# Copernicus S3 Product Notice – Altimetry

| | | |
|---|---|---|
| **Mission** | S3A & S3B | |
| **Sensor** | SRAL | |
| **Product** | L1 NRT, STC and NTC | |
| | | |
| **Product Notice ID** | S3.PN-STM-L1.08 | |
| **Issue/Rev Date** | 07/07/2020 | 01/09/2020 |
| **Version** | 1.1 | |
| **Preparation** | This Product Notice was prepared by the S3 Mission Performance Centre, by ESA and EUMETSAT experts | |
| **Approval** | Joint ESA-EUM Mission Management | |


**Summary**

This is a Product Notice (PN) for the Copernicus Sentinel-3A and Sentinel-3B Surface Topography Mission (STM) Level-1A, Level-1BS and Level-1B products. The Product Notice is applicable to all timeliness: Near Real Time (NRT), Short Time Critical (STC) and Non-Time Critical (NTC), but please note that L1A and L1B-S are only produced in STC and NTC and they are not produced when the SRAL instrument is operated in LRM mode.

The Notice describes the Level-1 current status, product quality and limitations, and product availability status.


| Processing Baseline | | |
|---|---|---|
| | **S3A** | **S3B** |
| **Processing Baseline including ADFs** | Processing Baseline: 2.69 | Processing Baseline: 1.45 |
| **IPFs version** | SR_1 IPF version: 06.19 | |

| Current Operational Processing Baseline | | |
|---|---|---|
| **IPF** | **IPF Version** | **In OPE since** |
| S3A SR1 | 06.19 | **Land Centre:**<br>2020-07-16 at 8:14 UTC<br>**Marine Centre:**<br>2020-07-16 |
| S3B SR1 | | **Land Centre:**<br>2020-07-16 at 8:14 UTC<br>**Marine Centre:**<br>2020-07-16 |

## Status of the Processing Baseline

### Sentinel-3

The same processor versions are used for S3A and S3B:

SRAL L1 IPF (SR-1): version 06.19

Some Static Auxiliary Data Files (ADFs), which are instrument specific, are different between S3A and S3B. The list of ADFs can be found at the end of the document.

The collection of IPF version and ADFs is known as Processing Baseline (PB). For S3A the PB number is 2.69 and for S3B is 1.45. Currently these numbers are internal to the PDGS; only IPF version and ADFs names/versions are available in the products.

The quality of L1 products is within the mission requirements.

Note that since IPF version 06.09 the L1 products are generated with internal netcdf4 compression enabled. This is transparent to the user.

The deployment dates in the Land and Marine Centres are specified above.

Notice that with IPF version 06.18 brings an update of the L1A format, please see details in Notice#S3-7.

The following anomalies were closed with this release, more details available below:

- Anomaly#S3-3
- Anomaly#S3-4
- Anomaly#S3-5
- Anomaly#S3-6

## Known product quality limitations

### Common to S3A and S3B

The Copernicus Sentinel-3A and Sentinel-3B STM products have some known processing limitations, which are reported in the next pages.

**Anomaly#S3-1: L1 Sigma0 scale does not take into account the azimuth compression gain (SIIIMPC-2927):**

- Since IPF version 06.17, the azimuth compression gain is taken into account in the L1 processing, its expression is given by 10*log10(64) has an impact on the backscatter coefficient absolute bias. For ocean retracker it is taken into account in the IPF L2 (see corresponding product notice), for the other retrackers, the sigma0 mean value is reduced by 18.06 dB
- Fixed in version SRAL SR-1 06.17

**Anomaly#S3-2: Wrong information in Level-1A coordinates attribute for variable agc_ku_l1a_echo_sar_ku (SIIIMPC-3265):**

- The coordinates attribute of agc_ku_l1a_echo_sar_ku field in the L1-A products was wrong and was modified accordingly:
- From "lon_l1b_echo_sar_ku" to "lon_l1a_echo_sar_ku"
- From "lat_l1b_echo_sar_ku" to "lat_l1a_echo_sar_ku"
- Fixed in version SRAL SR-1 06.17


**Anomaly#S3-3: Pass number anomaly in the Level-1 manifest and in the netcdf global attribute (SIIIMPC-3693 and SIIIMPC-3694):**

- The pass number information provided in the Level-1 manifest was sometimes wrong (pass number 771 instead of 770 on Sentinel-3A and repeated pass number for Sentinel-3B).
- Fixed in version SRAL SR-1 06.18

**Anomaly#S3-4: Anomaly in the granule attributes (number and position) specified in the Level-1 manifest (SIIIMPC 3789).**

- In the Level-1 manifest, the information related to the granule number and position (FIRST/LAST) was most of the time wrong.
- The anomaly appeared with deployment of SRAL SR-1 06.11 and is fixed in version SRAL SR-1 06.18

**Anomaly#S3-5: Anomaly in the data gaps reporting in the Level-1 manifest (SIIIMPC 4183).**

- In the Level-1 manifest, some data gaps that are outside of the sensing window are reported.
- Fixed in version SRAL SR-1 06.18

**Anomaly#S3-6: Anomaly in the products metadata in the Level-1 manifest (SIIIMPC 4183).**

- Unlike it is mentioned in the Sentinel-3 IPF metada specification, the container "sralProductInformation" have no “sral” namespace.
- Fixed in version SRAL SR-1 06.18

**Anomaly#S3-7: In the L1A products, the recorded CAL2 GPRW is a single calibration instead of a 27-days averaged one (SIIIMPC 4568).**

- The following fields are impacted:
    - gprw_meas_ku_l1a_echo_sar_ku
    - gprw_meas_c_l1a_echo_sar_ku
- Only the L1A netcdf fields are impacted, in the IPF processing the 27-days averaged CAL2 is used.
- Only the current Sentinel-3A and Sentinel-3B Processing Baselines are impacted


**Notice #S3-1: Longer calibration time window:**

Since IPF version 06.13 the time window of the on-board calibrations (CAL2) applied to the measurement data has been extended within the ground processing: both Ku and C band use a 27 days average calibration. This provides smoother calibration and less day-to-day variations in the scientific data.

**Notice #S3-2: Number of beams in the stack:**

The number of stack beams to build the 20 Hz waveform is set to 180. All the useful beams in the stack are used.

**Notice #S3-3: The CAL1 PTR Power is noisy ("EUM/Sen3/AR/3311"):**

Since IPF version 06.13, the noise present on the SRAL CAL1 PTR (Point Target Response) power has been reduced thanks to the application of an averaged CAL2 correction. Note that it has no impact on the scientific data in Ku-band and a small effect in C-band.

**Notice #S3-4: C Band CAL2 Filter Mask is quite noisy ("EUM/Sen3/AR/3739"):**

It is observed that the CAL2 Filter mask in C Band has still a high level of speckle noise. Since IPF version 06.13, the CAL2 Filter mask in Ku Band is used for processing the C-band parameters.

**Notice#S3-5: SRAL acquisition mode in L1 products (SIIIMPC-2065):**

Since IPF version 06.14, the SRAL data during which SRAL altimeter operates in acquisition mode are available in the SRAL Level 1 SAFE products. All these data are gathered in a separate NetCDF file named as follows "acquisition.nc". Note that this evolution has no impact on the measurement file "measurement.nc". When no acquisition information is available, no "acquisition.nc" file is available.

**Notice#S3-6: Update in the S3A&S3B SRAL Ku Band Antenna Pattern 3dB beamwidths (SIIIMPC-3106):**

Since PB 2.61A/1.33B, the Ku Band Antenna Pattern 3dB beamwidth has been updated for S3A and S3B SRAL sensors. The new values are 1.34 degrees for S3A SRAL and 1.33 degrees for S3B SRAL. The former value was 1.35 degrees for both S3A and S3B SRAL.

**Notice#S3-7: Unrepeated calibrations in Level-1A products (SIIIMPC-4161):**

CAL1 and CAL2 do not change rapidly (respectively averaged over 10 and 27 days) and do not need to be repeated for each measurement in the Level-1A products. Thus, to provide a unique CAL1 and CAL2 per Level-1A product, the time dimension (time_l1a_echo_sar_ku) and the index (ltm_max_ind) of the following variables has been removed:

- gprw_meas_ku_l1a_echo_sar_ku
- gprw_meas_c_l1a_echo_sar_ku
- burst_power_cor_ku_l1a_echo_sar_ku
- burst_phase_cor_ku_l1a_echo_sar_ku

**Notice#S3-8: Update of the Autocal sequences (SIIIMPC-4164):**

Analyses showed that the on-ground and in-flight Autocal sequences are slightly different. The sequences measured in flight are stable since December 2016 for Sentine-3A and since August 2018 for Sentinel-3B. Based on these measurements, averaged new Autocal sequences have been computed for both satellites. The expected impacts remain low at Level-2 (below 0.1 dB on backscatter coefficients)

**Notice#S3-9: New global attribute "phase identifier" in all Level-1 netcdf products (SIIIMPC-4170):**

In order to easily identify the different mission life phases a new global attribute "phase identifier" has been added to all the Level-1 NetCDF products. Before the IPF-SM1 version 06.18, this information was only available in the manifests.

**Notice#S3-10: Update of the Level-1 products chunksize (SIIIMPC 4169).**

Optimization of the NetCDF chunksize for a faster reading.

**Notice#S3-11: L1B product size has 45% increase in size and L1BS 5% (SIIIMPC 4458).**

The size of the L1BS and L1B products increase by 5% and 45% respectively.

**Specific to S3A**

The Copernicus Sentinel-3A STM products have some known processing limitations, which are reported in the next pages.


**Anomaly #S3A-1: EUM/Sen3/AR/3404: Issue in L0 IPF in computing the ANX Cross Time (SIIIMPC 1918)**

- An error has been detected in the computation of the ANX time that leads to an error of up to 8 seconds in the equator crossing time. This currently affects L1 and L2. This ANX value is used internally to generate the start/stop times of the pole-to-pole passes (STC and NTC), which was now improved.
- Fixed in version 06.14

## Specific to S3B

The Copernicus Sentinel-3B STM products have some known processing limitations, which are reported in the next pages.

**Anomaly #S3B-1: Degraded SRAL calibration quality for S3B between 6 June and 21 June 2018 (SIIIMPC-2823)**

Due to different parameterisation of SRAL commanding on board, SRAL Level 1 products acquired between 7 June and 21 June have been processed with old CAL1 data.

The impact on the L1 and L2 data is negligible.

**Anomaly #S3B-2 "S3B STC/NTC passes are not properly cut during drift" (EUM/Sen3/AR/4993)**

During the drift phase, the pass duration in STC and NTC was not properly calculated and this lead to slight offset in start/stop times of the passes. The offset value varies during the drift, up to a 5 seconds difference with the real pole crossing.

The Level-1 products reprocessed in the frame of the 2020 Marine reprocessing campaign are not impacted anymore by this anomaly. More details available here: https://www.eumetsat.int/website/home/News/DAT_4852830.html

**Notice #S3B-1: Jump on C-band S3B data due to different SRAL thermal conditions**

On the 29 May, due to different thermal conditions on SRAL sensor, a jump of 0.2 dB on the SRAL C-band CAL1 power value occurred.

This calibration is averaged into a 10-day window and applied to L1 data. Thus between 29 May and 7 June 2018 the L2 science data is affected by this jump.

No further mitigation actions are foreseen.

**Notice #S3B-2: S3B waveforms are not centred on gate 44 in average**

When the navigation bulletin is derived from GNSS instrument instead of DORIS, a bias of -80 cm is observed on the epoch distribution. The impact on the L2 estimated parameters is very low (less than 1 cm on SARM SWH) and observable in SARM only. The navigation bulleting was derived from GNSS from 7th of July 2018 to 16th of July 2018 and from the 23rd of November 2018 to the 9th of May 2019.

## Products Availability

☒ Copernicus Open Access Hub (https://scihub.copernicus.eu/), NRT, STC and NTC

☒ Copernicus Online Data Access (https://coda.eumetsat.int/), NRT, STC and NTC

☒ EUMETCast (https://eoportal.eumetsat.int/), NRT and STC

☒ EUMETSAT Data Centre (https://eoportal.eumetsat.int/), NRT, STC and NTC

☒ EUMETSAT Online Data Access (ftp://oda.eumetsat.int/), NRT, STC and NTC (see details below)

☐ FTP server address login: login password: password

☐ Other

| Product | EUMETCast | ODA* | CODA** | EUMETSAT Data Centre |
|---|---|---|---|---|
| **L1B** | NRT, STC | NRT, STC, NTC | NRT, STC, NTC | NRT, STC, NTC |
| **L1A** | - | STC, NTC | STC, NTC | STC, NTC |
| **L1BS** | - | STC, NTC | STC, NTC | STC, NTC |

*** ODA** is available only for Copernicus Services and S3VT users

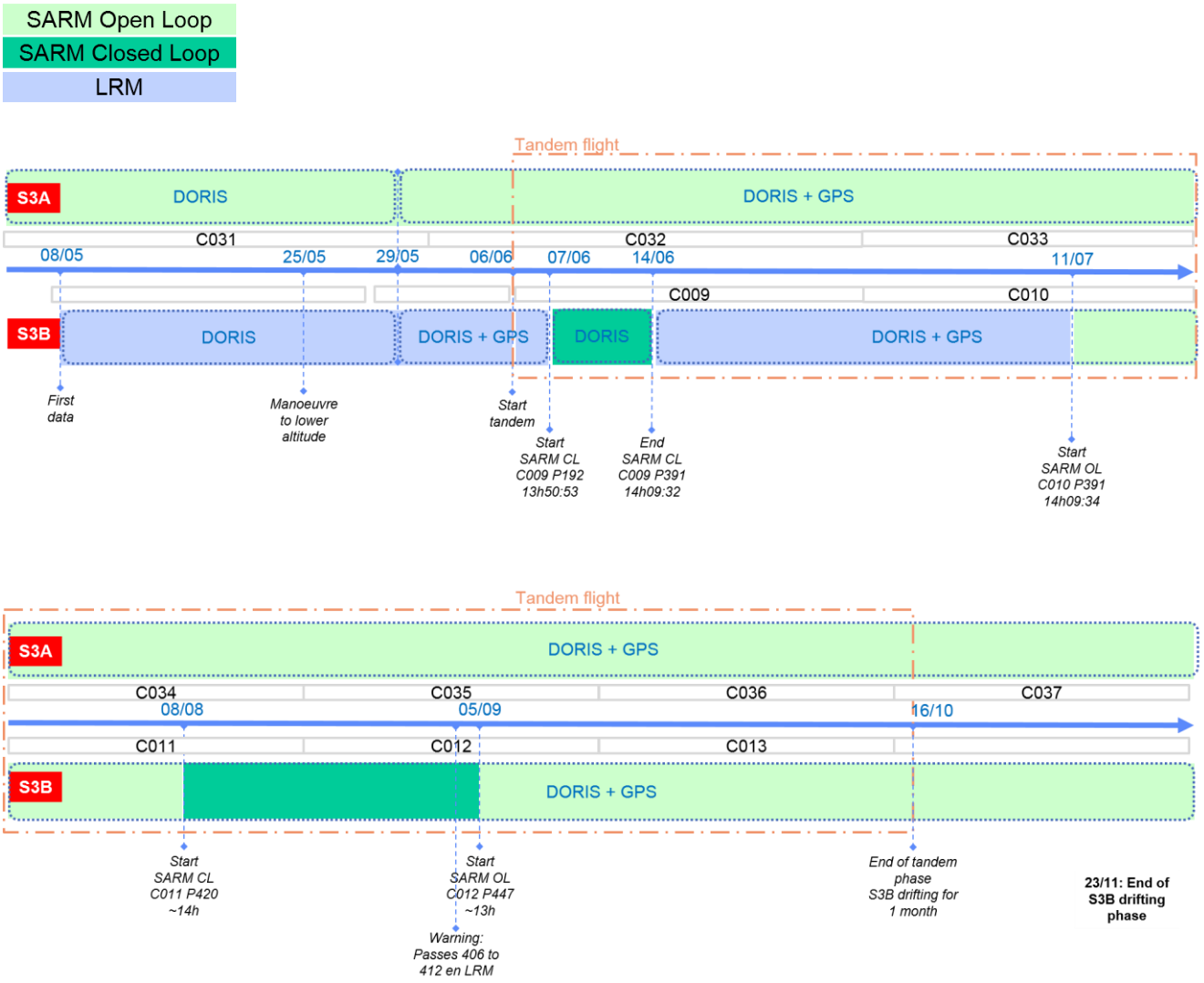
**** CODA** is the Copernicus Online Data Access service available to all users

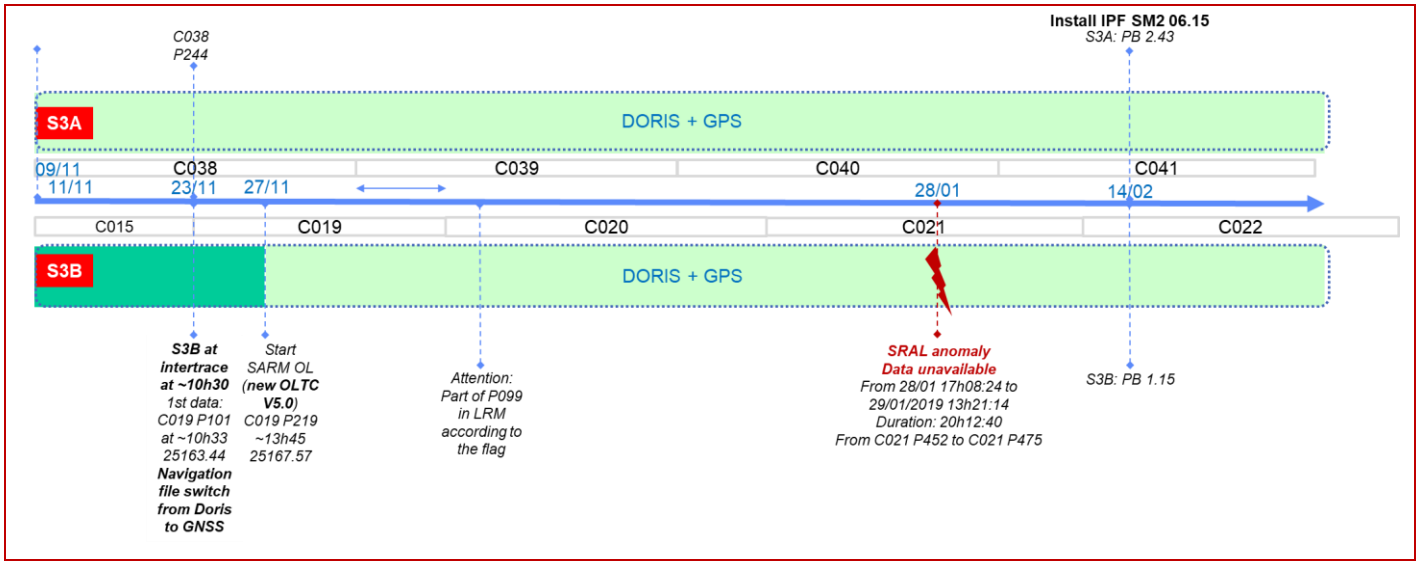
## Any other useful information

- Since IPF version 06.17, the baseline collection number in the products filename changed from 3 to 4 to reflect the major evolutions introduced by this Processing Baseline. As an example, the filename for STC products will be labeled as O_ST_004.SEN3 instead of O_ST_003.SEN3
- Note that the SRAL NRT products are 10 minutes length, instead of being dump based as originally specified – this is part of the new Product Definition.
- The fine tracker word is not applied in the L1B waveforms creating saw tooth behavior on the radargram. This is not considered an anomaly since the range can be computed using the tracker

and epoch provided in the product or from the epoch coming from any external retracking applied by the users. All versions are impacted.

- For Sentinel-3B, SRAL was switched-on on 8 May. Until 6 June, the S3B satellite drifted in its orbit to end up 30 seconds ahead of the S3A satellite, at which point the tandem phase started.
- The geographic coverage of S3B mission was partial until 29 May 2018. Indeed, since the altimeter PRF was not changed during the drifting phase, there have been no SRAL acquisitions below 50ºS until 24 May 2018, then partial coverage between 24 and 29 May.
- SRAL operated:
  - in LRM Closed Loop mode from 8 May till 6 June 2018;
  - in SAR Closed Loop mode from 7 June till 14 June 2018;
  - in LRM Closed Loop mode from 14 June till 11 July 2018;
  - in SAR Open Loop mode from 11 July till 8 August 2018;
  - in SAR Closed Loop mode from 8 August till 5 September 2018;
  - in SAR Open Loop mode since 5 September 2018;
  - in SAR Closed Loop mode since 2 October 2018;
  - in SAR Open Loop mode since 27 November 2018.
- S3B satellite reached its final orbit on 23 November 2018.
- Note that the strategy of cycle numbering during the S3B drifting phase is that the cycle number is incremented at each major satellite manoeuvre. This results in very short cycles from Cycle 2 to Cycle 8. Between Cycle 9 (start of the tandem phase) and cycle 13 (end of tandem phase), the repeat cycles have the nominal duration of 27 days. Then, cycles 14 to 17 are also shorter than 27 days during the second drifting phase needed to reach the final orbit.
- Since 9th of November 2018, the Sentinel-3A and -3B MOE and POE orbit standards were upgraded to standard –F.
- Information about the updates of the Sentinel-3 OLTC tables is available on https://sentinel.esa.int/web/sentinel/user-guides/sentinel-3-altimetry/overview/oltc.
- Since 14th of June 2019, Sentinel-3B is switched to Open Loop Fixed Gain mode over the Svalbard Transponder.
- Since the 29th of June 2019, Sentinel-3A is switched to Open Loop Fixed Gain mode over the Svalbard Transponder.
- Between the 23rd of November and the 9th of May 2019, the Sentinel-3B navigation bulletin was derived from GNSS instrument. After this date it is derived from Doris instrument.


SARM Open Loop
SARM Closed Loop
LRM
Tandem flight
S3A
DORIS
DORIS + GPS
C031
C032
C033
08/05
25/05
29/05
06/06
07/06
14/06
11/07
C009
C010
S3B
DORIS
DORIS + GPS
DORIS
DORIS + GPS
First data
Manoeuvre to lower altitude
Start tandem
Start SARM CL C009 P192 13h50:53
End SARM CL C009 P391 14h09:32
Start SARM OL C010 P391 14h09:34
Tandem flight
S3A
DORIS + GPS
C034
C035
C036
C037
08/08
05/09
16/10
C011
C012
C013
S3B
DORIS + GPS
Start SARM CL C011 P420 ~14h
Start SARM OL C012 P447 ~13h
Warning: Passes 406 to 412 en LRM
End of tandem phase S3B drifting for 1 month
23/11: End of S3B drifting phase




## User Support

Questions about STM products can be asked to the Sentinel-3 User Support desk at:

eosupport@copernicus.esa.int

ops@eumetsat.int

## References


Sentinel-3 Mission Requirements Traceability Document (MRTD), C. Donlon, EOP-SM/2184/CD-cd, 2011

https://sentinel.esa.int/documents/247904/1848151/Sentinel-3-Mission-Requirements-Traceability

Product Data Format Specification – SRAL and MWR Level 1, Ref: S3IPF.PDS.003.1, Issue: 2.13, Date: 29/05/2020

https://sentinel.esa.int/web/sentinel/user-guides/sentinel-3-altimetry/document-library

Sentinel-3 Level 1b SRAL Algorithm Theoretical Baseline Definition, Ref: S3MPC.CLS.PBD.003, Issue: 1.1, Date: 01/07/2019

https://sentinel.esa.int/web/sentinel/user-guides/sentinel-3-altimetry/document-library


## Static ADFs List.

The following list is the complete list of static ADF used by the processors. Any change from the previous processing baseline is highlighted. A brief description of the role of each ADF in processing is in the product manifest.

**S3A/S3B Common:**

- S3__AX___CST_AX_20000101T000000_20991231T235959_20151214T120000_____MPC_O_AL_001.SEN3
- S3__SR___LSM_AX_20000101T000000_20991231T235959_20151214T120000_____MPC_O_AL_001.SEN3

**S3A:**

- S3A_SR_1_CONCAX_20160216T000000_20991231T235959_20171130T120000_____MPC_O_AL_003.SEN3
- S3A_SR_1_CONMAX_20160216T000000_20991231T235959_20180213T120000_____MPC_O_AL_007.SEN3
- S3A_SR___CHDRAX_20160216T000000_20991231T235959_20190402T120000_____MPC_O_AL_005.SEN3
- S3A_SR___CHDNAX_20160216T000000_20991231T235959_20200312T120000_____MPC_O_AL_006.SEN3

**S3B:**

- S3B_SR_1_CONCAX_20180425T000000_20991231T235959_20180409T120000_____MPC_O_AL_001.SEN3
- S3B_SR_1_CONMAX_20180425T000000_20991231T235959_20200703T120000_____MPC_O_AL_004.SEN3
- S3B_SR___CHDNAX_20180425T000000_20991231T235959_20200312T120000_____MPC_O_AL_005.SEN3
- S3B_SR___CHDRAX_20180425T000000_20991231T235959_20190402T120000_____MPC_O_AL_004.SEN3

***End of the Product Notice***