cycle No. 013 (ref. S3MPC.UCL.PR.08-013)

All Cyclic Performance Reports are available on MPC pages in Sentinel Online website, at: https://sentinel.esa.int

End of document