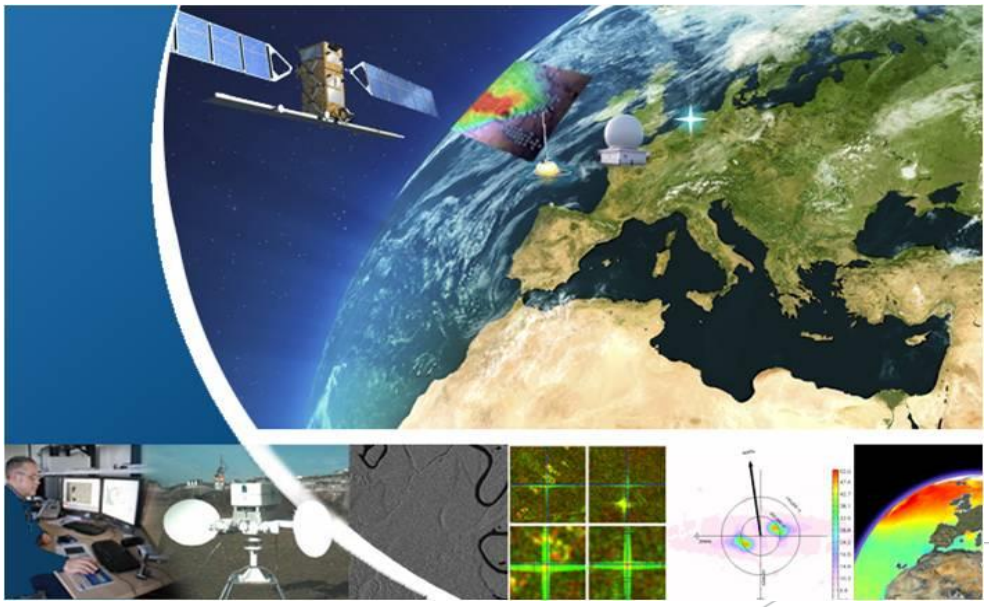
**SAR MPC**



# S1-A N-Cyclic Performance Report - 2023-02

## Cycles 285 to 289 (20th February to 9th April 2023)

| | |
|---|---|
| Reference: | MPC-0100 |
| Nomenclature: | DI-MPC-NPR |
| Issue: | 2023-02. 0 |
| Date: | 2023,Apr.24 |

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## Chronology Issues:

| Issue: | Date: | Reason for change: |
|---|---|---|
| 2023-02.0 | 24.04.23 | First Issue: reporting period from 20th February to 9th April 2023 |
| | | |
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| | | |

## People involved in this issue:

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## Index Sheet:

| | |
|---|---|
| Context: | Sentinel-1 Mission Performance Centre |
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## Applicable documents

| Nomenclature | Title | Edition Number | Revision Number |
|---|---|---|---|
| [S1-AD-14] | S1 RS-MDA-52-7441<br>Sentinel-1 Product Specification | 3 | 13 |
| [S1-AD-15] | S1-RS-MDA-57-7440<br>Sentinel-1 Product Definition | 2 | 7 |

## Reference documents


[1] Piantanida R., Recchia A., Franceschi N., Valentino A., Miranda N., Schubert A., Small D., *Accurate Geometric Calibration of Sentinel - 1 Data*, Proc. *EUSAR 2018*; Aachen, Germany, 2018, 6 p.

[2] Gisinger C., Libert L., Marinkovic P., Krieger L. Larsen Y., Valentino A., Breit H., Balss U., Suchandt S., Nagler T., Eineder M., Miranda N., "The Extended Timing Annotation Dataset for Sentinel-1—Product Description and First Evaluation Results," in *IEEE Transactions on Geoscience and Remote Sensing*, vol. 60, pp. 1-22, 2022, doi: 10.1109/TGRS.2022.3194216.

[3] GMES Sentinel-1 System Requirements Document, Ref S1-RS-ESA-SY-0001, Issue 3., Rev. 3

# List of Contents

# 1. Introduction

## 1.1. Purpose of the document

The purpose of this document is to provide a status on the S-1A instrument and product performance for orbit repeat cycle #285 from 20th February to 04th March 2023, cycle #286 from 4th to 16th March 2023, cycle #287 from 16th to 28th March 2023, and cycle # 288 from 28th March to 9th April 2023.

## 1.2. Structure of the document

- Chapter 1 : This introduction
- Chapter 2 : Executive Summary
- Chapter 3 : Instrument Status
- Chapter 4 : IPF and Auxiliary Date File Status
- Chapter 5 : Manoeuvres
- Chapter 6 : Products Status

The following appendices are also provided:

- Appendix A : List of Acronyms
- Appendix B : S1-A Transmit Receive Module Failures
- Appendix C : S1-A Instrument Unavailability
- Appendix D : S1-A Auxiliary Data Files
- Appendix E : S1-A Quality Disclaimers

## 2. Executive Summary

There was no particular issue on S1A for cycles 285 to 289.

On 30th March, the instrument Processing Facility was upgraded to IPF v3.6.1, the details are provided in section 4.1, also available on SAR-MPC website [here].

Since March 2022, the processor performs RFI mitigation. QD#112 and QD#113 provide respectively a non-exhaustive list of products affected by residual RFI degradation for February and March 2023.

A summary of the instrument and product status is provided in following sections of the document.

The list of Quality Disclaimers on the Sentinel-1A products performances and the list of the IPF Auxiliary Data Files can be accessed on the QC Web Server at following address:

https://sar-mpc.eu/

# 3. Instrument Status

Here the status of the S1-A instrument during the reporting period is provided.

## 3.1. Antenna Status

There were no new S1-A antenna transmit/receive module failures during the reporting period.

| TRM | Description | Date of Failure |
|---|---|---|
| | | |

**Table 1 S1-A Antenna Transmit/Receive Module Failures**

A full list of all TRM failures since S1-A launch is given in Appendix B .

## 3.2. Instrument Unavailability

There was one S1-A instrument unavailability during the reporting period.

| Start Date/Time | End Date/Time | MPC Reference | Summary |
|---|---|---|---|
| 29/03/23 09:09 | 29/03/23 15:47 | SOB-4337 | Sentinel-1A Unavailability on 29/03/2023 |

**Table 2 S1-A Instrument Unavailabilities**

A full list of all instrument unavailabilities since the S1-A launch is given in Appendix C .

# 4. IPF and Auxiliary Date File Status

## 4.1. Processor updates

The Instrument Processing Facility was upgraded to IPF v3.6.1 on 30th March 2023. Main goal of this version is:

- Enhanced resilience of the SAR burst processing to data reception contingencies;
- Filling of potential missing data in denoising vectors for TOPS GRD products at high latitudes;
- Addition of a new metadata in the Level-1 products manifest indicating the Level-0 A/C/N used for processing;
- Introduction of quick-looks in the Level-2 OCN products;
- Annotation of additionnal processing variables required to ease the exploitation of Level-2 OSW products
- Use of OpenStreetMap as default coastline indicator for Level-2 processing.

The description of last applicable IPF and the full list of IPF description is provided on Sar-MPC website [link].

## 4.2. Auxiliary Data File Updates

There were no updates to S1-A Auxiliary Data Files (ADFs) during the reporting period.

Full list of applicable Auxiliary Data Files is provided on Appendix D

### Instrument ADF (AUX_INS)

| ADF | Update Reason |
|---|---|
| | |

**Table 3 AUX_INS Updates**

### Calibration ADF (AUX_CAL)

| ADF | Update Reason |
|---|---|
| | |

**Table 4 AUX_CAL Updates**

### L1 Processor Parameters ADF (AUX_PP1)

| ADF | Update Reason |
|---|---|
| | |

**Table 5 AUX_PP1 Updates**

### L2 Processor Parameters ADF (AUX_PP2)

| ADF | Update Reason |
|---|---|
| | |

**Table 6 AUX_PP2 Updates**

## Simulated Cross Spectra ADF (AUX_SCS)

| ADF | Update Reason |
|---|---|
| | |

**Table 7 AUX_SCS Updates**

## 5. Manoeuvres

Table 8 gives a list of the S1-A orbit manoeuvres that occurred during the reporting period:

| Start Date | Start Time | Stop Date | Stop Time | Comment |
|---|---|---|---|---|
| 2023/02/22 | 21:39:31 | 2023/02/22 | 21:39:52 | |
| 2023/02/22 | 22:29:18 | 2023/02/22 | 22:29:33 | |
| 2023/03/01 | 21:37:02 | 2023/03/01 | 21:37:15 | |
| 2023/03/01 | 22:26:39 | 2023/03/01 | 22:26:56 | |
| 2023/03/06 | 18:35:30 | 2023/03/06 | 18:36:14 | |
| 2023/03/06 | 20:14:14 | 2023/03/06 | 20:14:58 | |
| 2023/03/06 | 21:52:57 | 2023/03/06 | 21:53:45 | |
| 2023/03/06 | 23:31:58 | 2023/03/06 | 23:32:13 | |
| 2023/03/08 | 22:21:33 | 2023/03/08 | 22:22:17 | |
| 2023/03/08 | 23:10:26 | 2023/03/08 | 23:10:44 | |
| 2023/03/15 | 22:21:19 | 2023/03/15 | 22:21:59 | |
| 2023/03/15 | 23:27:06 | 2023/03/15 | 23:27:24 | |
| 2023/03/22 | 21:24:41 | 2023/03/22 | 21:24:58 | |
| 2023/03/22 | 22:14:08 | 2023/03/22 | 22:14:39 | |
| 2023/03/24 | 17:00:00 | 2023/03/24 | 17:10:00 | |
| 2023/03/29 | 21:55:44 | 2023/03/29 | 21:56:24 | |
| 2023/03/29 | 22:44:33 | 2023/03/29 | 22:44:38 | |
| 2023/04/05 | 21:18:10 | 2023/04/05 | 21:18:31 | |
| 2023/04/06 | 01:21:34 | 2023/04/06 | 01:22:00 | |

**Table 8 S1-A Orbit Manoeuvres**

# 6. Products Status

## 6.1. Level 0 Products

Figure 1 shows missing lines, data gaps, and timeline failures derived from L1 annotation products (purple for IW, blue for EW and green for WV)

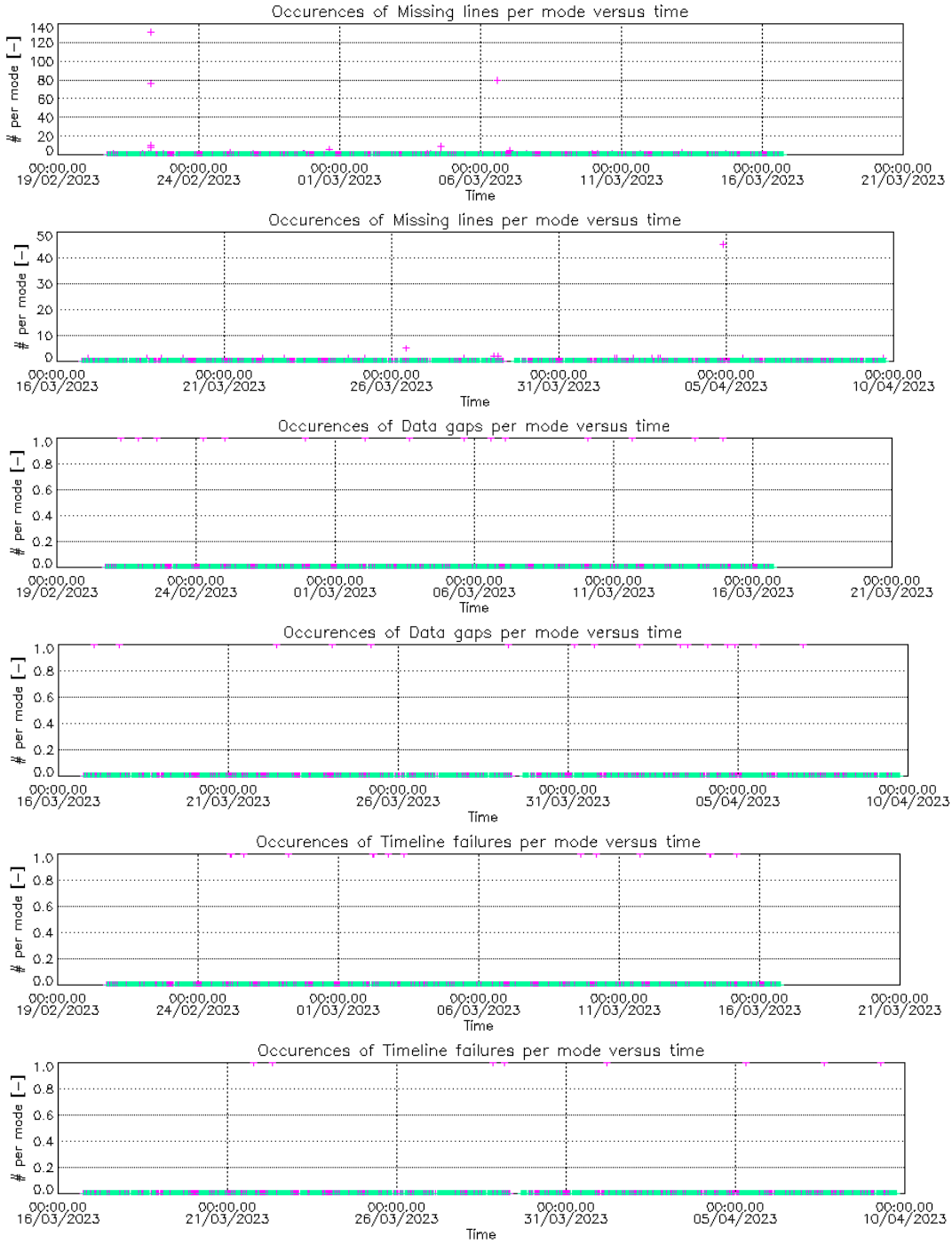



**Figure 1 Missing Lines, Data Gaps and Timeline Failures.**

The above plots indicate thatfew products suffer of missing lines due to downlink issue, no significant problems with data or timeline failures.

Figure 2 and Figure 3 show I and Q trends and imbalance for IW and WV modes:

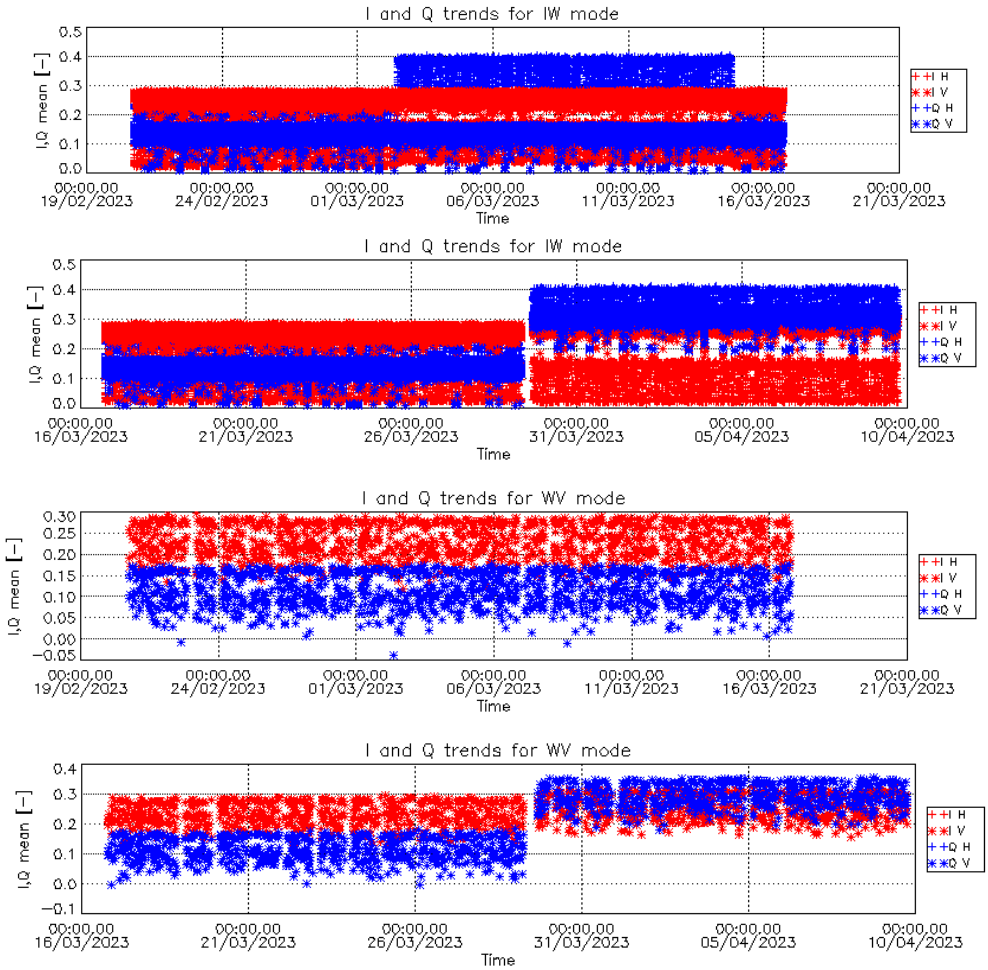
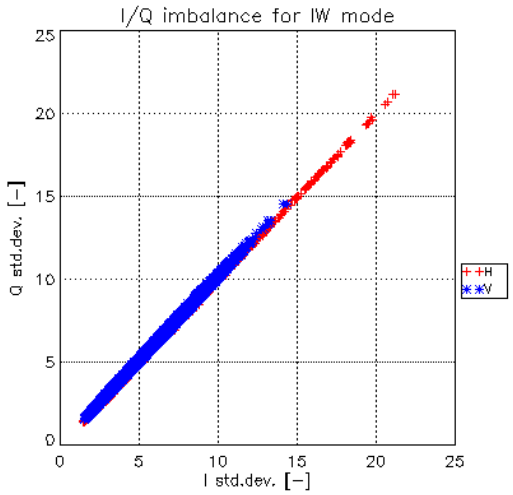
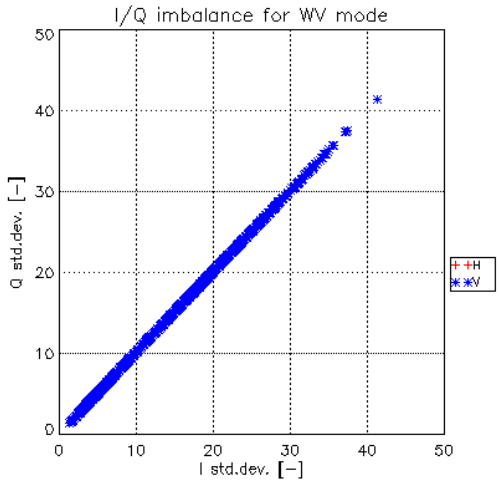



**Figure 2 I&Q Channels**

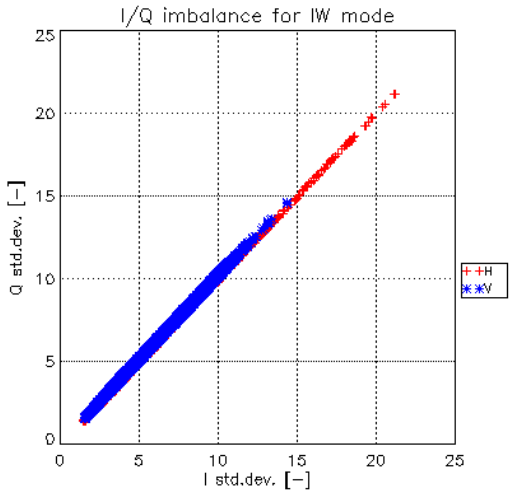
The jumps that may be noticed on the above time-series are related to instrument switch on/off, and correspond to a normal behaviour, that is compensated at processing level. It therefore has no impact on data quality.



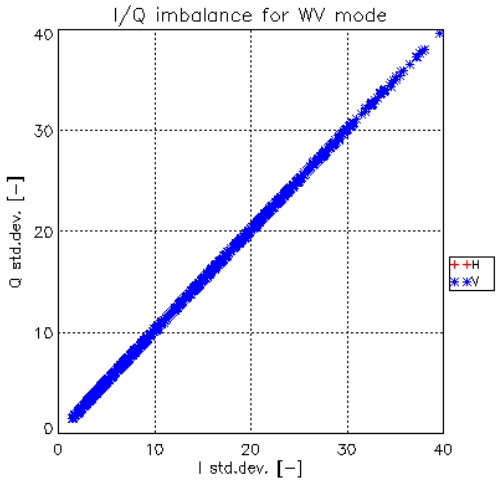

Cycles 285 & 286




Cycles 285 & 286




Cycles 287 & 288




Cycles 287 & 288

**Figure 3 WV I&Q Channel Imbalance**

The I & Q imbalance plots in the figure above (*left*: IW mode, *right*: WV mode) indicate that the Rx I and Q channels are perfectly balanced.

## 6.2. Level 1 Products

### 6.2.1. Image Quality

Figure 4 and Table 9 give the azimuth and range spatial resolution derived from IW imagery acquired during the reporting period, using the Australian corner reflector array and the DLR transponders & corner reflectors. For Australian corner reflector array, only the corner reflectors with the bigger size 2.0m and 2.5m (corresponding to 6 CR) are used. The spatial resolution has been derived from SLC data. Table 10 gives the impulse response function (IRF) sidelobe ratios. These indicate a nominal IRF performance.

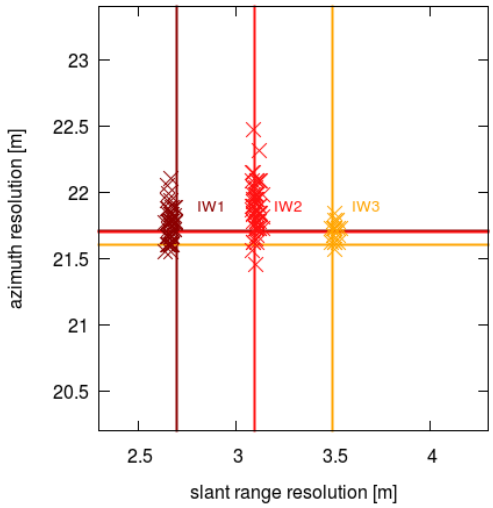



**Figure 4 IW Azimuth and Slant Range Spatial Resolutions**

| Mode/Swath | Azimuth Spatial Resolution (m) | Slant Range Spatial Resolution (m) |
|---|---|---|
| IW1 | 21.74 ± 0.13 | 2.67 ± 0.01 |
| IW2 | 21.88 ± 0.18 | 3.11 ± 0.01 |
| IW3 | 21.70 ± 0.07 | 3.51 ± 0.01 |

**Table 9 IW Azimuth and Slant Range Spatial Resolutions**

| Mode/Swath | ISLR azimuth (dB) | ISLR range (dB) | PSLR azimuth (dB) | PSLR range (dB) |
|---|---|---|---|---|
| IW1 | -17.30 ± 0.11 | -15.75 ± 0.20 | -23.21 ± 0.38 | -20.56 ± 0.55 |
| IW2 | -16.11 ± 0.18 | -15.52 ± 0.17 | -20.85 ± 0.39 | -19.94 ± 0.35 |
| IW3 | -15.97 ± 0.08 | -15.72 ± 0.14 | -20.69 ± 0.17 | -20.73 ± 0.33 |

**Table 10 IW Sidelobe Ratios derived from transponders' IRF**

No Equivalent Number of Looks/Radiometric Resolution and Ambiguity measurements were made during the reporting period.

## 6.2.2. Radiometric Calibration

Figure 5 and Table 11 show the absolute calibration factor derived from IW imagery acquired during the reporting period, using the DLR transponders & corner reflectors and Australian corner reflector array. For the Australian corner reflector array, only Corner Reflectors with the bigger size 2.0m and 2.5m (corresponding to 6 CR) are used. The absolute calibration factor is estimated as the difference between the measured radar cross section of each target response (transponder or corner reflector) with their own reference value. It has been derived from SLC data. These indicate a nominal radiometric calibration performance (with sufficient measurements per sub-swath).

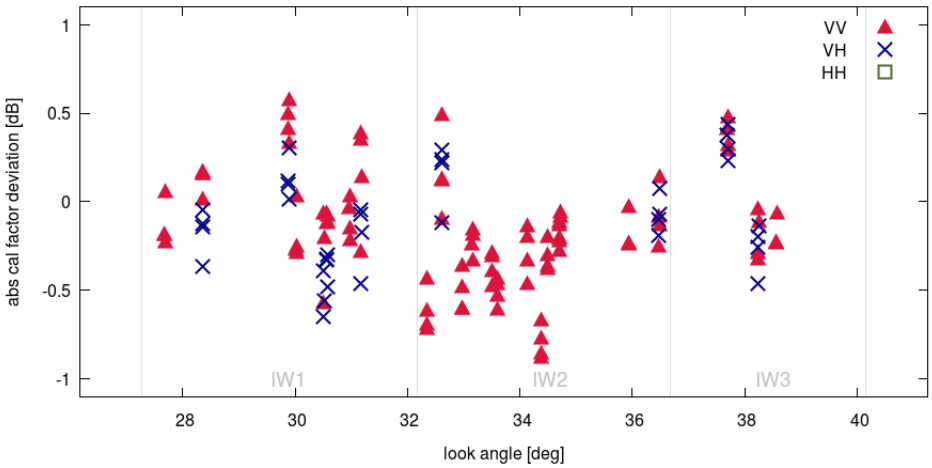



Figure 5 **S-1A calibration factor for IW acquisitions for different polarization channels**

| Mode/Swath | Absolute calibration factor (dB) | | | | |
|---|---|---|---|---|---|
| | All | HH | VH | VV | HV |
| IW1 | -0.08 ± 0.28 (50) | Nan (0) | -0.21 ± 0.25 (19) | 0.00 ± 0.26 (31) | Nan (0) |
| IW2 | -0.26 ± 0.28 (59) | Nan (0) | 0.04 ± 0.18 (8) | -0.31 ± 0.26 (51) | Nan (0) |
| IW3 | 0.03 ± 0.30 (19) | Nan (0) | 0.04 ± 0.31 (8) | 0.02 ± 0.28 (11) | Nan (0) |

**Table 11 S1A calibration for IW acquisitions for different polarization channels (mean, standard deviation and number of measurements points in brackets)**

### 6.2.3. Geometric Calibration

Figure 6 shows the absolute location error (ALE) based on 14 S-1A SLC slice products from the IW acquisition mode acquired during the current reporting period (6 products acquired in DV polarization, 8 in SV, 7 separate dates).

All the three TopSAR IW sub-swaths are represented. The points have been colour-coded according to the subswath the targets were visible in. The products were analysed using the same orbit files used for processing, i.e., the restituted orbit solution.

Corrections described in previous reports were made, including the atmospheric path delay (PD), the “intra-burst-dependent” range correction, “bulk bistatic” and “bistatic residual” corrections, and a topography-dependent Doppler centroid correction (the azimuth corrections are briefly described e.g. in [1] ). Instrument range and azimuth calibration constants are applied as described in [2] , i.e., 0.1691m for Rg and 0.0875m for Az in case of S1A. Note that PD correction depends on the off-nadir angle, which is considered here for the individual corner reflectors spanning the over-100km wide array.

Figure 6 shows the ALE scatter after the effects listed above were corrected during post-processing. The range and azimuth ALE mean and standard deviations are annotated next to the figure. A possible residual separation of the ALE scatter "cloud" for the IW1 sub-swath is apparent in azimuth, see Table 12. The separation may represent an as-of-yet unidentified timing bias, or possibly a bias introduced by the antenna tile event of June 2016. In any case, a physical explanation for such a separation has yet to be identified. The observed range offset may be due to the restituted orbit solution (the precise orbit solution was used when determining the instrument calibration [Gisinger et al., 2022]) and unknown seasonal biases in the atmospheric path delay corrections.

| Mode/Swath | ALE [m] | |
|---|---|---|
| | Range | Azimuth |
| IW1 | +0.155 ± 0.060 | -0.204 ± 0.277 |
| IW2 | +0.165 ± 0.047 | +0.038 ± 0.248 |
| IW3 | +0.143 ± 0.055 | -0.114 ± 0.254 |

**Table 12 S1-A absolute localisation error based on S-1A IW SLC products acquired over the test site during the current reporting period**

The IW mode ALE plots indicate a localisation performance well within the requirements. The ALE is within the specified 1-sigma for IW mode products (3.33m, i.e. 10m at 3 sigma; see section 5.5.2.2 of [3]

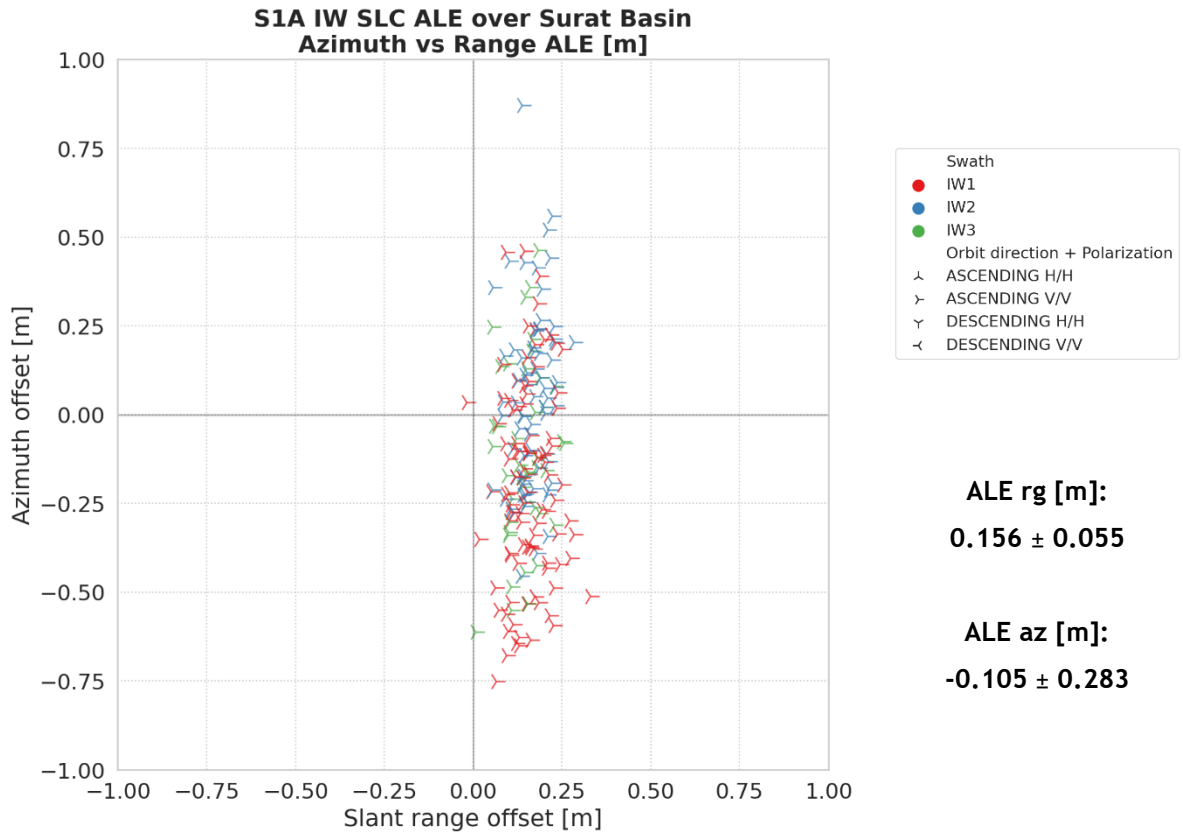



**Figure 6 S1-A absolute localisation error based on S-1A IW SLC products acquired over the test site during the current reporting period.**

## 6.2.4. Polarimetric Calibration

Table 13 gives the co-registration between the two polarisations of dual-polarisation products acquired during the reporting period (based on DLR transponder measurements).

| Mode/Swath | Range Co-registration Accuracy (m) | Azimuth Co-registration Accuracy (m) | Channel Imbalance (dB) |
|---|---|---|---|
| IW DV | -0.02 ± 0.05 | -0.10 ± 0.28 | 0.17 ± 0.16 |

**Table 13 Polarimetric Calibration Measurements**

## 6.2.5. Elevation Antenna Patterns

No Elevation Antenna Patterns (EAPs) were updated during the reporting period.

### 6.2.6. Azimuth Antenna Patterns

No Azimuth Antenna Patterns (AAPs) were updated during the reporting period.

### 6.2.7. Noise Equivalent Radar Cross-section

No NESZ measurements were made during the reporting period.

### 6.2.8. Antenna Pointing

Figure 7 shows yaw, pitch and roll errors calculated for the reporting period against ascending node crossing time (ANX). The red horizontal lines show the nominal ±0.01° bounds for these attitude errors – points outside these bounds are normally due to orbit manoeuvres. Please note that in February, April, August and October, it is seasonally recorded, an increase of the amplitude of yaw and pitch (around ANX ~3000s or either ANX 0/6000s, respectively descending and ascending equator node), which does not impact the Doppler Centroid estimate and is observable on the current reporting period.

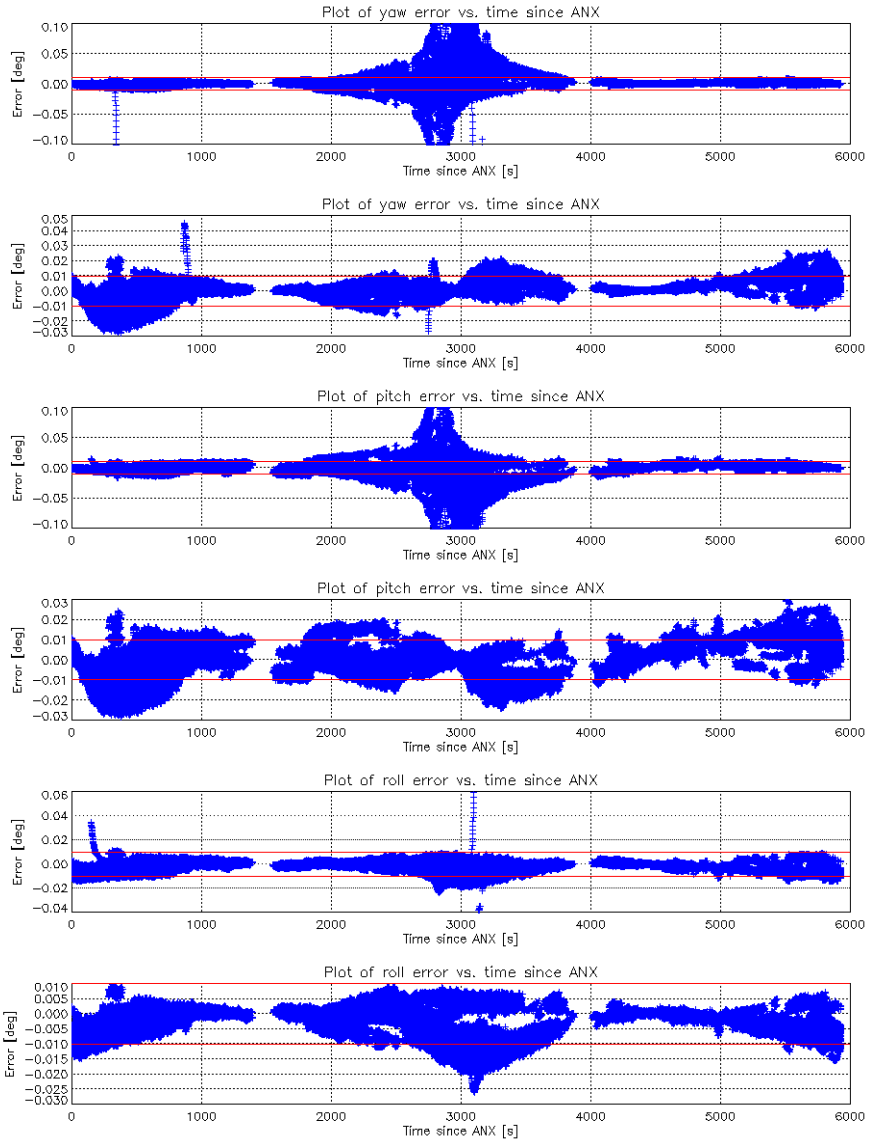
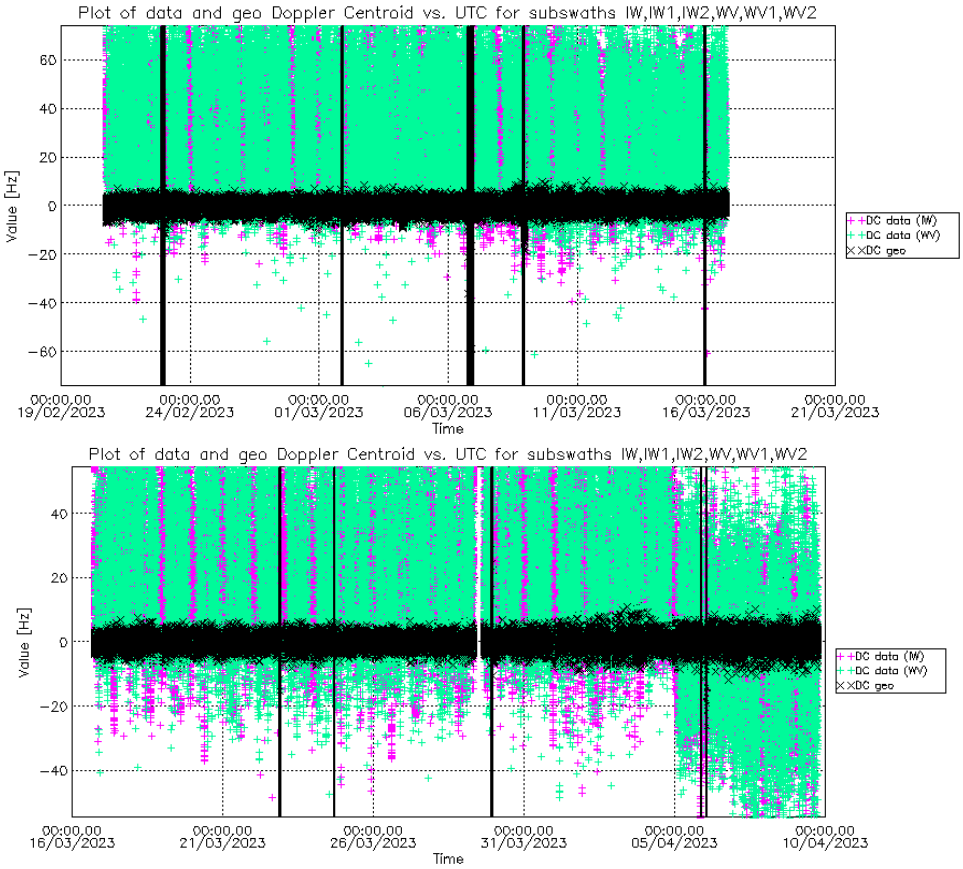



**Figure 7 S1-A Yaw, Pitch and Roll Errors (top and bottom plots respectively cycles 285-286 and cycles 287-288) as function of ANX time**

Figure 7, for cycles #285-286, covering end February (1 month before the equinox), we can mainly observe the known increase amplitude at 3000s ANX time, and a local large deviation at ANX 200 and ANX 3010 due to manoeuvres respectively on the 22nd February and 06th March. Lower deviations could be observed for cycles #287-288. Some small effect of the manoeuvres on the 29th March and 06th April can be observed on yaw.

Figure 8 shows the Doppler Centroid frequency as a function of date and ANX. The data has been derived from IW & WV data and from geometry. Note that it is expected that the Doppler estimation from WV mode data will have a higher standard deviation than from IW mode due to the Doppler estimation over the ocean will be noisier than over land. Table 14 gives the statistics based on Doppler Centroid derived from IW and WV data. A more detailed plot of Doppler Centroid frequency derived over land from SM, IW and EW products is shown in Figure 9. A DC jump of about -25 Hz can be observed around the 5th April 2023. This is a known S-1A behaviour due to a change of the on-board Star Trackers (STTs) configuration.



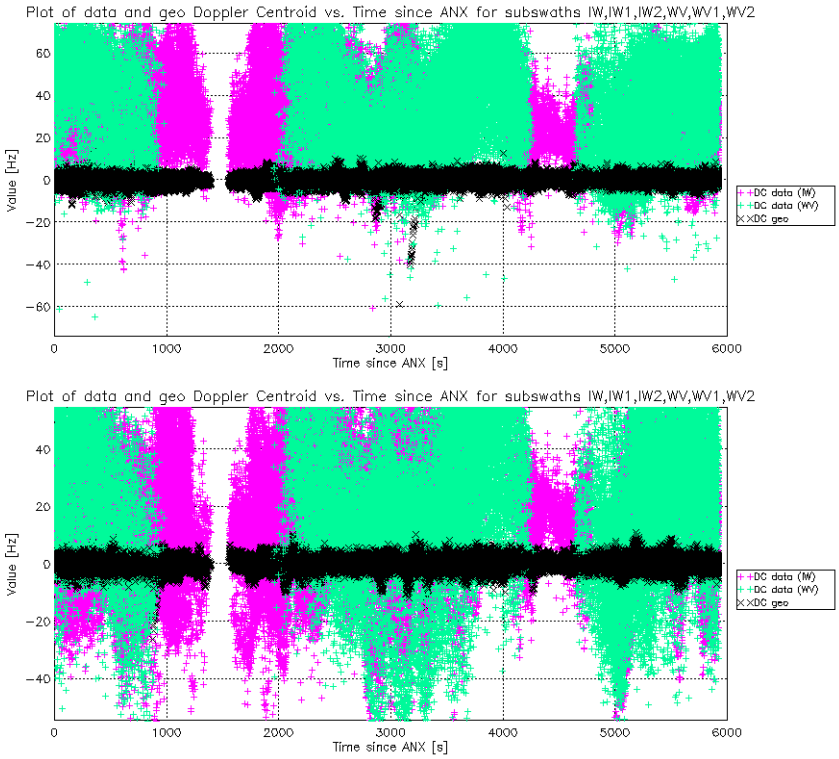



**Figure 8 S1-A Doppler Centroid as respect to 1) time (vertical black lines representing the date of manoeuvres) and 2) ANX time (top and bottom respectively cycle 285-286 and cycles 287-288)**

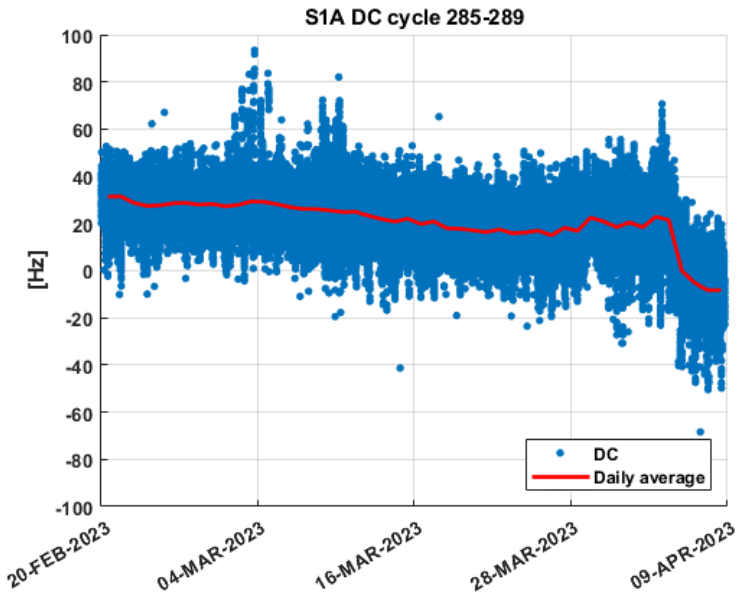



**Figure 9 S1-A Doppler Centroid**

| | Min (Hz) | Mean (Hz) | Max (Hz) |
|---|---|---|---|
| Cycles 285 & 286 | -590.15 | 31.448±14.649 | 216.11 |
| Cycles 287 & 288 | -493.60 | 18.071 ±18.168 | 407.31 |

**Table 14 Doppler Centroid Statistics**

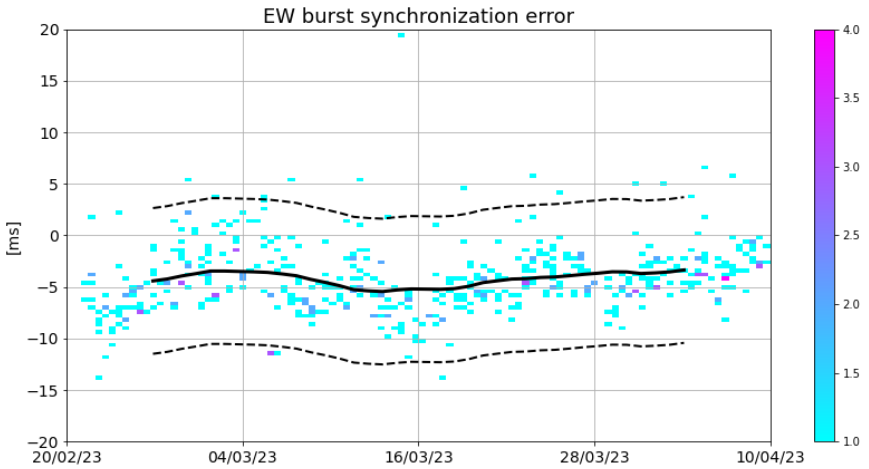
## 6.2.9. Interferometric performance

### 6.2.9.1. Burst synchronisation

The burst synchronization between repeat pass interferometric acquisitions is relevant for the TOPSAR modes (IW and EW), to provide an indication of the quality of the interferometric phase that can be expected. The SAR acquisition start time is planned over a discrete set of points round orbit with precision down to milliseconds. The burst synchronization is systematically monitored by the MPC comparing the times of TopSAR acquisitions derived from current L0A products. Figure 11 shows an histogram of the burst synchronization error over time for EW (top plot) and IW (bottom plot) mode, with the times of the corresponding acquisitions performed in an arbitrary selected reference cycle in the past, namely cycle number 60 (30 September - 12 October 2015) for S-1A.

A synchronization timing error between two bursts causes a mis-match in the Doppler bands under which targets are observed, which in turn causes a loss of coherence. It can be shown that the loss of coherence is approximately linearly proportional to the timing error: for S-1 a synchronization error of 5 ms - corresponding to a Doppler spectrum overlap reduction of about 10 Hz in the SLC products - causes a coherence loss of about 3% for IW mode (that has a processed bandwidth around 300 Hz). This estimate is obtained considering only the Doppler mis-match due to the burst de-synchronization; an additional error in pointing may either increase or decrease the Doppler error depending on the sign, thus increasing or decreasing the coherence loss.

In Figure 10, the colours represent the number of repeat pass acquisitions falling in a certain temporal and burst synchronization interval.
The continuous black line shows the moving average of a cycle period.
The black dashed lines represent the nominal S-1 synchronization requirements, which is about ±7 ms for the $\pm 3\sigma$ interval, with respect to the average. This value is obtained by multiplying the 5 ms timing requirement for single acquisitions by $\sqrt{2}$, as all the values in the image are obtained by combining the timing error of two independent acquisitions.
The measured compliance percentages are 95,5% for EW and 91,6% for IW. The compliance percentages may be less than ideal due to a cumulative worsening of the synchronization with respect to the reference cycle in 2015. Future reports will further investigate the topic.



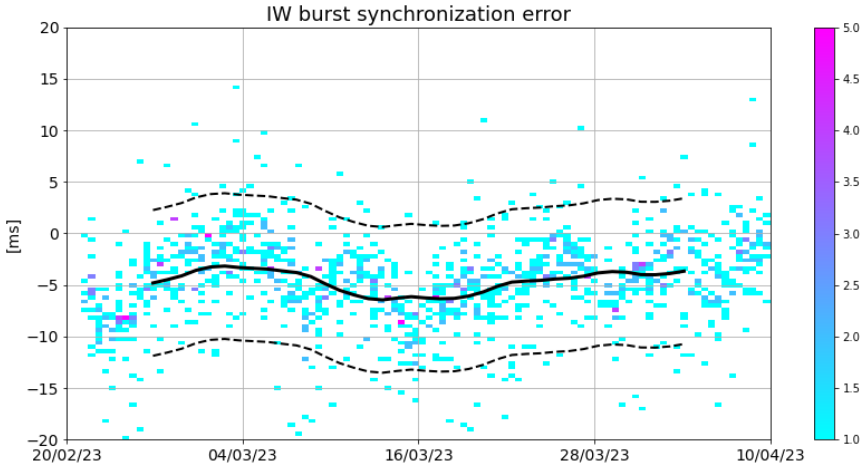



**Figure 10:Burst synchronization error for current reporting period. Top image is for EW acquisition mode, bottom is for IW acquisition mode.**

### 6.2.9.2. Orbit Interferometric Baseline

Repeat pass interferometry requires that acquisitions at different times are performed with a similar orbit to ensure high coherence interferograms. The “distance” between the orbits of a pair of interferometric acquisition is called interferometric baseline. The interferometric baseline is continuously monitored by the MPC, comparing S-1 State Vectors of current orbits (from AUX-RESORB files) with those of an arbitrary selected reference cycle in the past, namely cycle number 60 (30 September - 12 October 2015) for S-1A.

Figure 13 shows the evolution during the current reporting period of the three interferometric baseline components (Parallel on top, Normal in the middle and Along-Track at the bottom). The hot colours are used for the maximum baseline value and the cold colours for the minimum baseline value measured for each orbit. The colors changing along the plot represent the track number evolving for each cycle from 1 to 175.

The most critical baseline component for the interferometric coherence is the normal one, which shall be lower than a certain threshold named critical baseline (about 5 km for S-1 and depending on the considered swath). The measured normal baseline (mid plot) shows that normal baselines are below 10% of the critical one, i.e., the worst-case coherence loss due to the interferometric baseline is always well below 10%. Please note that some outliers can be observed. They are regularly spaced in time, meaning that they come from the reference cycle rather than from the target orbits. They are most likely related to orbit manoeuvres performed in the reference cycle (cycle #60) in 2015. This issue will be further investigated in next reports.

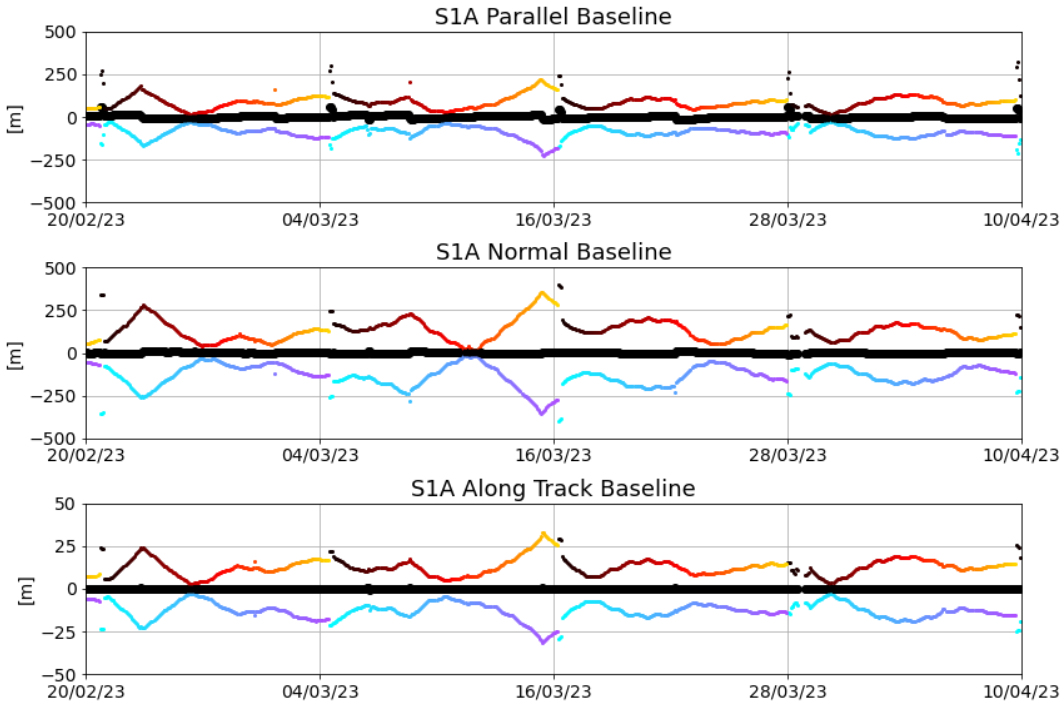



**Figure 11: Interferometric baselines for cycles #281-284**

## 6.2.10. Summary of Anomalies

There were no anomalies during the reporting period.

## 6.2.11. Quality Disclaimers

The quality disclaimers were issued on data covering the reporting period (see Appendix E for a list of issued and prepared quality disclaimers). A full list of issued quality disclaimers can also be found on the QC Web site.

| | | | | |
|---|---|---|---|---|
| #112 | Products with residual RFI degradation acquired in February 2023 | 2023-02-01 00:00:00 | 2023-03-01 00:00:00 | Issued |
| #113 | Products with residual RFI degradation acquired in March 2023 | 2023-03-01 05:25:50 | 2023-04-01 22:39:24 | Issued |

**Table 15 Quality Disclaimers issued impacting data on the reporting period**

## Appendix A : List of Acronyms

| | |
|---|---|
| AAP | Azimuth Antenna Pattern |
| AD | Applicable Document |
| ADF | Auxiliary Data File |
| ALE | Absolute Localisation Accuracy Error |
| ANX | Ascending Node Crossing Time |
| CR | Corner Reflector |
| EAP | Elevation Antenna Pattern |
| EW | Extra Wide Swath |
| IPF | Instrument Processing Facility |
| IRF | Impulse Response Function |
| IW | Interferometric Wide Swath |
| NESZ | Noise Equivalent Sigma0 Zero |
| PD | Path Delay |
| PSCAL | Permanent Scatter Calibration |
| RD | Reference Document |
| RDB | Radar Data Base |
| RFI | Radar Frequency Interference |
| Rx | Receive |
| SM | Stripmap |
| TBC | To be confirmed |
| TBD | To be defined |
| TRM | Transmit Receive Module |
| Tx | Transmit |
| WV | Wave Mode |

## Appendix B : S1-A Transmit Receive Module Failures

The following S1-A antenna TRM have failed since the S1-A launch:

| TRM | Description | Date of Failure |
|---|---|---|
| Tile 4, Row 11 | Tx, H & V | 05-May-2014 |
| Tile 4, Row 12 | Tx, H & V | 05-May-2014 |
| Tile 4, Row 11 | Rx, V | 05-May-2014 |
| Tile 4, Row 12 | Rx, V | 05-May-2014 |
| Tile 4, Row 12 | Rx, H | 09-June-2014 |
| Tile 5, all TRM failures (intermittent) | Rx, H & V | Between 18-Oct-2014, 15:29:30 UT and 20-Jan-2015, 19:04:54 UT |
| Tile 5, all TRM failures (intermittent) | Rx, H & V | Between 18-Mar-2015, 04:09:00 UT and 20-Mar-2015, 11:46:30 UT |
| Tile 5, all TRM failures (intermittent) | Rx, H & V | Between 26-Mar-2015, 16:20:00 UT and 28-Mar-2015, 02:50:30 UT |
| Tile 12, Row 16 (intermittent) | Tx V & Rx V | Between 16-Apr-2015 and 18-Apr-2015 |
| Tile 5, all TRM failures (intermittent) | Rx, H & V | Between 18-Apr-2015, 17:40:21 UT and 24-Apr-2015, 17:48:08 UT |
| Tile 12, Row 16 (intermittent) | Tx V & Rx V | Between 20-Apr-2015 and 28-Apr-2015 |
| Tile 5, all TRM failures (intermittent) | Rx, H & V | Between 25-Apr-2015 17:37:37 UT and 30-Apr-2015, 23:01:11 UT |
| Tile 4, Row 11 | Rx H | 29-Apr-2015, 21:57:30 UT |
| Tile 12, Row 16 (intermittent) | Tx V & Rx V | Between 01-May-2015 and 04-May-2015 |
| Tile 5, all TRM failures (intermittent) | Rx, H & V | Between 05-May-2015, 05:12:51 UT and 06-May-2015, 00:44:43 UT |
| Tile 12, Row 16 | Tx V & Rx V | 18-May-2015, 22:33:36 UT |
| Tile 5, all TRM failures | Rx, H & V | Between 26-May-2015, 19:06:00 UT and 27-May-2015, 06:07:00 UT |
| Tile 5, all TRM failures | Rx, H & V | Between 06-Jun-2015, 06:35:00 UT and 14-July-2015, 10:43:00 UT |
| Tile 5, all TRM failures | Rx, H & V | Between 17-July-2015, 19:07:00 UT and 21-July-2015, 11:58:00 UT |
| Tile 11, Rows 1 to 10 | Tx H, Tx V | 16 June -27 June 2016 |
| Tile 11 | See below | |

On the 16th October 2017 the S-1A antenna was reconfigured to optimize the electronic operation after the tile 11 issue on June 2016. The new antenna configuration, only related to the tile 11, was

captured in RDB#6. From the SAR data point of view, the new antenna status is not much different from the previous one and the only observed effects are a slight increase of the PG (less than 0.1 dB) and a modification of the EAP from the S-1 AM (lower then ±0.1 dB).

## Appendix C : S1-A Instrument Unavailability

The S1-A instrument has been unavailable during the following periods since S-1A launch:

| Start Date/Time | End Date/Time | MPC Reference | Summary |
|---|---|---|---|
| 26/04/2014 11:56 | 29/04/2014 12:13 | SOB-23 | Sentinel-1A Unavailability - Instrument Anomaly |
| 29/05/2014 14:00 | 02/06/2014 17:00 | SOB-27 | Sentinel-1A Unavailability - Spacecraft Anomaly |
| 06/07/2014 05:04 | 08/07/2014 15:22 | SOB-39 | Sentinel-1A Unavailability - Spacecraft Anomaly |
| 21/07/2014 03:30 | 23/07/2014 08:35 | SOB-40 | Sentinel-1A Unavailability - Instrument Switch OFF for test |
| 12/08/2014 09:37 | 12/08/2014 15:31 | SOB-47 | Sentinel-1A Unavailability - Onboard planned operation |
| 21/08/2014 07:59 | 21/08/2014 15:29 | SOB-49 | Sentinel-1A Unavailability - Instrument Anomaly |
| 25/08/2014 09:49 | 25/08/2014 17:50 | SOB-50 | Sentinel-1A Unavailability - SAR Instrument |
| 03/09/2014 08:30 | 04/09/2014 15:11 | SOB-53 | Sentinel-1A Unavailability - SAR Instrument |
| 20/09/2014 22:30 | 21/09/2014 12:06 | SOB-62 | SAR anomaly from 20/09 at 22:30 UTC to 21/09 12:06 UTC |
| 23/09/2014 08:00 | 23/09/2014 20:00 | SOB-60 | S1PDGS - SAR & X-Band downlink unavailability on Tuesday 23rd from 08:00 CET to 20:00 CET |
| 26/09/2014 21:40 | 27/09/2014 09:42 | SOB-63 | SAR instrument unavailable between 26/09/2014 21.40.48 UTC and 27/09/2014 09.42.38 UTC |
| 29/09/2014 14:56 | 30/09/2014 15:17 | SOB-64 | SAR instrument unavailability from 29/09/2014 16.54 UTC to 30/09/2014 at 15.17 UTC. |
| 06/10/2014 10:51 | 06/10/2014 14:05 | SOB-70 | Sentinel-1A Unavailability - SAR Anomaly |
| 07/10/2014 06:30 | 07/10/2014 21:30 | SOB-69 | Sentinel-1A Unavailability - planned maintenance |
| 10/10/2014 21:52 | 11/10/2014 11:03 | SOB-73 | Sentinel-1A Unavailability - SAR anomaly |
| 13/10/2014 08:00 | 13/10/2014 12:48 | SOB-71 | Sentinel-1A Unavailability - Planned maintenance |
| 19/11/2014 10:20 | 19/11/2014 14:50 | SOB-91 | Sentinel 1A unavailability |
| 29/12/2014 20:45 | 30/12/2014 11:33 | SOB-99 | Sentinel-1A Unavailability |
| 20/01/2015 07:30 | 20/01/2015 18:00 | SOB-112 | Sentinel-1A Unavailability - Planned maintenance |

| Start Date/Time | End Date/Time | MPC Reference | Summary |
|---|---|---|---|
| 01/02/2015 07:50 | 02/02/2015 16:26 | SOB-116 | Sentinel-1A unavailability from 01/02/2015 7h50 to 02/02/2015 16h27 |
| 17/02/2015 19:56 | 18/02/2015 16:02 | SOB-118 | Sentinel-1A Unavailability - since 17/02/15 evening to 18/02/15 afternoon |
| 19/02/2015 13:29 | 20/02/201510:15 | SOB-121 | Sentinel-1A unavailability from 19/02/2015 13h29 to 20/02/2015 10h15 |
| 14/04/2015 08:30 | 14/04/2015 17:00 | SOB-147 | Sentinel-1A unavailability planned on 14/04/2015 for maintenance |
| 09/05/2015 23:19 | 10/05/2015 15:39 | SOB-159 | Sentinel-1A unavailability on 10/05/2015 |
| 19/05/2015 05:00 | 19/05/2015 12:00 | SOB-168 | Sentinel-1A planned unavailability on 19/05/2015 (RDB#4 uplink onboard) |
| 28/05/2015 04:00 | 28/05/2015 14:30 | SOB-170 | Planned Sentinel-1A unavailability on 28/05/2015 for maintenance purpose |
| 20/06/2015 15:30 | 21/06/2015 13:00 | SOB-176 | Sentinel-1A unavailability on 20 and 21/06/2015 |
| 22/07/2015 06:35 | 22/07/2015 08:21 | SOB-206 | Sentinel-1A Planned Unavailability (RDB#5) |
| 03/08/2015 02:37 | 03/08/2015 18:33 | SOB-207 | Sentinel-1A Unavailability from orbit 7093 to 7101 |
| 04/08/2015 04:52 | 04/08/2015 13:47 | SOB-208 | Sentinel-1A Unavailability from orbit 7103 to 7114 |
| 04/08/2015 23:44 | 05/08/2015 11:20 | SOB-209 | Sentinel-1A Unavailability from orbit 7120 to 7128 |
| 09/08/2015 21:22 | 10/08/2015 16:14 | SOB-210 | Sentinel-1A Unavailability from orbit 7192 to 7204 |
| 04/09/2015 16:54 | 05/09/2015 11:08 | SOB-214 | Sentinel-1A Unavailability from 04/09 to 05/09/2015 |
| 23/09/2015 07:20 | 23/09/2015 11:56 | SOB-222 | Sentinel-1A Unavailability from orbit 7840 to 7842 |
| 19/10/2015 16:28 | 20/10/2015 07:27 | SOB-226 | Sentinel-1A Unavailability from 19/10 to 20/10/2015 |
| 21/10/2015 14:54 | 22/10/2015 07:12 | SOB-227 | Sentinel-1A Unavailability from 21/10 to 22/10/2015 |
| 05/11/2015 16:50 | 06/11/2015 12:20 | SOB-229 | Sentinel-1A Unavailability from 05/11 to 06/11/2015 |
| 07/11/2015 17:53 | 08/11/2015 12:10 | SOB-230 | Sentinel-1A Unavailability from 07/11 to 08/11/2015 |
| 18/11/2015 07:40 | 18/11/2015 12:28 | SOB-233 | Sentinel-1A Unavailability on 18/11/2015 |
| 29/11/2015 22:54 | 30/11/2015 11:10 | SOB-251 | Sentinel-1A Unavailability from 29/11 to 30/11/2015 |
| 10/12/2015 07:30 | 10/12/2015 13:00 | SOB-252 | Sentinel-1A Planned unavailability on 10/12/2015 |

| Start Date/Time | End Date/Time | MPC Reference | Summary |
|---|---|---|---|
| 11/12/2015 02:30 | 11/12/2015 16:00 | SOB-253 | Sentinel-1A Unavailability on 11/12/2015 |
| 02/01/2016 04:45 | 02/01/2016 15:14 | SOB-255 | Sentinel-1A Unavailability on 02/01/2016 |
| 16/01/2016 14:59 | 16/01/2016 19:57 | SOB-257 | Sentinel-1A Unavailability on 16/01/2016 |
| 21/02/2016 18:17 | 22/02/2016 10:51 | SOB-310 | Sentinel-1A Unavailability from 21/02/2016 to 22/02/2016 |
| 13/03/2016 08:23 | 13/03/2016 16:14 | SOB-332 | Sentinel-1A Unavailability on 13/03/2016 |
| 15/03/2016 07:46 | 15/03/2016 09:36 | SOB-340 | Sentinel-1A Planned Maintenance on 15/03/2016 |
| 06/05/2016 21:17 | 07/05/2016 14:27 | SOB-389 | Sentinel-1A Unavailability from 06/05/2016 to 07/05/2016 |
| 22/05/2016 14:51 | 22/05/2016 18:11 | SOB-411 | Sentinel-1A Unavailability on 22/05/2016 |
| 16/06/2016 05:59 | 16/06/2016 13:57 | SOB-447 | Sentinel-1A Unavailability on 16/06/2016 |
| 16/06/2016 16:45 | 17/06/2016 11:26 | SOB-448 | Sentinel-1A Unavailability between 16/06/2016 and 17/06/2016 |
| 17/06/2016 11:45 | 27/06/2016 16:32 | SOB-467 | Sentinel-1A Unavailability between 17/06/2016 and 27/06/2016 |
| 02/07/2016 04:52 | 02/07/2016 13:23 | SOB-476 | Sentinel-1A Unavailability on 02/07/2016 |
| 10/07/2016 06:39 | 10/07/2016 17:51 | SOB-483 | Sentinel-1A Unavailability on 10/07/2016 |
| 11/07/2016 21:32 | 12/07/2016 12:05 | SOB-507 | Sentinel-1A Unavailability on 11/07/2016 |
| 27/07/2016 07:49 | 27/07/2016 15:42 | SOB-508 | Sentinel-1A Unavailability on 27/07/2016 |
| 27/08/2016 23:58 | 28/08/2016 09:45 | SOB-533 | Sentinel-1A Unavailability from 27/08/2016 to 28/08/2016 |
| 24/11/2016 20:38 | 25/11/2016 11:34 | SOB-614 | Sentinel-1A Unavailability from 24/11/2016 to 25/11/2016 |
| 04/12/2016 06:52 | 04/12/2016 11:07 | SOB-624 | Sentinel-1A Unavailability on 04/12/2016 |
| 16/06/2017 09:09 | 16/06/2017 12:31 | SOB-751 | Sentinel-1A Unavailability on 16/06/2017 |
| 17/06/2017 11:43 | 17/06/2017 14:43 | SOB-752 | Sentinel-1A Unavailability on 17/06/2017 |
| 21/06/2017 14:09 | 21/06/2017 17:35 | SOB-753 | Sentinel-1A Unavailability on 21/06/2017 |

| Start Date/Time | End Date/Time | MPC Reference | Summary |
|---|---|---|---|
| 07/07/2017 02:20 | 07/07/2017 10:29 | SOB-758 | Sentinel-1A Unavailability on 07/07/2017 |
| 03/08/2017 13:30 | 03/08/2017 14:07 | SOB-776 | Sentinel-1A Unavailability on 03/08/2017 |
| 01/10/2017 12:06 | 01/10/2017 20:01 | SOB-796 | Sentinel-1A Unavailability on 01/10/2017 |
| 25/10/2017 08:25 | 25/10/2017 10:15 | SOB-817 | Sentinel-1A planned Unavailability on 25/10/2017 |
| 02/02/2018 14:27 | 02/02/2018 16:13 | SOB-854 | Sentinel-1A Unavailability on 02/02/2018 |
| 15/03/2018 20:06 | 16/03/2018 10:25 | SOB-888 | Sentinel-1A Unavailability between 15/03/2018 and 16/03/2018 |
| 16/05/2018 07:51 | 16/05/2018 09:34 | SOB-892 | Sentinel-1A Unavailability on 16/05/2018 |
| 22/05/2018 16:52 | 22/05/2018 19:00 | SOB-895 | Sentinel-1A Unavailability on 22/05/2018 |
| 31/05/2018 06:37 | 31/05/2018 09:54 | SOB-897 | Sentinel-1A Unavailability on 31/05/2018 |
| 02/06/2018 01:23 | 02/06/2018 09:42 | SOB-898 | Sentinel-1A Unavailability on 02/06/2018 |
| 29/06/2018 16:27 | 29/06/2018 18:16 | SOB-911 | Sentinel-1A Unavailability on 29/06/2018 |
| 06/07/2018 11:30 | 06/07/2018 13:11 | SOB-916 | Sentinel-1A Unavailability on 06/07/2018 |
| 13/08/2018 07:59 | 13/08/2018 11:21 | SOB-917 | Sentinel-1A Unavailability on 13/08/2018 |
| 05/12/2018 23:45 | 06/12/2018 09:29 | SOB-953 | Sentinel-1A Unavailability between 05/12/2018 and 06/12/2018 |
| 09/12/2018 18:53 | 10/12/2018 08:57 | SOB-954 | Sentinel-1A Unavailability between 09/12/2018 and 10/12/2018 |
| 14/02/2019 19:54 | 15/02/2019 10:26 | SOB-997 | Sentinel-1A Unavailability between 14/02/2019 and 15/02/2019 |
| 28/02/2019 09:25 | 28/02/2019 09:38 | SOB-998 | Sentinel-1A Planned Unavailability on 28/02/2019 |
| 12/03/2019 09:25 | 12/03/2019 09:38 | SOB-1010 | Sentinel-1A Planned Unavailability on 12/03/2019 |
| 18/04/2019 00:45 | 18/04/2019 15:00 | SOB-1030 | Sentinel-1A Unavailability on 18/04/2019 |
| 24/05/2019 17:37 | 25/05/2019 12:34 | SOB-1047 | Sentinel-1A Unavailability on 24/05/2019 and 25/05/2019 |
| 11/11/2019 15:34 | 11/11/2019 18:46 | SOB-1216 | Sentinel-1A Unavailability on 11/11/2019 |

| Start Date/Time | End Date/Time | MPC Reference | Summary |
|---|---|---|---|
| 03/12/2019 08:35 | 03/12/2019 09:17 | SOB-1252 | Sentinel-1A Unavailability on 03/12/2019 |
| 03/12/2019 15:42 | 03/12/2019 15:46 | SOB-1255 | Sentinel-1A Unavailability on 03/12/2019 |
| 06/01/2020 15:17 | 06/01/2020 15:42 | SOB-1305 | Sentinel-1A Unavailability on 06/01/2020 |
| 29/02/2020 14:43 | 29/02/2020 17:45 | SOB-1396 | Sentinel-1A Unavailability on 29/02/2020 |
| 09/09/2020 08:50 | 09/09/2020 11:05 | SOB-1688 | Sentinel-1A Unavailability on 09/09/2020 |
| 26/11/2020 10:06 | 26/11/2020 13:32 | SOB-1839 | Sentinel-1A Unavailability on 26/11/2020 |
| 19/01/2021 21:42 | 20/01/2021 10:02 | SOB-1948 | Sentinel-1A Unavailability on 19/01/2021 and 20/01/2021 |
| 02/03/2021 05:34 | 02/03/2021 11:52 | SOB-2014 | Sentinel-1A Unavailability on 02/03/2021 |
| 22/06/2021 11:10 | 22/06/2021 11:20 | SOB-3357 | Sentinel-1A Planned Unavailability on 22/06/2021 |
| 29/06/2021 09:24 | 29/06/2021 11:09 | SOB-3358 | Sentinel-1A Planned Unavailability on 29/06/2021 |
| 09/08/2021 06:23 | 09/08/2021 09:37 | SOB-3418 | Sentinel-1A Unavailability on 09/08/2021 |
| 11/08/2021 01:23 | 11/08/2021 09:23 | SOB-3422 | Sentinel-1A Unavailability on 11/08/2021 |
| 15/09/2021 08:40 | 15/09/2021 12:02 | SOB-3496 | Sentinel-1A Planned Unavailability on 15/09/2021 |
| 16/11/2021 05:11 | 16/11/2021 11:41 | SOB-3559 | Sentinel-1A Unavailability on 16/11/2021 |
| 16/11/2021 12:23 | 16/11/2021 16:38 | SOB-3560 | Sentinel-1A Unavailability on 16/11/2021 #2 |
| 19/11/2021 06:30 | 19/11/2021 08:54 | SOB-3561 | Sentinel-1A Unavailability on 19/11/2021 |
| 24/12/2021 19:32 | 25/12/2021 08:51 | SOB-3611 | Sentinel-1A Unavailability on 24/12/2021 and 25/12/2021 |
| 10/02/22 11:25 | 10/02/22 14:38 | SOB-3691 | Sentinel-1A Unavailability on 10/02/2022 |
| 22/02/22 04:54 | 22/02/22 14:37 | SOB-3726 | Sentinel-1A Unavailability on 22/02/2022 |
| 01/03/22 19:07 | 02/03/22 12:01 | SOB-3727 | Sentinel-1A Unavailability on 01/03/20022 and 02/03/2022 |
| 13/04/22 20:52 | 14/04/22 08:34 | SOB-3809 | Sentinel-1A Unavailability on 13/04/2022 and 14/04/2022 |

| Start Date/Time | End Date/Time | MPC Reference | Summary |
|---|---|---|---|
| 25/04/22 06:17 | 25/04/22 09:35 | SOB-3810 | Sentinel-1A Unavailability on 25/04/2022 |
| 12/05/22 14:26 | 12/05/22 21:12 | SOB-3950 | Sentinel-1A Unavailability on 12/05/2022 |
| 23/05/22 16:21 | 24/05/22 08:02 | SOB-3951 | Sentinel-1A Unavailability on 23/05/2022 and 24/05/2022 |
| 09/07/22 18:26 | 10/07/22 12:15 | SOB-3952 | Sentinel-1A Unavailability on 09/07/2022 and 10/07/2022 |
| 23/08/22 23:20 | 24/08/22 08:33 | SOB-4005 | Sentinel-1A Unavailability on 23/08/2022 and 24/08/2022 |
| 08/09/22 23:01 | 09/09/22 08:02 | SOB-4015 | Sentinel-1A Unavailability on 08/09/2022 and 09/09/2022 |
| 26/12/22 11:24 | 26/12/22 14:31 | SOB-3183 | Sentinel-1A Unavailability on 26/12/2022 |
| 02/02/23 03:00 | 02/02/23 12:41 | SOB-4336 | Sentinel-1A Unavailability on 02/02/2023 |
| 29/03/23 09:09 | 29/03/23 15:47 | SOB-4337 | Sentinel-1A Unavailability on 29/03/2023 |

## Appendix D : S1-A Auxiliary Data Files

The following is a full list of currently applicable ADF updates:

### Instrument ADF (AUX_INS)

| ADF | Update Reason |
|---|---|
| S1A_AUX_INS_V20190228T092500_G20211103T111906.SAFE | Circulation of S1A_AUX_INS to be compliant with IPF3.40 with the introduction of two fields:<br>- onBoardDecimationFilterParamsList for modes IW/EW to support RFI mitigation processing,<br>- deltaTXLatch parameter used to perfom instrument timing correction.<br>Related to RDB#7. |
| S1A_AUX_INS_V20171017T080000_G20211028T133136.SAFE | As above but related to RDB#6. |
| S1A_AUX_INS_V20160627T000000_G20211028T133055.SAFE | As above but related to RDB#5 (after tile #11 failure). |
| S1A_AUX_INS_V20150722T120000_G20211028T132901.SAFE | As above but related to RDB#5 (before tile #11 failure). |
| S1A_AUX_INS_V20150519T120000_G20211028T132821.SAFE | As above but related to RDB#4. |
| S1A_AUX_INS_V20140908T000000_G20211028T132730.SAFE | As above but related to RDB#3. |
| S1A_AUX_INS_V20140616T133500_G20211028T132453.SAFE | As above but related to RDB#2. |
| S1A_AUX_INS_V20140406T133000_G20211028T132414.SAFE | As above but related to RDB#1. |

### Calibration ADF (AUX_CAL)

| ADF | Update Reason |
|---|---|
| S1A_AUX_CAL_V20190228T092500_G20210104T141310.SAFE | Refinement of S1A IW DH Elevation Antenna patterns.<br>Compatible with RDB#7 |
| S1A_AUX_CAL_V20171017T080000_G20210104T141000.SAFE | As above but related to RDB#6. |
| S1A_AUX_CAL_V20160627T000000_G20190626T100501.SAFE | Circulation of S1A_AUX_CAL to be compliant with IPF3.10.<br>Modification of the noiseCalibrationFactor for SM, IW, EW and WV modes to accommodate for the software changes introduced in IPF 3.1.0 and related to noise normalization. In addition, the WV NESZ annotations have been re-calibrated. |

| | |
|---|---|
| | Compatible RDB#5 after tile 11 failure |
| S1A_AUX_CAL_V20150722T120000_G20190626T100253.SAFE | As above but related to RDB#5 before Tile #11 failure. |
| S1A_AUX_CAL_V20150519T120000_G20190626T100229.SAFE | As above but related to RDB#4 |
| S1A_AUX_CAL_V20140908T000000_G20190626T100201.SAFE | As above but related to RDB#3 |
| S1A_AUX_CAL_V20140616T133500_G20190626T100133.SAFE | As above but related to RDB#2 |
| S1A_AUX_CAL_V20140406T133000_G20190626T100036.SAFE | As above but related to RDB#1 |

### L1 Processor Parameters ADF (AUX_PP1)

| ADF | Update Reason |
|---|---|
| S1A_AUX_PP1_V20190228T092500_G20220323T153041.SAFE | Circulation of S1A_AUX_PP1:<br>1)allowing the activation of RFI mitigation.<br>- flag rfiMitigationPerformed triggering the activation of RFI mitigation processing, is set to BasedOnNoiseMeas for all S1A TOPS products (IW/EW Level1 and Level2 products), so that the RFI mitigation is applied if RFI detection from noise measurements<br>- flag rfiMitigationDomain triggerring the method for RFI mitigation is set to TimeandFrequency<br>2) reviewing the processing gains of SL2/GR2 EW/IW for HH channel, in order to aligned S-1A wind speed performance to S-1B for OCN products<br>Relative to RDB#7 |
| S1A_AUX_PP1_V20171017T080000_G20220323T144732.SAFE | As above but related to RDB#6. |
| S1A_AUX_PP1_V20150722T120000_G20220323T144038.SAFE | As above but related to RDB#5. |
| S1A_AUX_PP1_V20150519T120000_G20220323T143127.SAFE | As above but related to RDB#4. |
| S1A_AUX_PP1_V20140908T000000_G20220323T142628.SAFE | As above but related to RDB#3. |
| S1A_AUX_PP1_V20140616T133500_G20220323T142238.SAFE | As above but Related to RDB#2. |
| S1A_AUX_PP1_V20140406T133000_G20220323T141316.SAFE | As above but Related to RDB#1. |

### L2 Processor Parameters ADF (AUX_PP2)

| ADF | Update Reason |
|---|---|
| S1A_AUX_PP2_V20190228T092500_G20220607T093912.SAFE | Circulation of S1A_AUX_PP2 allowing the activation of TotalHs estimation |

| | |
|---|---|
| | - Flag activateTotalHs triggering the activation of TotalHs estimation based on machine learning method is set to true for WV mode, for both subswath WV1 and WV2. Consequently, oswTotalHs and oswTotalHsStdev will be populated for WV OCN products.<br>The change affects only WV mode.<br>Relative to RDB#7 |
| S1A_AUX_PP2_V20171017T080000_G20220607T093818.SAFE | As above and compliant with RDB#6 |
| S1A_AUX_PP2_V20150722T120000_G20220607T093737.SAFE | As above and compliant with RDB#5 |
| S1A_AUX_PP2_V20150519T120000_G20220607T093644.SAFE | As above and compliant with RDB#4 |
| S1A_AUX_PP2_V20140908T000000_G20220607T093557.SAFE | As above and compliant with RDB#3 |
| S1A_AUX_PP2_V20140616T133500_G20220607T093510.SAFE | As above and compliant with RDB#2 |
| S1A_AUX_PP2_V20140406T133000_G20220607T093358.SAFE | As above and compliant with RDB#1 |

### Simulated Cross Spectra ADF (AUX_SCS)

| ADF | Update Reason |
|---|---|
| S1__AUX_SCS_V20140402T000000_G20160413T103855.SAFE | Introduction of AUX_SCS. Related to RDB#1. |
| S1__AUX_SCS_V20140616T133700_G20160413T104849.SAFE | Introduction of AUX_SCS. Related to RDB#2. |
| S1__AUX_SCS_V20140908T000000_G20160413T105124.SAFE | Introduction of AUX_SCS. Related to RDB#3. |
| S1__AUX_SCS_V20150519T120000_G20160413T105253.SAFE | Introduction of AUX_SCS. Related to RDB#4. |
| S1__AUX_SCS_V20150722T120000_G20160413T105410.SAFE | Introduction of AUX_SCS. Related to RDB#5. |
| S1__AUX_SCS_V20171017T080000_G20171016T150910.SAFE | Update of ADF to be compliant with RDB#6. |
| S1__AUX_SCS_V20140406T133000_G20200623T142050.SAFE | This new AUX_SCS files was specifically developed to accompany a modification of the MTF (Modulation Transfer Function) estimated in the Level-2 Ocean Processor (LOP) in the ocean swell processing on IPF 3.30. This modification was performed to |

| | |
|---|---|
| | remove the several ad-hoc tunings applied to the initial MTF and to also propose a better compensation of the ocean wave spectral energy with respect to the ocean surface wind speed. |
| S1__AUX_SCS_V20210622T130000_G20210621T100158.SAFE | This version of the AUX_SCS embeds a new tunned version of the Real Aperture Radar Modulation Transfer Function (RAR MTF), specific to the optimised WV2 antenna configuration. This AUX_SCS impacts only WV2, and support the upgrade of RDB configuration (S1A RDB#7, S1B RDB#2). |

## Appendix E : S-1A Quality Disclaimers

The following Quality Disclaimers have been prepared since the S1-A launch:

| Number | Description | Start Validity Date | End Validity Date | Issue Status |
|---|---|---|---|---|
| 1 | S1A_WV_SLC_1S products filled with zero (black products) | 2014-09-30 15:17:26 UT | 2014-10-03 03:34:01 UT | Issued |
| 2 | Failure on tile amplifier #5 of the receiving antenna | 2014-10-18 15:29:30 UT | 2015-01-20 19:04:54 UT | Issued |
| 3 | Level 1 products processed with incorrect gains | 2014-09-30 15:17:26 UT | 2014-10-03 04:07:54 UT | Issued |
| 4 | Incorrect Cycle Number and Relative orbit number in products processed in PAC2/DPA | 2014-12-09 11:45:25 UT | 2015-01-21 03:53:00 UT | Issued |
| 5 | Failure on Tile amplifier #5 of the receiving antenna from 18/03/2015 and 20/03/2015 | 2015-03-18 04:09:00 UT | 2015-03-20 11:46:30 UT | Issued |
| 6 | Failure on Tile amplifier #5 of the receiving antenna from 26/03/2015 to 28/03/2015 | 2015-03-26 16:20:00 UT | 2015-03-28 02:50:30 UT | Issued |
| 7 | Failure on Tile amplifier #5 of the receiving antenna from 18/04/2015 to 24/04/2015 | 2015-04-18 17:40:21 UT | 2015-04-24 17:48:08 UT | Issued |
| 8 | Failure on Tile amplifier #5 of the receiving antenna from 25/04/2015 to 30/04/2015 | 2015-04-25 17:37:37 UT | 2015-04-30 23:01:11 UT | Issued |
| 9 | Failure on Tile amplifier #5 of the receiving antenna from 05/05/2015 to 06/05/2015 | 2015-05-05 05:12:51 UT | 2015-05-06 00:44:43 UT | Issued |
| 10 | Denoising vectors not qualified | 2014-10-03 00:00:00 UT | 2015-07-03 06:33:15 UT | Issued |
| 11 | S-1 L2 OCN product preliminary qualified | 2015-07-02 00:31:03 UT | 2030-01-01 00:00:00 UT | Issued |
| 12 | Failure of TRM #5 between 2015-05-26 and 2015-05-27. | 2015-05-26 21:10:28 UT | 2015-05-27 05:53:00 UT | Issued |
| 13 | Failure of TRM #5 between 2015-06-06 and 2015-07-14 | 2015-06-06 06:44:28 UT | 2015-07-14 07:50:55 UT | Issued |
| 14 | Invalid radiometric calibration of WV L1 and L2 products | 2015-03-19 02:29:22 UT | 2015-07-03 08:09:02 UT | Issued |
| 15 | Failure of TRM #5 from 2015-07-17 to 2015-07-21 | 2015-07-17 18:58:56 UT | 2015-07-21 12:04:57 UT | Issued |
| 16 | Invalid Orbit Number at UPA - before 2014-10-10 | 2014-10-03 00:00:00 UT | 2014-10-10 06:28:50 UT | Issued |
| 17 | Incorrect Cycle Number in S1-A Products acquired between 26/01/2016 and 04/02/2016. | 2016-01-26 21:17:42 UT | 2016-02-04 16:29:59 UT | Issued |
| 18 | Invalid annotation of NSSDC identifier of Sentinel-1A between April 2014 and July 5th 2016 | 2014-09-30 15:17:26 UT | 2016-07-05 10:16:00 UT | Issued |
| 21 | Issue on geolocation of Sentinel-1A SM SLC products with IPF v2.71 | 2016-05-11 21:02:59 UT | 2016-08-22 21:35:50 UT | Issued |
| 22 | Invalid annotation of SSPPDU in the manifest of S-1A products | 2014-09-30 15:17:26 UT | 2019-04-17 06:30:03 UT | Issued |
| 24 | Incorrect Cycle Number in S1-A Products acquired between 12/01/2017 and 24/01/2017 | 2017-01-12 00:18:59 UT | 2017-01-24 06:52:28 UT | Issued |

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|---|---|---|---|---|
| 26 | S-1A products processed with invalid Restituted Orbit Files (AUX_RESORB) between 2017-09-06 and 2017-09-07 | 2017-09-06 18:57:47 UT | 2017-09-07 08:07:45 UT | Issued |
| 28 | S-1A L2 OCN products provide reverse OSW wind direction respect to the specification | 2015-11-24 12:03:51 UT | ongoing | Issued |
| 30 | Issue on the noise vector annotation of S-1A products generated from L0N with updated content | 2018-03-13 01:00:42 UT | 2018-03-15 14:01:26 UT | Issued |
| 32 | S-1A mis synchronisation with impact on azimuth bandwidth synchronisation for InSAR applications | 2015-05-17 00:03:40 UT | 2015-05-18 23:14:45 UT | Issued |
| 33 | S-1A products processed without Restituted Orbit Files (AUX_RESORB) between 2018-03-21 and 2018-03-22 | 2018-03-21 21:42:52 UT | 2018-03-22 07:33:09 UT | Issued |
| 35 | S-1A products processed without Restituted Orbit Files (AUX_RESORB) between 2018-04-08 and 2018-04-11 | 2018-04-08 18:58:39 UT | 2018-04-11 16:20:49 UT | Issued |
| 37 | S1A denoising vectors for Strip Map products were not properly calibrated after IPF 2.90 deployment | 2018-03-13 11:54:53 UT | 2018-06-21 18:53:32 UT | Issued |
| 38 | S-1A products processed without Restituted Orbit Files (AUX_RESORB) between 2018-07-07 and 2018-07-09 | 2018-07-07 11:49:47 | 2018-07-09 03:34:48 | Issued |
| 40 | S-1A products processed without Restituted Orbit Files (AUX_RESORB) on 2018-09-20 | 2018-09-20 10:41:03 | 2018-09-20 16:15:34 | Issued |
| 42 | Test of the new S-1A antenna configuration, aiming improvement of WV2 performances | 2019-02-28 09:42:51 | 2019-03-12 00:00:00 | Issued |
| 43 | S-1A Products generated without AUX_RESORB between 10 April 14:00 UTC to 11 April 07:00 UTC 2019 | 2019-04-18 15:20:30 | 2019-04-10 12:37:43 | Issued |
| 46 | Products have been wrongly generated as S1B instead of S1A on 20th August 2019 | 2019-08-20 05:33:56 | 2019-08-20 13:42:08 | Issued |
| 47 | S-1A Products generated without AUX_RESORB on 19th July 2019 | 2019-07-18 22:52:54 | 2019-07-18 23:55:52 | Issued |
| 49 | S-1A Products generated without AUX_RESORB on 12th September 2019 | 2019-09-12 05:47:48 | 2019-09-12 05:54:28 | Issued |
| 50 | S-1A Products generated without AUX_RESORB on 31th August 2019 | 2019-08-31 18:26:10 | 2019-08-31 23:16:23 | Issued |
| 51 | S-1A Products generated without AUX_RESORB on 13th November 2019 | 2019-11-13 07:04:23 | 2019-11-13 12:54:52 | Issued |
| 52 | S-1A Products generated without AUX_RESORB on 06 January 2020 | 2020-01-06 12:29:32 | 2020-01-06 13:33:35 | Issued |
| 53 | S-1A OCN Products generated with missing wind information (OWI) content on 11th March 2020 | 2020-03-10 18:41:02 | 2020-03-11 23:49:57 | Issued |
| 55 | S-1A radiometric jumps on S1A IW products on 08/03/2020 | 2020-03-08 17:35:11 | 2020-03-08 17:36:01 | Issued |
| 56 | S-1A issue on the WV OCN: anomaly on swell spectrum energy with IPF 3.3x | 2020-06-22 20:17:50 | 2020-07-02 02:00:46 | Issued |
| 58 | Phase artefacts for products acquired over region with strong variations of terrain height in range direction | 2015-11-13 23:40:21 | 2016-04-13 10:04:58 | Issued |

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|---|---|---|---|---|
| 59 | S-1A products on a same datatake processed with different processing configuration | 2015-03-23 17:14:52 | 2019-06-18 17:14:49 | Issued |
| #60 | S-1A products containing data gaps | 2021-01-18 16:46:17 | 2021-01-31 15:49:44 | Issued |
| #62 | Bias in OSW Wind Speed measurement for S-1A WV1 between 12th May 2020 and 23rd June 2020 | 2020-05-12 10:18:41 | 2020-06-23 01:38:51 | Issued |
| #64 | Bias in OSW Wind Speed measurement for S-1A WV2 starting from 12th May 2020 2020 | 2020-05-12 10:18:41 | 2030-01-01 00:00:00 | Issued |
| #66 | Bias in radiometric calibration of S1-A WV products acquired before 12th May 2020 | 2014-09-30 15:17:26 | 2020-05-12 10:18:41 | Issued |
| #68 | S-1A products generated without orbit file between 31/07/2021 and 02/08/2021 | 2021-07-29 23:11:10 | 2021-08-08 17:03:56 | Issued |
| #70 | S-1A products generated with inconsistent processing configuration following the IPF3.40 deployment | 2021-11-03 03:43:32 | 2021-11-03 10:33:59 | Issued |
| #72 | For some IW products, a far range part of IW3 sub swath is missing | 2014-10-14 09:10:48 | 2015-06-26 07:54:00 | Issued |
| #73 | S-1A Products processed without using orbit file | 2021-03-25 00:00:00 | 2021-12-14 03:51:31 | Issued |
| #75 | S-1A Level 2 OCN products not containing the OWI (gridded wind field) and OSW (Swell) information | 2021-12-12 23:57:58 | 2021-12-14 11:12:43 | Issued |
| #77 | Invalid Burst ID for some S-1A products | 2021-11-02 23:07:50 | 2030-01-01 00:00:00 | Issued |
| #79 | Invalid annotation of acquisition anxTime for some S1-A RAW products | 2014-09-30 15:17:26 | 2030-01-01 00:00:00 | Issued |
| #81 | S-1A OCN products with invalid xsd files | 2022-03-23 07:50:46 | 2030-01-01 00:00:00 | Issued |
| #82 | S-1A Products generated without POD orbit file | 2022-02-22 14:47:17 | 2022-02-25 13:16:37 | Issued |
| #83 | S-1A Products generated without POD orbit file | 2022-03-02 12:11:35 | 2022-03-06 23:57:54 | Issued |
| #84 | S-1A products processed without using POD orbit file | 2021-07-29 23:11:10 | 2021-08-08 17:03:56 | Issued |
| #86 | Sentinel-1A swell inversion (OCN/OSW processing) performed using invalid a priori wind speed and direction | 2022-04-08 00:00:00 | 2022-05-12 08:25:01 | Issued |
| #87 | Auxiliary product information not properly projected on the SAR image, leading to major degradation of OCN measurements | 2022-03-23 07:50:46 | 2022-05-12 08:25:01 | Issued |
| #88 | The Sentinel-1A StripMap OCN products are not operationally qualified | 2014-10-04 02:43:30 | 2030-01-01 00:00:00 | Issued |

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|---|---|---|---|---|
| #90 | S-1A Range shifts of denoising vectors for GRDM, GRDH and OCN products | 2014-09-30 15:17:26 | 2022-03-23 10:25:10 | Issued |
| #92 | S-1A: Invalid POD orbit files used during the processing | 2022-05-11 21:46:04 | 2022-05-12 13:15:58 | Issued |
| #93 | S-1A: Invalid POD orbit files used during the processing | 2022-05-16 14:18:30 | 2022-05-17 06:40:32 | Issued |
| #94 | Sentinel-1A OCN products crossing Greenwich meridian with no OWI information and issue on rvlNrcs | 2022-04-08 04:56:57 | 2022-05-12 08:25:01 | Issued |
| #95 | S-1A products with invalid data due to downlink issue through EDRS-C | 2022-01-19 21:59:30 | 2022-02-18 18:08:52 | Issued |
| #96 | Degraded geolocation accuracy due to degraded AUX_PREORB | 2022-10-12 10:56:30 | 2022-10-16 07:10:09 | Issued |
| #97 | Degraded geolocation accuracy due to degraded AUX_RESORB | 2022-10-09 19:40:25 | 2022-10-15 22:05:46 | Issued |
| #98 | Product degradations due to acquisition during Orbit Control on 2022-10-18 | 2022-10-18 10:53:03 | 2022-10-18 20:54:23 | Issued |
| #99 | S-1A Products with RFI degradation acquired between 2014-09-15 and 2022-03-31 | 2014-09-15 00:00:00 | 2022-04-01 00:00:00 | Issued |
| #101 | Products with residual RFI degradation acquired in April 2022 | 2022-04-01 00:00:00 | 2022-05-01 00:00:00 | Issued |
| #102 | Products with residual RFI degradation acquired in May 2022 | 2022-05-01 00:00:00 | 2022-06-01 00:00:00 | Issued |
| #103 | Products with residual RFI degradation acquired in June 2022 | 2022-06-01 00:00:00 | 2022-07-01 00:00:00 | Issued |
| #104 | Products with residual RFI degradation acquired in July 2022 | 2022-07-01 00:00:00 | 2022-08-01 00:00:00 | Issued |
| #105 | Products with residual RFI degradation acquired in August 2022 | 2022-08-01 00:00:00 | 2022-09-01 00:00:00 | Issued |
| #106 | Products with residual RFI degradation acquired in September 2022 | 2022-09-01 00:00:00 | 2022-10-01 00:00:00 | Issued |
| #107 | Products with residual RFI degradation acquired in October 2022 | 2022-10-01 00:00:00 | 2022-11-01 00:00:00 | Issued |
| #108 | Products with residual RFI degradation acquired in November 2022 | 2022-11-01 00:00:00 | 2022-12-01 00:00:00 | Issued |
| #109 | Products with residual RFI degradation acquired in December 2022 | 2022-12-01 00:00:00 | 2023-01-01 00:00:00 | Issued |
| #110 | Products with residual RFI degradation acquired in January 2023 | 2023-01-01 00:00:00 | 2023-02-01 00:00:00 | Issued |
| #111 | S-1A products generated without POD orbit files | 2023-02-01 05:25:50 | 2023-02-01 22:39:24 | Issued |

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|---|---|---|---|---|
| #112 | Products with residual RFI degradation acquired in February 2023 | 2023-02-01 00:00:00 | 2023-03-01 00:00:00 | Issued |
| #113 | Products with residual RFI degradation acquired in March 2023 | 2023-03-01 00:00:00 | 2023-04-01 00:00:00 | Issued |

## Appendix F : IPF Updates and description

| version | delivery | start usage | end usage |
|---|---|---|---|
| 003.61 | 2023-03-17 12:00:00 | 2023-03-30 10:19:46 | |
| 003.52 | 2022-05-12 00:00:00 | 2022-05-12 10:48:19 | 2023-03-30 09:29:57 |
| 003.51 | 2022-03-04 00:00:00 | 2022-03-23 16:25:31 | 2022-05-12 09:31:31 |
| 003.40 | 2021-10-08 00:00:00 | 2021-11-04 07:56:32 | 2022-03-23 12:25:17 |
| 003.31 | 2020-06-19 12:00:00 | 2020-06-30 12:00:00 | 2021-11-03 11:08:26 |
| 003.30 | 2020-03-09 12:00:00 | 2020-06-23 08:00:00 | 2020-06-30 12:00:00 |
| 003.20 | 2019-12-16 12:00:00 | 2020-01-29 10:00:00 | 2020-06-23 08:00:00 |
| 003.10 | 2019-06-04 15:00:00 | 2019-06-26 10:00:00 | 2020-01-29 10:00:00 |
| 002.91 | 2018-05-29 00:00:00 | 2018-06-26 08:30:00 | 2019-06-26 10:00:00 |
| 002.90 | 2018-01-16 00:00:00 | 2018-03-13 12:00:00 | 2018-06-26 08:30:00 |
| 002.84 | 2017-07-12 00:00:00 | 2017-08-22 10:00:00 | 2018-03-13 12:00:00 |
| 002.82 | 2017-02-27 00:00:00 | 2017-03-28 06:00:00 | 2017-08-22 10:00:00 |
| 002.72 | 2016-07-29 00:00:00 | 2016-08-23 12:00:00 | 2017-03-28 12:00:00 |
| 002.71 | 2016-04-21 00:00:00 | 2016-05-11 12:00:00 | 2016-08-23 12:00:00 |
| 002.70 | 2016-03-31 00:00:00 | 2016-04-13 12:00:00 | 2016-05-11 12:00:00 |
| 002.60 | 2015-10-09 00:00:00 | 2015-11-20 12:00:00 | 2016-04-13 12:00:00 |
| 002.50 | 2015-06-30 00:00:00 | 2015-07-02 12:00:00 | 2015-11-24 12:00:00 |
| 002.40 | 2015-03-09 00:00:00 | 2015-03-19 00:00:00 | 2015-07-02 12:00:00 |