Copernicus Sentinel-3 Product Notice - STM L1 and L2 Marine

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Change Record

Version	***Date***	***DCR* No.*** *if applicable*	***Description of Changes***
1			Versions prior to 2 were relative to L2 only
2A	08/02/2022		For release PB 2.79-Marine (L2 + L1)
3	05/07/2022		For release SM__WAT.005.01 (L2 + L1)
3A	09/03/2023		For release SM__WAT.005.02 (L2 + L1)
3B	08/11/2023		For release SM__WAT.005.03 (L2)
3C	12/04/2024		For release SM__WAT.005.04 (L2)
3D	04/12/2024		For release SM__WAT.006.01 (L2 + L1)

****DCR = Document Change Request***

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1 INTRODUCTION

This document reports on any relevant change made to the Copernicus Sentinel-3 marine altimetry products quality. Usually there will be a new version of this document accompanying every new Processing Baseline (PB). A PB is the collection of an IPF (processor) version and a set static ADFs (auxiliary data).

1.1 Scope

This document addresses all altimeter users of the Copernicus Sentinel-3 marine altimetry products, SRAL/MWR both L1 and L2 for all timeliness (NRT, STC, NTC).

1.2 Applicable Documents

	Document Title	Reference	Current Version
AD-1	Product Data Format Specification - SRAL and MWR Level 2 Marine	EUM/SEN3/SPE/20/1191479	3E
AD-2	Product Data Format Specification - SRAL and MWR Level 1 (Marine)	EUM/SEN3/SPE/24/1413631	1
AD-3	Product Data Format Specification - SRAL and MWR Level 1 (Common)	S3IPF.PDS.003.1	i3r0

The applicable documents are public and can be obtained in the User Portal.

1.3 Resources

1.3.1 Data monitoring: cyclic and mission status reports

Cyclic reports (based on NTC data), are available at EUMETSAT's User Support Confluence Space.

User guides ("Handbooks") for Sentinel-3 level-1 and level-2 altimetry data are also available in the user portal.

1.3.2 User notification Service

The EUMETSAT User Notification Service (UNS) gives up-to-date information on scheduled maintenance outages, new product releases and enhancements, and service alerts when anomalies occur. To access the User Notification Service, go to https://uns.eumetsat.int/ ; users can subscribe to this service via the EUMETSAT's Earth Observation Portal.

1.4 Data Access

EUMETSAT data is accessible through the Earth Observation Portal (EOP):

- Access to the data involves an initial registration process: Register for data

The current available methods to access S3 data are:

- EUMETSAT Data Store (https://data.eumetsat.int)
  - NRT, STC and NTC (see details below)
- EUMETCast (https://eoportal.eumetsat.int)
  - NRT, STC (see details below)
- EUMETSAT Data Centre (https://eoportal.eumetsat.int)
  - NRT, STC and NTC (see details below)

Users wishing to access data via the data store API can find supporting examples in the EUMETSAT gitlab (https://gitlab.eumetsat.int/eumetlab/oceans/ocean-training/sensors/learn-sral/)

For questions concerning Sentinel-3 altimetry data and access please e-mail the EUMETSAT User Help Desk (ops@eumetsat.int).

Product	EUMETCast	Data Store	EUMETSAT Data Centre
L2 Marine Products *(SR_2_WAT)*	NRT STC	NRT STC NTC NTC Rep	NRT STC NTC
L1 Marine Products *(SR_1_SRA___, SR_1_SRA_BS, SR_1_SRA_A)*	NRT, STC (SR_1_SRA___ only)	NRT STC NTC NTC Rep	NRT STC NTC

DATASTORE COLLECTION	***DESCRIPTION***	***SENSING START AVAILABILITY***
EO:EUM:DAT:0415	SRAL Level 2 Altimetry Global (OPE)	2023-03-10
EO:EUM:DAT:0834	SRAL Level 2 Altimetry Global (REP:BC005)	2016-05-05
EO:EUM:DAT:0406	SRAL Level 1B (OPE)	2023-03-10
EO:EUM:DAT:0833	SRAL Level 1B (REP:BC005)	2016-05-05
EO:EUM:DAT:0414	SRAL Level 1B Stack Echoes (OPE)	2023-03-10
EO:EUM:DAT:0836	SRAL Level 1B Stack Echoes (REP:BC005)	2016-05-05
EO:EUM:DAT:0413	SRAL Level 1A Complex Echoes (OPE)	2023-03-10
EO:EUM:DAT:0835	SRAL Level 1A Complex Echoes (REP:BC005)	2016-05-05

The reprocessed dataset BC005 stops in 2023-03-09 (sensing time). More details about the reprocessing can be found here: https://user.eumetsat.int/news-events/news/release-of-sentinel-3-altimetry-marine-bc005-reprocessed-dataset. BC005 data on the OPE stream is available since 2023-03-09, for data with earlier sensing time it's recommended to use the REP stream.
The BC006 dataset will go into the same operational collections mentioned above. A reprocessing of the Sentinel-3 with BC006 is currently planned for 2025.

Please note that data processed with older versions of the Baseline Collection/Processing Baseline may still be available – **It is not recommended to use them if there is a newer version.**

1.5 Terminology

Acronyms and Abbreviations

Acronym/Abbr.	Explanation
ADF	Auxiliary Data File
IPF	Instrument Processing Facility (the processor)
BUFR	Binary Universal Form for the Representation of meteorological data
CAL1	Calibration type 1
L0, L1, L2	Level 0, Level 1, Level 2
MWR	Microwave Radiometer
NAVATT	Navigation Attitude (auxiliary file)
NetCDF	Network Common Data Form
NRT	Near Real Time
NTC	Non Time Critical
OPE	Operational processing platform
SRAL	Radar Altimeter on-board of S3
S3	Sentinel-3
SSB	Sea State Bias
SSHA	Sea Surface Height Anomaly
STC	Short Time Critical
SWH	Significant Wave Height

2 STATUS OVERVIEW

The quality of L2 marine products for the key SRAL/MWR parameters (corrected range, significant wave height, wind speed and wet tropospheric correction) is within the mission requirements.

The S3A/B dataset produced with SM__WAT.006.01 exhibit excellent stability w.r.t. the reference mission and can be recommend for long-term analysis and climate usage, same as previous baseline 005.

The data are produced within requirements also in terms of completeness and timeliness. In case of any satellite/instrument or data production/dissemination anomaly, the users can get the most up to date info via the User Notification Service (UNS) (see section 1.3.2).

Some known limitations on the mission dataset are described in the following sections.

The cyclic/quarterly/annual reports, reporting the data quality of the Sentinel-3 marine altimetry products are available at EUMETSAT's User Support space.

3 CURRENT PROCESSING BASELINE

3.1 Processors Version

The overall processing baseline is **SM__WAT.006.01.00**. This new PB naming convention, ensures the PBs within the same processing chain are continuous:

- **`SM__WAT.006.01.00`** (SRAL/MWR L2 Marine)
  - SRAL/MWR L2 IPF (SM-2): Version **07.11** + static ADFs (see 3.11)
- **`SR__L1M.006.01.00`** (SRAL L1 Marine)
  - SRAL L1 IPF (SR-1): Version **07.00** + static ADFs (see 3.11)
- **`MW__L1_.005.01.02`** (MWR L1 Global)
  - MWR L1 IPF (MW-1): Version **06.16** + static ADFs (see 3.11)

The first 7 characters refer to the processing chain/product type, followed by the Baseline Collection (3 digits), followed the processing baseline (2 digits, incremental), followed by patch number (2 digits, incremental). All the fields are separated by a decimal point. This information is now part of the products (both netcdf and manifest).

Unless specifically mentioned the usage of the SRAL/MWR L2 Marine PB name contains all the changes for both L1 and L2 and it is used to aggregate in a simplified way all changes, through this document.

3.2 Changes with respect to previous Processing Baseline

3.2.1 Detailed updates at Level 2 (SM__WAT.006.01 – v7.11)

- This new baseline is an evolutionary upgrade to the previous baseline. While there are no drastic changes to the geophysical retrievals with this version of the processing baseline, there are several evolutions that improve the products.

- **GDR-G standards** are introduced in this processing baseline, these are applicable to the SSHA computation (1 Hz / 20Hz, SAR/PLRM) . These same standards will be implemented by Sentinel-6 and Jason-3 on a very near future. The GDR-G standards include the following models:
  - Mean Sea Surface (solution 1): Hybrid MSS 2023: Scripps_CLS22, CNES_CLS22 and DTU21
    - https://doi.org/10.24400/527896/A01-2024.002
    - Impacted variables: `mean_sea_surf_sol1_[01 | 20_ku | 20_c]; mean_sea_surf_sol1_acc_[01 | 20_ku | 20_c]`
  - Mean Dynamic Topography: MDT HYBRID-CNES-CLS22-CMEMS2020
    - https://doi.org/10.24400/527896/a01-2024.010
    - Impacted variables: `mean_dyn_topo_01 ; mean_dyn_topo_acc_01`
  - Ocean Tide Model (solution 2): FES2022B
    - https://doi.org/10.24400/527896/A01-2024.004

        - Impacted variables: `ocean_tide_sol2_01 ; ocean_tide_non_eq_01 ; load_tide_sol2_01; ocean_tide_total_sol2_20_ku`
    - Mean Sea Surface (solution 2): DTU21
        - https://doi.org/10.5194/essd-15-4065-2023
        - No change, was already present in the product.
- **20Hz variables improvements**. In this release several variables linked to SAR SSHA were introduced in the products at 20Hz, these were also calculated (in most cases) natively at 20Hz (See section 3.6 for details):
        - `pole_tide_20_ku ;`
        - `internal_tide_sol1_20_ku`
        - `solid_earth_tide_20_ku`
        - `ocean_tide_total_sol2_20_ku`
        - `dyn_atm_cor_20_ku`
        - `mod_dry_tropo_cor_zero_altitude_20_ku`
        - `mod_wet_tropo_cor_zero_altitude_20_ku`
        - `iono_cor_alt_filtered_20_ku`
        - `sea_state_bias_20_ku`
        - `rad_wet_tropo_cor_20_ku`
        - `gpd_wet_tropo_cor_20_ku`
        - `geoid_20_ku`
        - `iono_cor_gim_20_ku`
        - `quality_ssha_20_ku`
- **Improved product usability**:
    - Updates at 1 Hz:
        - **Manoeuvre flag at 1Hz** was added and combines the current 20Hz flags for manoeuvre presence, manoeuvre thrust, and manoeuvre plane flags into one single 1Hz flag. See section 3.7 for details: `manoeuvre_flag_01`.
        - The **quality flags** for SWH and Wind Speed (1- and 2-parameter) variables were improved including the SWH RMS thresholds, see section 3.8 for more details on this technique. Information on the criteria used to determine SWH and Wind Speed (1- and 2-parameter) quality flags at 1 Hz are provided in section 3.9.2:
            - `quality_swh_ocean_01_ku`
            - `quality_swh_ocean_01_plrm_ku`
            - `quality_wind_speed_alt_01_ku`
            - `quality_wind_speed_alt_01_plrm_ku`
            - `quality_wind_speed_alt_2p_01_ku`
            - `quality_wind_speed_alt_2p_01_plrm_ku`
        - The manoeuvre flags are now accounted for in the quality flags for SSHA, more details on these quality flags is provided in section 3.9.1:
            - `quality_ssha_01_ku`
            - `quality_ssha_01_plrm_ku`

- **Anomalies fixed**: There were two anomalies fixed with the release, one on ‘`thermal_noise_ocean_20_ku`’ and another on ‘`total_electron_content_01`’ fields. See more details in the section 3.3.

3.2.2 Detailed updates at Level 1 (SR_L1M.006.01 and MW_L1_.005.02)

The **SRAL L1** products are now generated using Range Walk CZT correction in all timeliness (NRT/STC/NTC). This is equivalent to the Range Walk DFT algorithm that up to now was only present in NTC timeliness, but less computationally heavy. The SAR waveforms in the L1 are changed because of this correction. At Level2 the most visible impacts this will improve the SWH in NRT/STC, aligning it to the one in NTC.

Also to support the expert users to get the most of the L1 dataset the following variables were added L1B product (SR_1_SRA___):

- `max_loc_stack_l1b_echo_sar_ku`
- `noise_stack_l1b_echo_sar_ku`.

The **MWR processor** was updated to the latest software library versions, without any impact on the internal MWR products, thus the minor version increase.

3.2.3 Geophysical retrievals impact

The main geophysical retrievals (Sea Level Anomaly, Wind & Waves) are slightly changed by this update.

For SAR S3A/B NTC there are no differences in SWH and Winds and the SSHA is increased by a mean value of 3.5mm (mostly due to updated models and different range walk correction).
For SAR S3A/B NRT/STC and the SSHA is increased by a mean value of 2.5mm (mostly due to updated models and different range walk correction). The Winds and Waves have a residual mean change but there are regional differences because of the impact of the newly applied range walk correction.

The impact of the new processing baseline can be seen mostly in vicinity of coasts, with improved 20 Hz SSHA on SAR Ku band.

The wet tropospheric correction mean values were not modified by this release.

3.3 Anomalies or limitations closed since the last product notice

Anomaly ID	Title	Closure PB
EUM/Sen3/AR/8565	Error in thermal noise in SAMOSA retracker	SM__WAT.006.01
EUM/Sen3/AR/8632	Error in total electron content	SM__WAT.006.01

Anomaly EUM/Sen3/AR/8565 – Error in thermal noise in SAMOSA retracker

- An error was discovered in computation of thermal noise in SAMOSA retracker (SAR), as the de-normalization of the thermal noise is not corrected. This issue has no impact on the retracking as it's just changing the scaling after the retracking stage to write it on the products. With this fix, the following variable was affected: `thermal_noise_ocean_20_ku`

Affects: all data processed with BC005.02, BC005.03, and BC005.04
Resolved: in the current operational dataset with BC006.01.

Anomaly EUM/Sen3/AR/8632 – Error in Total Electron Content (TEC)

- The problem was a presence of high frequency noise in Total Electron Content (TEC) variable (`total_electron_content_01`). This problem was due to a usage of unfiltered dual-frequency ionospheric correction as input rather than the filtered time series. We updated the IPF SM2 processor to use the filtered dual-frequency ionospheric correction as input instead of the unfiltered one. This resolves high frequency noise in the total electron content. Additionally, a TEC fraction was also missing in the mathematical equation and is now added. The latter was needed to correct for a shift. With this fix, the following variable was affected: `total_electron_content_01`

Affects: all data processed with BC005.02, BC005.03, and BC005.04
Resolved: in the current operational dataset with BC006.01.

3.4 New anomalies open since last product notice

None.

3.5 Other open anomalies or known limitations

Anomaly "EUM/Sen3/AR/8353 – S3A/B MWR behaviour for 36.5 GHz channel"
Monitoring had shown different behaviour between ascending and descending passes for 36.5 GHz channel. Unlike the 23.8 GHz channel issue, previously fixed, this one does not seem to be linked to the thermal impact of the OLCI duty cycle. The issue with the 36.5 GHz channel is currently under investigation as up to 0.3 K differences can be observed between ascending and descending passes.
Affects: MWR L1 and SRAL/MWR L2 data starting late 2021.

Notice #6 – Some geophysical flags have not been tuned for Sentinel-3

Some geophysical flags were derived from the Envisat mission and have not been tuned for Sentinel-3: rain flag and ocean/sea ice flag.

Notice #14 – Bad handling of _FillValue for the field swh_ocean_20_plrm_ku ("EUM/Sen3/NCR/3971")

The field *swh_ocean_20_plrm_ku* is is affected by numerical overflow (i.e. padded to _FillValue) when it takes values above 32.767 m.
This issue is expected to remain like this for the near future.

Notice #15 - KREMS safe zone (Pacific Ocean) ("EUM/Sen3/AR/5239")
The KREMS safe zone corresponds to a zone of the globe where the radiometer (MWR) is disabled and thus there is no wet tropospheric correction available from the radiometer, causing the SSHA to be set to a default value. Users interested in having SSHA in this area are advised to recalculate SSHA with the ECMWF wet tropo correction (*mod_wet_tropo_cor_zero_altitude_01*) instead of the radiometer one (*rad_wet_tropo_cor_01_ku*). For SM__WAT.005.01 onwards (NTC only) GPD+ Wet Tropo correction can also be used.
The area of the safe zone around the KREMS radar facility has changed since the beginning of the Mission (S3A/S3B) as follows:

- From the beginning of S3A Mission until 2019-01-17 it was defined as a circular area of about 25 km, radius;
- From 2019-01-17 until 2019-05-28, the zone has been enlarged to 300 km to avoid any damage to the MWR instrument;
- From 2019-05-28 onwards, the zone has a radius of 100 km around the KREMS radar facility.
- This exclusion area is expected to remain like this for the near future.

Notice #17 – Jitter Noise on top of the sea level at sea-ice leads ("SIIIMPC-3816")

Since the zero-padding is not applied when building the waveform after range FFT, the sea level features a significant level of jitter noise at sea-ice leads

This issue should be tackled when dedicated L1 processing for sea level in the sea ice leads is available, expected for 2024/2025 timeframe.

Notice #19 - EUM/Sen3/AR/4760 – Differences between COR2 and Orbital Altitude Rate

The COR2 calculated on-board (range_rate_l1b_echo_sar_ku) and the orbital altitude rate (orb_alt_rate_l1b_echo_sar_ku) calculated from the precise orbits are different. The differences show an anomalous cosin(lat) pattern in open-loop. The COR2 is less precise than the precise orbits. This difference that can imply about +/-0.5mm error in PLRM for range and +/-0.25cm for SWH. This impacts PLRM data acquired in Open Loop only, as it impacts the pulse alignment.
Affects: All SRAL L1 + L2 PLRM data
This issue is expected to remain like this for the foreseeable future.

3.5.1 Time-Limited product degradation

The following anomalies are product degradations clearly delimited in time, when possible, it is intended that these will be solved in the next reprocessing.

Anomaly "EUM/Sen3/NCR/3403" – Issue in range positioning the SAR waveform at Greenwich Meridian
A few 20-Hz geophysical measurements (range, wave height and sigma nought) are systematically padded to _FillValue at Greenwich meridian cross in SAR and PLRM mode. This issue is related to an issue in the OLTC on board of S3A. This affects some 20-Hz measurements crossing the meridian, but it is not enough to invalidate the 1-Hz data. It affects about 21 seconds of data per cycle.
Affects: L2 SRAL NRT/STC/NTC before 18/12/2017 (**corrected** for data after this date)

Notice #2 - MWR parameters not computed due to MWR calibration over open ocean
During MWR calibrations over open ocean, the brightness temperatures for both channels are not computed and set to default values in the product. As a consequence, 1-Hz parameters derived from the MWR are set to default values, except for the atmospheric attenuation. This affects the wet tropospheric correction, water vapour content, and cloud liquid water content.
Corrected since 01/03/2018 (sensing time) for S3A, and 25/05/2018 (sensing time) for S3B, previous data processed may exhibit the issue.

Anomaly "AR EUM/Sen3/AR/8383 - Missing ANX information"

- From the period 2023/11/20 to 2023/12/12 (creation date) the first products of the day (sensing time) had missing ANX information in the manifest and netcdf. The issue is no longer happening and in future reprocessing this will be fixed for the impacted period.

Affects: NTC data created between 2023/11/20 to 2023/12/12
Resolved: NTC data produced after 2023/12/12.

3.6 New 20 Hz variables

As from processing baseline SM__WAT.006.01.00, all 20 Hz corrections that are involved in construction of sea surface height anomalies on SAR Ku band are computed and added to SR_2_WAT___ products. Additionally, the same is done for some other variables, namely, geoid height and GIM ionospheric correction and model wet tropo correction. In doing so, one of the following four methods are used:

- Replication (copying) from 1 Hz counterpart variables
- Linear interpolation from adjacent 1 Hz counterpart variables
- Spline interpolation from adjacent 1 Hz counterpart variables
- Truth: computation from input geophysical models and/or auxiliary data at 20Hz

The method-of-choice has been determined per variable by analysing results quality and considering processing time of an operational mission.

Table 1 – L2 20 Hz variables newly added and computation method used:

Variable	Method-of-choice
pole_tide_20_ku	Truth
internal_tide_sol1_20_ku	Truth
solid_earth_tide_20_ku	Truth
ocean_tide_total_sol2_20_ku	Truth
mod_dry_tropo_cor_zero_altitude_20_ku	Spline interpolation
iono_cor_alt_filtered_20_ku	Spline interpolation
gpd_wet_tropo_cor_20_ku	Spline interpolation
sea_state_bias_20_ku	Linear interpolation
rad_wet_tropo_cor_20_ku	Linear interpolation
dyn_atm_cor_20_ku	Truth
geoid_20_ku	Truth
iono_cor_gim_20_ku	Truth
mod_wet_tropo_cor_zero_altitude_20_ku	Spline interpolation

3.7 New manoeuvre flag at 1Hz

The manoeuvre flag is now computed at 1 Hz (manoeuvre_flag_01). It combines three manoeuvres flags at 20Hz flags: manoeuvre presence flag (`flag_man_pres_20_ku`), manoeuvre thrust flag (`flag_man_thrust_20_ku`), and manoeuvre plane flag (`flag_man_plane_20_ku`), into one single flag (as long as one of the 20Hz is affected, so it's the 1Hz):

Table 2 – Manoeuvre Flag 1 Hz

manoeuvre_flag_01	Expected Degradation	flag_man_pres_20_ku	flag_man_plane_20_ku	flag_man_thrust_20_ku
0	No	0	-	-
10	No	1	0	0
11	No	1	0	1
20	**Yes**	1	1	0
21	**Yes**	1	1	1

3.8 Usage of SWH RMS threshold as editing criteria

As part of a study performed by the Copernicus Altimetry Services (COPAS): https://www.eumetsat.int/copernicus-altimetry-services-copas, Ifremer has prepared a set of look-up-tables (LUT) that take into account the RMS of the SWH to set dynamic thresholds for spurious SWH rejection, more details can be found here https://www.eumetsat.int/media/52329, the following image is an extract of the report.

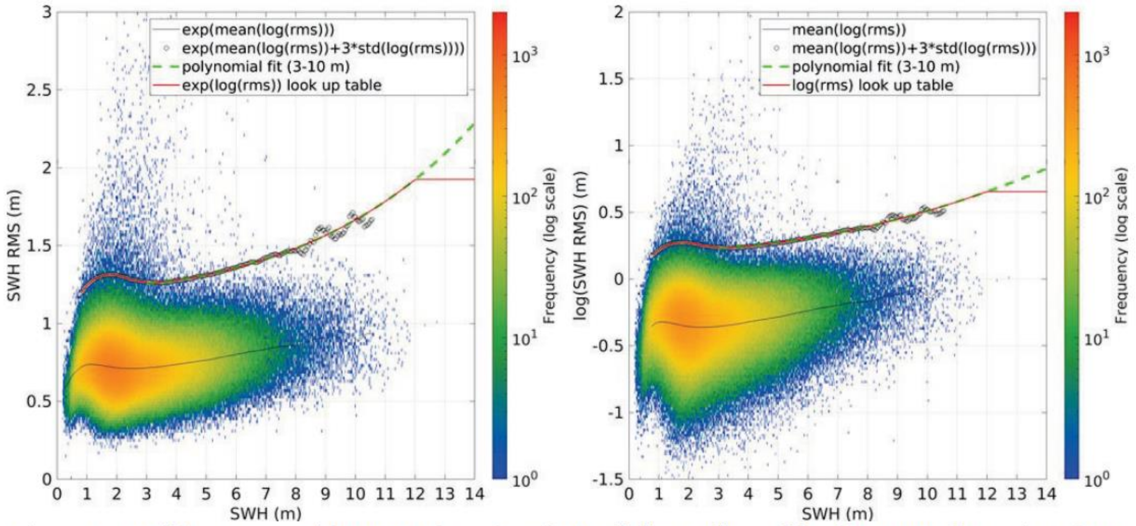

Figure 1: 2D histograms of SWH RMS against SWH (left panel), and log(SWH RMS) against SWH (right panel) using S3A PLRM measurement during cycle 27. The thin black line represents the mean SWH RMS. The black circles represents the upper statistical thresholds for detecting SWH RMS outliers. The thick green line represents the second-order polynom fitted through the thresholds for SWH comprised between 3-10m. The thin red line represents the SWH LUT obtained for this dataset. Statistics are computed over 0.5m-wide SWH bins shifted every 0.05m. No statistics are computed for bins with less than 100 values.

Since SM_WAT.006.01 these LUTs, one for SAR another for PLMR, are used in the generation of the quality flag.

3.9 Quality flags for SSHA, SWH, and Wind Speed

This section provides the lists of criteria used in determining quality flags at 1 Hz for sea surface height anomaly (SSHA), ocean significant wave height (SWH) and wind speed (for both 1- and 2-parameter variables) on both SAR and PLRM. It also provides the list of criteria used in determining quality flags for SSHA at 20 Hz on SAR.

SAR variables use SAR Wind/SWH/Range, etc., PLRM variables use PLRM Wind/SWH/Range, etc. By default, the Wind Speed used is the 1 parameter version.

3.9.1 Quality flags for SSHA (1 Hz)

Quality flags for SSHA are created at 1 Hz on both SAR and PLRM, for each 1 Hz measurement. They are determined based on the set of criteria given in table below. The intervals are two-sided in most cases. In a few cases, they are one-sided. They are all closed, except for the one related to the manoeuvre flag:

Table 3 – Quality flags for SSHA at 1 Hz on SAR and PLRM

Variable	Minimum	Maximum	Valid value
Sea surface height	-130 m	100 m	-
Sea surface height anomaly	-2 m	2 m	-
Standard deviation of range	0 m	SAR	-
		0.12 m + 0.02 × SWH m	
		PLRM	
		0.2 m	
Number of valid measurements of range	10	-	-
Dry tropospheric correction	-2.5 m	-1.9 m	-
Dynamic atmospheric correction	-2 m	2 m	-
Wet tropospheric correction	-0.5 m	-0.001 m	-
Sea state bias	-0.5 m	0 m	-
Standard deviation of backscatter coefficient	0 dB	SAR	-
		0.7 dB	
		PLRM	
		1 dB	
Ocean tide (solution 2)	-5 m	5 m	-
Earth tide	-1 m	1 m	-
Pole tide	-15 m	15 m	-
Backscatter coefficient	5 dB	28 dB	-
Significant wave height	0 m	15 m	-
Filtered ionospheric correction	-0.4 m	0.04 m	-
Orbit type	3	-	-

Manoeuvre flag	-	20	-
Open sea ice flag	-	-	0 or 5
Wind speed (1-parameter)*****	0 m/s	30 m/s	-

3.9.2 Quality flags for SWH and Wind Speed

Quality flags for SWH and Wind Speeds are created at 1 Hz on both SAR and PLRM, for each 1 Hz measurement. They are determined based on the set of criteria given in table below. The intervals are two-sided in most cases. In a few cases, they are one-sided. They are all closed intervals:

Table 4 – Wind and Waves quality flags

Variable	Minimum	Maximum	Valid value
Surf class flag	-	-	0 or 2
Significant wave height	0 m	30 m	-
Backscatter coefficient	5 dB	28 dB	-
Sea surface height	-130 m	100 m	-
Standard deviation of backscatter coefficient	0 dB	SAR	-
		0.7 dB	
		PLRM	
		1 dB	
Standard deviation of range	0 m	SAR	-
		0.12 m + 0.02 × SWH m	
		PLRM/	
		0.2 m	
Number of valid measurements of SWH	18	-	-
RMS of SWH	-	Section 3.8	-
Open sea ice flag	-	-	0 or 5
Altimeter Wind speed*****	0 m/s	30 m/s	-

*Wind speed used:

Table 5 – Wind Speed used for each of the quality flags

Quality Flag	**Wind used**
quality_swh_ocean_01_ku	wind_speed_alt_01_ku
quality_swh_ocean_01_plrm_ku	wind_speed_alt_01_plrm_ku
quality_wind_speed_alt_01_ku	wind_speed_alt_01_ku
quality_wind_speed_alt_01_plrm_ku	wind_speed_alt_01_plrm_ku
quality_wind_speed_alt_2p_01_ku	wind_speed_alt_2p_01_ku
quality_wind_speed_alt_2p_01_plrm_ku	wind_speed_alt_2p_01_plrm_ku
quality_ssha_01_ku	wind_speed_alt_01_ku
quality_ssha_01_plrm_ku	wind_speed_alt_01_plrm_ku

3.9.3 Quality flags for SAR SSHA at 20 Hz

Quality flags for SSHA are created at 20 Hz on SAR for each 20 Hz measurement. They are determined based on the set of criteria given in table below. The intervals are two-sided in most cases. The values used in the flags are calculated internally at 20Hz. In a few cases, they are one-sided. They are all closed, except for the one related to the manoeuvre flag:

Table 6 – Quality flags for SAR SSHA at 20 Hz

Variable	Minimum	Maximum	Valid value
Sea surface height	-130 m	100 m	-
Sea surface height anomaly	-2 m	2 m	-
Dry tropospheric correction	-2.5 m	-1.9 m	-
Dynamic atmospheric correction	-2 m	2 m	-
Wet tropospheric correction	-0.5 m	-0.001 m	-
Sea state bias	-0.5 m	0 m	-
Ocean tide (solution 2)	-5 m	5 m	-
Earth tide	-1 m	1 m	-
Pole tide	-15 m	15 m	-
Backscatter coefficient	5 dB	28 dB	-
Significant wave height	-0.5 m	15 m	-
Filtered ionospheric correction	-0.4 m	0.04 m	-
Orbit type	3	-	-
Manoeuvre flag	-	20	-
Open sea ice flag	-	-	0 or 5

3.10 Bias and other internal processing information

This section contains details on the systematic bias applied in the processing (usually at Level 2) that are needed for the certain models (like Wind speed or SSB), or for range based on cal/val or to account for Range Walk processing in L1 NTC and not NRT/STC. A mean value bias is applied in NRT/STC to mimic the Range Walk effect from NTC processing.
These details may be relevant to know for expert users that are trying to do their own processing.

In the following tables, the current bias is shown in blue, the remaining values, in grey, present for historical information.

Since SM__WAT.005.02 all the following bias can be seen on the global attributes of SR_2_WAT NetCDF products. These attributes read as follows per SM__WAT.006.01:

```
:system_bias_range_lrm_plrm_ku_added = 0.02725 ;
:system_bias_range_lrm_c_added = 0.035 ;
:system_bias_range_sar_added = 0. ;
:system_bias_swh_lrm_plrm_ku_added = 0. ;
:system_bias_swh_lrm_c_added = 0. ;
:system_bias_swh_sar_added = 0. ;
:system_bias_sig0_lrm_plrm_ku_added = -1.58 ;
:system_bias_sig0_lrm_c_added = 0.223 ;
:system_bias_sig0_sar_added = -0.425 ;
:algo_bias_wind_speed_sig0_sar_ku_added = -0.0413 ;
:algo_bias_wind_speed_2p_sig0_sar_ku_added = 2.744 ;
:algo_bias_wind_speed_2p_swh_sar_ku_added = 0. ;
:algo_bias_wind_speed_sig0_plrm_ku_added = -0.0382 ;
:algo_bias_wind_speed_2p_sig0_plrm_ku_added = 2.7525 ;
:algo_bias_wind_speed_2p_swh_plrm_ku_added = 0. ;
```

3.10.1 Sigma0 bias

The Ku-band sigma0 in all modes (LRM, PLRM and SAR) has been biased to be aligned with the mean value for Envisat (10.8 dB without the atmospheric attenuation). The sigma0 present in the products is corrected for attenuation, since PB 2.24. Beginning from SM__WAT.006.01.00/SR__L1M.006.01.00, Range Walk process has been applied to all three timeliness's. Therefore, beginning with SM__WAT.006.01.00/SR__L1M.006.01.00, sigma0 bias value is the same for all three timeliness's per SAR Ku band, too.

Table 7 – S3A Applied Level 2 sigma0 bias, w.r.t. to L1 processing.

<table>
<tr><th rowspan="2">S3A Processing Baseline
Sigma0</th><th colspan="2">SAR (Ku Band)</th><th colspan="2">PLRM/LRM</th></tr>
<tr><th>NRT/STC</th><th>NTC</th><th>Ku Band (NRT/STC/NTC)</th><th>C Band (NRT/STC/NTC)</th></tr>
<tr><td>2.61 <= PB <= 2.79</td><td colspan="2">-0.65 dB</td><td>-1.80 dB</td><td>+0.09 dB</td></tr>
<tr><td>SM__WAT.005.01</td><td colspan="2">-0.461 dB</td><td>-1.631 dB</td><td rowspan="3">+0.223 dB</td></tr>
<tr><td>>= SM__WAT.005.02 < SM__WAT.006.01</td><td>-0.42252 dB</td><td>-0.425 dB</td><td rowspan="2">-1.580 dB</td></tr>
<tr><td>>= SM__WAT.006.01</td><td colspan="2">-0.425 dB</td></tr>
</table>

Table 8 – S3B Applied Level 2 sigma0 bias, w.r.t. to L1 processing.

<table>
<tr><td rowspan="2">S3B Processing Baseline
Sigma0</td><td colspan="2">SAR (Ku Band)</td><td colspan="2">PLRM/LRM</td></tr>
<tr><td>NRT/STC</td><td>NTC</td><td>Ku Band (NRT/STC/NTC)</td><td>C Band (NRT/STC/NTC)</td></tr>
<tr><td>2.61 <= PB <= 2.79</td><td colspan="2">-0.68 dB</td><td rowspan="2">- 1.87 dB</td><td>+0.09 dB</td></tr>
<tr><td>SM__WAT.005.01</td><td colspan="2">-0.532 dB</td><td rowspan="3">+ 0.207 dB</td></tr>
<tr><td>>= SM__WAT.005.02 < SM__WAT.006.01</td><td>-0.5266 dB</td><td>- 0.530 dB</td><td rowspan="2">-1.740 dB</td></tr>
<tr><td>>= SM__WAT.006.01</td><td colspan="2">-0.530 dB</td></tr>
</table>

3.10.1.1 Wind Speed Bias

Starting with SM__WAT.005.02, the Altimeter Wind Speed derived from 1 parameter (sigma0) or from 2 parameters (sigma0 and SWH) have had their own specific bias values. The values for this bias are also reported on the global attributes of the L2 water products. These bias values remain unchanged in SM__WAT.006.01.00/SR__L1M.006.01.00.

Table 9 – S3A Wind Speed bias (1p)

S3A Processing Baseline *WS 1p: Sigma0*	*SAR (Ku Band)*	*PLRM/LRM (Ku Band)*
	NRT/STC/NTC	***NRT/STC/NTC***
>= SM__WAT.005.02	-0.0413 dB	-0.0382 dB

Table 10 – S3B Wind Speed bias (1p)

Processing Baseline (S3B) *WS 1p: Sigma0*	*SAR (Ku Band)*	*PLRM/LRM (Ku Band)*
	NRT/STC/NTC	***NRT/STC/NTC***
>= SM__WAT.005.02	-0.0008 dB	+ 0.02795 dB

Table 11 – S3A Wind Speed bias (2p)

Processing Baseline (S3A) *WS 2p: Sig0, SWH*	*SAR (Ku Band)*	*PLRM/LRM (Ku Band)*
	NRT/STC/NTC	***NRT/STC/NTC***
>= SM__WAT.005.02	Sig0: 2.744 dB SWH: 0.0 m	Sig0: 2.7525 dB SWH: 0.0 m

Table 12 – S3B Wind Speed bias (2p)

Processing Baseline (S3B) *WS 2p: Sig0, SWH*	*SAR (Ku Band)*	*PLRM/LRM (Ku Band)*
	NRT/STC/NTC	***NRT/STC/NTC***
>= SM__WAT.005.02	Sig0: 2.7735 dB SWH: 0.0 m	Sig0: 2.8071 dB SWH: 0.0 m

3.10.2 Range bias

Starting from SM__WAT.006.01.00/SR__L1M.006.01.00, the Range Walk process has been applied to all three timeliness's. Thus, as from SM__WAT.006.01.00/SR__L1M.006.01.00, range bias value is the same for all three latencies. Before, starting with SM__WAT.005.01/SR__L1M.005.00, there have been different bias values being applied for NRT/STC and NTC timeliness. Only in NTC, we used to have the Range Walk process being applied at L1 data. Thus, the NRT/STC data used to be biased to the mean values of the NTC. per SAR Ku band, too.

Table 13 – S3A Applied Level 2 range bias, w.r.t. to L1 processing.

<table>
<tr><th rowspan="2">S3A Processing Baseline Range</th><th colspan="2">SAR (Ku Band)</th><th colspan="2">PLRM/LRM</th></tr>
<tr><th>NRT/STC</th><th>NTC</th><th>Ku Band (NRT/STC/NTC)</th><th>C Band (NRT/STC/NTC)</th></tr>
<tr><td>2.61 <= PB <= 2.79</td><td colspan="2">+ 2 mm</td><td rowspan="2">+2 mm</td><td rowspan="2">+2.5 mm</td></tr>
<tr><td>SM__WAT.005.01</td><td>+12 mm</td><td>+2 mm</td></tr>
<tr><td>>= SM__WAT.005.02 < SM__WAT.006.01</td><td>+ 10.5 mm</td><td>0 mm</td><td rowspan="2">+ 27.25 mm</td><td rowspan="2">+35 mm</td></tr>
<tr><td>>= SM__WAT.006.01</td><td colspan="2">0 mm</td></tr>
</table>

Table 14 – S3B Applied Level 2 range bias, w.r.t. to L1 processing.

<table>
<tr><th rowspan="2">S3B Processing Baseline Range</th><th colspan="2">SAR (Ku Band)</th><th colspan="2">PLRM/LRM</th></tr>
<tr><th>NRT/STC</th><th>NTC</th><th>Ku Band (NRT/STC/NTC)</th><th>C Band (NRT/STC/NTC)</th></tr>
<tr><td>2.61 <= PB <= 2.79</td><td colspan="2">-9 mm</td><td>- 9 mm</td><td>+ 8.5 mm</td></tr>
<tr><td>SM__WAT.005.01</td><td>+ 4 mm</td><td rowspan="3">0 mm</td><td>0 mm</td><td>+ 60 mm</td></tr>
<tr><td>>= SM__WAT.005.02 < SM__WAT.006.01</td><td>+ 3.7 mm</td><td rowspan="2">+28 mm</td><td rowspan="2">+78.5 mm</td></tr>
<tr><td>>= SM__WAT.006.01</td><td>0 mm</td></tr>
</table>

3.10.3 SWH bias

Since SM__WAT.005.01/SR__L1M.005.00 the Range Walk process had been applied in NTC, only. For that reason, since SM__WAT.005.01/SR__L1M.005.00 the mean values of SWH had to be adjusted in NRT/STC to keep them consistent, at mean level. Beginning with SM__WAT.006.01.00/SR__L1M.006.01.00, the Range Walk process has been applied at L1 data for all three timeliness's. Thus, as from SM__WAT.006.01.00/SR__L1M.006.01.00, SWH bias value is the same for all three timeliness's. Those bias values are currently set to zero.

Table 15 – S3A Level 2 Significant Wave Height (SWH) bias applied

<table>
<tr><td rowspan="2">S3A Processing Baseline
SWH</td><td colspan="2">SAR (Ku Band)</td><td colspan="2">PLRM/LRM</td></tr>
<tr><td>NRT/STC</td><td>NTC</td><td>Ku Band (NRT/STC/NTC)</td><td>C Band (NRT/STC/NTC)</td></tr>
<tr><td>2.61 <= PB <= 2.79</td><td colspan="2">0 mm</td><td rowspan="4">0 mm</td><td rowspan="4">0 mm</td></tr>
<tr><td>SM__WAT.005.01</td><td>-60 mm</td><td rowspan="3">0 mm</td></tr>
<tr><td>>= SM__WAT.005.02 < SM__WAT.006.01</td><td>-63 mm</td></tr>
<tr><td>>= SM__WAT.006.01</td><td>0 mm</td></tr>
</table>

Table 16 – S3B Level 2 Significant Wave Height (SWH) bias applied

<table>
<tr><td rowspan="2">S3B Processing Baseline
SWH</td><td colspan="2">SAR (Ku Band)</td><td colspan="2">PLRM/LRM</td></tr>
<tr><td>NRT/STC</td><td>NTC</td><td>Ku Band (NRT/STC/NTC)</td><td>C Band (NRT/STC/NTC)</td></tr>
<tr><td>2.61 <= PB <= 2.79</td><td colspan="2">0 mm</td><td rowspan="4">0 mm</td><td rowspan="4">0 mm</td></tr>
<tr><td>SM__WAT.005.01</td><td>-55 mm</td><td rowspan="3">0 mm</td></tr>
<tr><td>>= SM__WAT.005.02 < SM__WAT.006.01</td><td>-60 mm</td></tr>
<tr><td>>= SM__WAT.006.01</td><td>0 mm</td></tr>
</table>

3.10.4 Calibration

It has been identified that SRAL calibrations are noisy, an averaging strategy has been implemented:

- Ku/C-Band CAL1 power/delay averaged over 10 days, using Centre of Gravity (Cog) method, starting with SM__WAT.005.01/SR__L1M.005.00. Previous PBs used the half-power method.
- Ku CAL2 averaged over 90 days (27 days prior to PB-2.79M), using normalization by mean plateau, starting with SM__WAT.005.01/SR__L1M.005.00. Previous PBs used the normalization by maximum method.
- Ku CAL2 is used by C-Band processing, due to noise in C-Band CAL2
- CAL2 is **not** applied to CAL1 starting with SM__WAT.005.01/SR__L1M.005.00. Previous PBs applied CAL2 to CAL1.
- Autocal sequences were updated in the on-ground processing as part of PB 2.72 (L1)

>= SM__WAT.005.01/SR__L1M.005.00	**Average window on-ground**	**Method**
CAL1 range correction (Ku-band)	Previous 10 days	CoG
CAL1 range correction (C-band)	Previous 10 days	Half-Power
CAL2 applied to CAL1		No
CAL2 applied to Ku-band science data		Ku
CAL2 applied to C-band science data		Ku
CAL2	Previous 90 days	Mean Plateau

3.10.5 Processing details

Antenna beam-width values used in the processing of L1 data are the following:

- 1.34 deg for S3A SRAL
- 1.33 deg for S3B SRAL

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

3.11 Static Auxiliary Data Files (ADFs)

The following list is the complete list of <u>static</u> ADF used by the processors. Any change from the previous processing baseline is highlighted in red. A new ADF type is highlighted in blue. A brief description of the role of each ADF in processing is available in the product manifest.

<u>SRAL/MWR L2 Common</u>

```
S3__SR_2_CP00AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_CP06AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_CP12AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_CP18AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_EOT1AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_EOT2AX_20160216T000000_20991231T235959_20240910T000004___________________EUM_O_AL_004.SEN3
S3__SR_2_FLT_AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_GEO_AX_20160216T000000_20991231T235959_20220707T000003___________________EUM_O_AL_003.SEN3
S3__SR_2_LNEQAX_20160216T000000_20991231T235959_20240910T000004___________________EUM_O_AL_004.SEN3
S3__SR_2_LRC_AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_LT1_AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_LT2_AX_20160216T000000_20991231T235959_20240910T000004___________________EUM_O_AL_004.SEN3
S3__SR_2_LUTEAX_20160216T000000_20991231T235959_20170713T120000___________________MPC_O_AL_002.SEN3
S3__SR_2_LUTFAX_20160216T000000_20991231T235959_20170713T120000___________________MPC_O_AL_002.SEN3
S3__SR_2_LUTSAX_20160216T000000_20991231T235959_20240910T000004___________________EUM_O_AL_004.SEN3
S3__SR_2_MAG_AX_20160216T000000_20991231T235959_20170811T140000___________________MPC_O_AL_002.SEN3
S3__SR_2_MDT_AX_20160216T000000_20991231T235959_20240910T000004___________________EUM_O_AL_004.SEN3
S3__SR_2_MLM_AX_20160216T000000_20991231T235959_20231118T120000___________________MPC_O_AL_005.SEN3
S3__SR_2_MSMGAX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_MSS1AX_20160216T000000_20991231T235959_20240910T000006___________________EUM_O_AL_006.SEN3
S3__SR_2_MSS2AX_20160216T000000_20991231T235959_20240910T000005___________________EUM_O_AL_005.SEN3
S3__SR_2_ODLEAX_20160216T000000_20991231T235959_20170322T120000___________________MPC_O_AL_002.SEN3
S3__SR_2_RET_AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_RRC_AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_S1AMAX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_S1PHAX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_S2AMAX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_S2PHAX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SD01AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SD02AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SD03AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SD04AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SD05AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SD06AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SD07AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SD08AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SD09AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SD10AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SD11AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SD12AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SET_AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SFL_AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SHD_AX_20160216T000000_20991231T235959_20210425T000003___________________EUM_O_AL_003.SEN3
S3__SR_2_SHA_AX_20160216T000000_20991231T235959_20210425T000002___________________EUM_O_AL_002.SEN3
S3__SR_2_SI01AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SI02AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SI03AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SI04AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SI05AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SI06AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SI07AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SI08AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SI09AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SI10AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SI11AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SI12AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SIGLAX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SIGSAX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SSM_AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SST_AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_SURFAX_20160216T000000_20991231T235959_20161010T120000___________________MPC_O_AL_002.SEN3
S3__SR_2_WNDLAX_20160216T000000_20991231T235959_20220824T120003___________________EUM_O_AL_003.SEN3
S3__SR_2_WNDSAX_20160216T000000_20991231T235959_20220824T120003___________________EUM_O_AL_003.SEN3
S3__AX___CST_AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3__SR___LSM_AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
```

SRAL/MWR L2 S3A

S3A_SR_2_CCT_AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3A_SR_2_IC01AX_20160216T000000_20991231T235959_20161010T120000___________________MPC_O_AL_002.SEN3
S3A_SR_2_IC02AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3A_SR_2_IC03AX_20160216T000000_20991231T235959_20161010T120000___________________MPC_O_AL_002.SEN3
S3A_SR_2_IC04AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3A_SR_2_IC05AX_20160216T000000_20991231T235959_20161010T120000___________________MPC_O_AL_002.SEN3
S3A_SR_2_IC06AX_20000101T000000_20991231T235959_20151214T120000___________________MPC_O_AL_001.SEN3
S3A_SR_2_IC07AX_20160216T000000_20991231T235959_20161010T120000___________________MPC_O_AL_002.SEN3
S3A_SR_2_IC08AX_20160216T000000_20991231T235959_20161010T120000___________________MPC_O_AL_002.SEN3
S3A_SR_2_IC09AX_20160216T000000_20991231T235959_20161010T120000___________________MPC_O_AL_002.SEN3
S3A_SR_2_IC10AX_20160216T000000_20991231T235959_20161010T120000___________________MPC_O_AL_002.SEN3
S3__SR_2_ITD_AX_20160216T000000_20991231T235959_20210425T000001___________________EUM_O_AL_001.SEN3
S3__SR_2_POTDAX_20160216T000000_20991231T235959_20220425T000001___________________EUM_O_AL_001.SEN3
S3A_SR_2_SSBLAX_20000101T000000_20991231T235959_20220425T000002___________________EUM_O_AL_002.SEN3
S3A_SR_2_SSBSAX_20000101T000000_20991231T235959_20220425T000002___________________EUM_O_AL_002.SEN3
S3A_SR_2_CON_AX_20160216T000000_20991231T235959_20240910T000023___________________EUM_O_AL_023.SEN3
S3A_SR___CHDNAX_20160216T000000_20991231T235959_20200312T120000___________________MPC_O_AL_006.SEN3
S3A_SR___CHDRAX_20160216T000000_20991231T235959_20190402T120000___________________MPC_O_AL_005.SEN3
S3A_MW___CHDNAX_20160216T000000_20991231T235959_20210929T120000___________________MPC_O_AL_005.SEN3
S3A_MW___CHDRAX_20160216T000000_20991231T235959_20170908T120000___________________MPC_O_AL_004.SEN3

SRAL/MWR L2 S3B

S3B_SR_2_CCT_AX_20180425T000000_20991231T235959_20180409T120000___________________MPC_O_AL_001.SEN3
S3B_SR_2_IC01AX_20180425T000000_20991231T235959_20180409T120000___________________MPC_O_AL_001.SEN3
S3B_SR_2_IC02AX_20180425T000000_20991231T235959_20180409T120000___________________MPC_O_AL_001.SEN3
S3B_SR_2_IC03AX_20180425T000000_20991231T235959_20180409T120000___________________MPC_O_AL_001.SEN3
S3B_SR_2_IC04AX_20180425T000000_20991231T235959_20180409T120000___________________MPC_O_AL_001.SEN3
S3B_SR_2_IC05AX_20180425T000000_20991231T235959_20180409T120000___________________MPC_O_AL_001.SEN3
S3B_SR_2_IC06AX_20180425T000000_20991231T235959_20180409T120000___________________MPC_O_AL_001.SEN3
S3B_SR_2_IC07AX_20180425T000000_20991231T235959_20180409T120000___________________MPC_O_AL_001.SEN3
S3B_SR_2_IC08AX_20180425T000000_20991231T235959_20180409T120000___________________MPC_O_AL_001.SEN3
S3B_SR_2_IC09AX_20180425T000000_20991231T235959_20180409T120000___________________MPC_O_AL_001.SEN3
S3B_SR_2_IC10AX_20180425T000000_20991231T235959_20180409T120000___________________MPC_O_AL_001.SEN3
S3__SR_2_ITD_AX_20160216T000000_20991231T235959_20210425T000001___________________EUM_O_AL_001.SEN3
S3__SR_2_POTDAX_20160216T000000_20991231T235959_20220425T000001___________________EUM_O_AL_001.SEN3
S3B_SR_2_SSBLAX_20000101T000000_20991231T235959_20220425T000002___________________EUM_O_AL_002.SEN3
S3B_SR_2_SSBSAX_20000101T000000_20991231T235959_20220425T000002___________________EUM_O_AL_002.SEN3
S3B_SR_2_CON_AX_20180425T000000_20991231T235959_20240910T000015___________________EUM_O_AL_015.SEN3
S3B_SR___CHDNAX_20180425T000000_20991231T235959_20220426T120000___________________MPC_O_AL_006.SEN3
S3B_SR___CHDRAX_20180425T000000_20991231T235959_20220426T120000___________________MPC_O_AL_005.SEN3
S3B_MW___CHDNAX_20180425T000000_20991231T235959_20210929T120000___________________MPC_O_AL_003.SEN3
S3B_MW___CHDRAX_20180425T000000_20991231T235959_20181116T120000___________________MPC_O_AL_002.SEN3

SRAL L1 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
S3__SR_2_MLM_AX_20160216T000000_20991231T235959_20231118T120000___________________MPC_O_AL_005.SEN3

SRAL L1 S3A

S3A_SR___CHDNAX_20160216T000000_20991231T235959_20200312T120000___________________MPC_O_AL_006.SEN3
S3A_SR___CHDRAX_20160216T000000_20991231T235959_20190402T120000___________________MPC_O_AL_005.SEN3
S3A_SR_1_CONCAX_20160216T000000_20991231T235959_20220428T120000___________________MPC_O_AL_005.SEN3
S3A_SR_1_CONMAX_20160216T000000_20991231T235959_20240910T000010___________________EUM_O_AL_010.SEN3

SRAL L1 S3B

S3B_SR___CHDNAX_20180425T000000_20991231T235959_20190402T120000___________________MPC_O_AL_004.SEN3
S3B_SR___CHDRAX_20180425T000000_20991231T235959_20190402T120000___________________MPC_O_AL_004.SEN3
S3B_SR_1_CONCAX_20180425T000000_20991231T235959_20220428T120000___________________MPC_O_AL_003.SEN3
S3B_SR_1_CONMAX_20180425T000000_20991231T235959_20240910T000007___________________EUM_O_AL_007.SEN3

MWR L1 S3A

S3A_MW_1_SLC_AX_20160216T000000_20991231T235959_20190621T120000___________________MPC_O_AL_003.SEN3
S3A_MW___STD_AX_20160216T000000_20991231T235959_20220111T120000___________________MPC_O_AL_003.SEN3
S3A_MW___CHDNAX_20160216T000000_20991231T235959_20210929T120000___________________MPC_O_AL_005.SEN3
S3A_MW___CHDRAX_20160216T000000_20991231T235959_20170908T120000___________________MPC_O_AL_004.SEN3

MWR L1 S3B

```
S3B_MW_1_SLC_AX_20180425T000000_20991231T235959_20190621T120000___________________MPC_O_AL_002.SEN3
S3B_MW___STD_AX_20180425T000000_20991231T235959_20220111T120000___________________MPC_O_AL_003.SEN3
S3B_MW___CHDNAX_20180425T000000_20991231T235959_20210929T120000___________________MPC_O_AL_003.SEN3
S3B_MW___CHDRAX_20180425T000000_20991231T235959_20181116T120000___________________MPC_O_AL_002.SEN3
```

4 PREVIOUS UPDATES (BASELINE COLLECTION 005)

4.1 SM__WAT.005.04

4.1.1 Detailed updates at Level 2 (SM__WAT.005.04 – v7.05)

- There are no relevant changes to the geophysical retrievals with this version of the processor. The changes in the dataset are related to the anomalies fixed (related to 'rain flag', 'open sea ice flag' and 'waveform classification'). See more details in the section 3.3.

JCR-190: The Marine/Land Mask (SR_2_MLM_AX) was extended by ESA/MPC over areas such as: Maracaibo Lake and over small islands where Hydro Lake targets are not included in the Land part of the MLM. No impact on Marine Centre data production as these continue to be produced also by EUMETSAT.

4.1.2 Detailed updates at Level 1

No update was performed to the SRAL and MWR L1 processors in this release.

4.1.3 Geophysical retrievals impact

The main geophysical retrievals are not impacted by this minor update. Mean levels of Sea Level Anomaly, Wind & Waves should remain the same.
The impact of the new processing baseline can be seen mostly on the Polar Ocean retrievals, with improved 'open sea ice flag', 'rain flag' and 'waveform classification'.

4.1.4 Anomalies or limitations closed since the last product notice

ID	Title	Closure PB
EUM/Sen3/AR/8316	Degraded Open Sea Ice Flag and Rain Flag	SM__WAT.005.04
EUM/Sen3/AR/8459	Issue with waveform classification	SM__WAT.005.04
EUM/Sen3/AR/8383	Missing ANX information	SM__WAT.005.04

AR EUM/Sen3/AR/8316 – Degraded Open Sea Ice Flag and Rain Flag

- It was discovered that (mostly) for higher latitudes, the BC005 has introduced a regression in the flags “open sea ice” and “rain flag”. The open_sea_ice_flag_01_ku present on the product shows very little sea ice for high latitudes (values 1-4) and most of the times only the unevaluated states (5) is set. The issue does not allow characterizing sea ice, especially age. Users could still use values different from 0 as a non “pure” ocean detector. The impacts on the rain flag were also limited to areas invalid (non-ocean) backscatter coefficient (sigma0). In a similar way users could still use values different from 0 as non-rainy epochs.
- With this version of the processor dedicated processing steps were done to keep consistency with previous baselines for these flags. To filter invalid Sea Level data it is recommended to the users to use the quality_ssha_01_ku flag.
- As part of the fix the following flags were changed wrt to BC005.03
  - rain_flag_01_ku/ rain_flag_01_plrm_ku
  - rain_att_01_ku/ rain_att_01_plrm_ku/
- as well
  - open_sea_ice_flag_01_ku/open_sea_ice_flag_01_plrm_ku
  - first_year_ice_class_01_ku/ first_year_ice_class_01_plrm_ku
  - multi_year_ice_class_01_ku/ multi_year_ice_class_01_plrm_ku
  - open_water_class_01_ku/ open_water_class_01_plrm_ku
  - wet_ice_class_01_ku/ wet_ice_class_01_plrm_ku
- It can be seen in the following images the difference (central panel) between the version 7.04 (top right) and 7.05 (bottom left) of the processors. The first image is for the ‘rain flag’ variable, the differences are mostly limited to higher latitudes (sigma0 contaminated by sea ice) and with limited impact the open ocean. The second image is for the open sea ice flag where the classification of the ice age now shows nicely, there is no impact on open ocean.

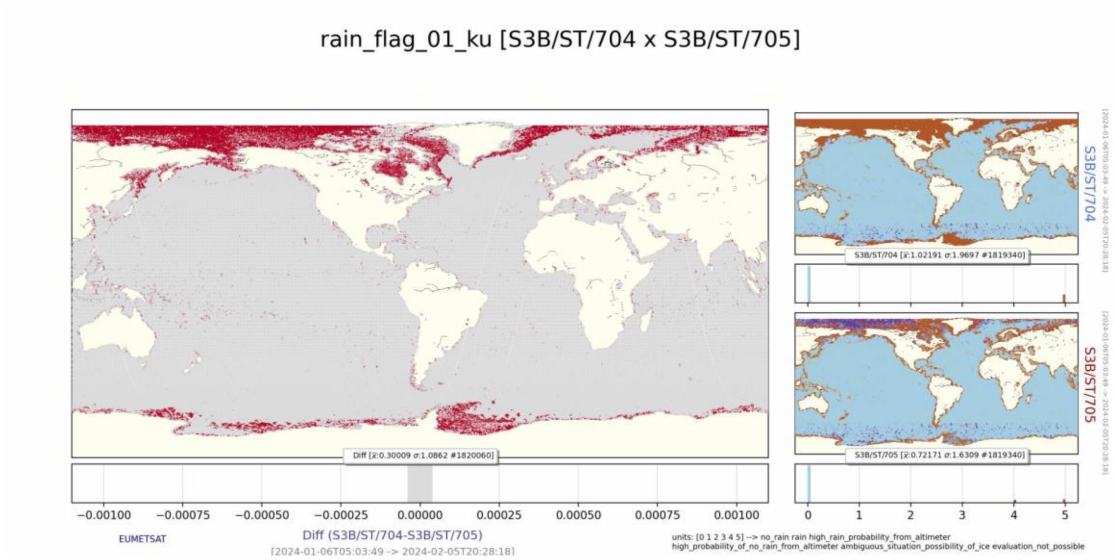

Figure 1 – Changes to the rain flag

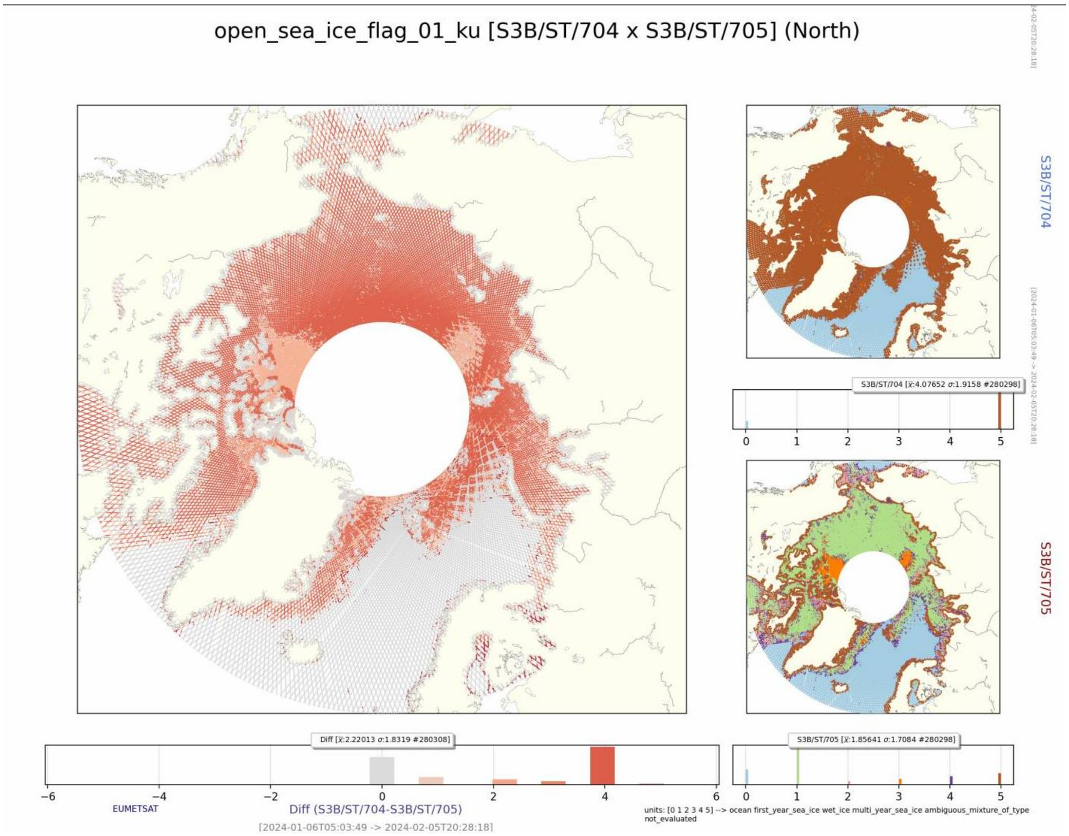

Figure 2 – Changes to the open sea ice flag

Affects: all data processed with BC005.02 and BC005.03
Resolved: in the current operational dataset with BC005.04.

AR EUM/Sen3/AR/8459 – Issue with waveform classification

- An issue was found with the waveform classification (surf_type_class_20_ku) in in areas with high sea ice concentration, where the classification would default to 'unclassified' when classification was possible. The issue become evident with the change of Sea Ice Concentration provider from MSSL to OSI-SAF. The issue is now tackled and impacted only a small of amount of data.

Affects: all data processed with versions lower than BC005.04
Resolved: in the current operational dataset with BC005.04.

AR EUM/Sen3/AR/8383 - Missing ANX information

- From the period 2023/11/20 to 2023/12/12 (creation date) the first products of the day (sensing time) had missing ANX information in the manifest and netcdf. The issue is no longer happening and in future reprocessing this will be fixed for the impacted period.

Affects: NTC data created between 2023/11/20 to 2023/12/12
Resolved: NTC data produced after 2023/12/12.

4.2 SM__WAT.005.03

4.2.1 Detailed updates at Level 2 (SM__WAT.005.03 – v7.04)

- Update of Sea Ice Concentration provider to OSI-SAF:
  - Since this processor version the Sea Ice Concentration present on the S3 L2 products (`sea_ice_concentration_20_ku` and `sea_ice_concentration_01`) is provided by OSI-SAF:
    - https://osi-saf.eumetsat.int/products/osi-430-a
  - The variables are generated for all timeliness:
    - NRT/STC contains fast-track data, generated by OSI-SAF about 48 hours after the DMPS/SSMIS data acquisition.
    - NTC contains ICDR data, generated by OSI-SAF about 16 days after the DPMS/SSMIS data acquisition.
  - The following variables are dependent on the sea ice concentration value, and thus are changed:
    - Sea Ice SSHA: `sea_ice_ssha_20_ku`
    - Interpolated Sea Ice SSHA: `int_sea_ice_ssha_20_ku`
    - Freeboard: `freeboard_20_ku`
    - Surface Type Class: `surf_type_class_20_ku`
- Addition of Météo-France Wave Model (MFWAM) information:
  - The following variables are added to the S3 L2 product:
    - MFWAM Significant Wave Height:
      - `mod_significant_wave_height_01`
    - MFWAM Swell Wave Direction:
      - `mod_mean_swell_wave_direction_01`
    - MFWAM Significant Swell Wave Height:

        - `mod_significant_swell_wave_height_01`
    - MFWAM Swell Wave Period:
        - `mod_mean_swell_wave_period_01`
    - MFWAM Mean Wave Direction:
        - `mod_mean_wave_direction_01`
    - MFWAM Mean Wave Period (t02):
        - `mod_mean_wave_period_t02_01`
    - Quality Flag for MFWAN variables in the product:
        - `interp_flag_mod_wave_01`
  - The information is based on the same dataset as provided to Copernicus Marine Service (CMEMS):
    - https://data.marine.copernicus.eu/product/GLOBAL_ANALYSISFORECAST_WAV_001_027/description
  - Currently it is not used on any L2 processing.
  - The variables are generated for all timeliness:
    - NRT contains predicted modelled data, prediction up to 24 hours prior to altimeter sensing
    - STC/NTC contains assimilated/modelled data

4.2.2 Anomalies or limitations closed since the last product notice

Anomaly "EUM/Sen3/AR/7272" – MWR failing due to STD_AX
Due to STD_AX ADF formatting (in version 002, see below) the MWR L1 IPF would fail under certain conditions. During the period 2021-12-22 to 2022-02-07 (creation date), the SRAL/MWR L2 data is not following PB 2.79-Marine, due to the MWR L1 IPF rollback. The impact is limited SSHA and Radiometer Wet Tropospheric correction (less than 1mm).
Problematic ADFs (can be seen in the manifests):
`S3A_MW___STD_AX_20160216T000000_20991231T235959_20210929T120000___________________MPC_O_AL_002.SEN3`
`S3B_MW___STD_AX_20180425T000000_20991231T235959_20210929T120000___________________MPC_O_AL_002.SEN3`
Affects: data processed between 2021-12-22 and 2022-02-07
Resolved: in the reprocessed dataset.

Notice #3 (V3A) – Platform Angles have values around +-180 degrees
Due to the update of the Copernicus POD service the platform angles change on some case to be around +- 180 degrees, these values were correct, but could be confusing for users. The values have been reverted in the meantime to 0. The upcoming reprocessing dataset will have a consistent value around zero.
Affects: data processed between 30/01/2023 and 13/02/2023
Resolved: in the reprocessing dataset

4.3 SM__WAT.005.02

4.3.1 Detailed updates at Level 2 (SM__WAT.005.02 – v7.03)

- Update of mean values for SSHA (and its corrections) and SWH and Wind Speed.
- Application of GPD+ Wet Tropospheric Correction (WTC) to SSHA (NTC only).

- Addition of Wind Speed calculated from Sigma0 and SWH (like Sentinel-6)
  - `wind_speed_alt_2p_01_ku`
  - `wind_speed_alt_2p_01_plrm_ku`
- Addition of quality flags for SSHA, SWH, Wind (at 1Hz measurement level)
  - `quality_ssha_01_ku`
  - `quality_ssha_01_plrm_ku`
  - `quality_swh_ocean_01_ku`
  - `quality_swh_ocean_01_plrm_ku`
  - `quality_wind_speed_alt_01_ku`
  - `quality_wind_speed_alt_01_plrm_ku`
  - `quality_wind_speed_alt_2p_01_ku`
  - `quality_wind_speed_alt_2p_01_plrm_ku`
- Update of the 1Hz data generation method, to include strict MQE screening — preventing bad 20Hz data to be used on 1Hz
- Addition of information (in the netCDFs global attributes) about the bias applied in the L2 products
  -
- Addition of sea ice concentration information at 1Hz
  - `sea_ice_concentration_01`
- Addition of SRAL acquisition mode at 1Hz:
  - `mode_id_01_ku`
- Addition of information regarding the WTC applied to build the SSHA:
  - `wet_tropo_applied_to_ssha_01_ku`
  - `wet_tropo_applied_to_ssha_01_plrm_ku`
- Correction of the geoid (EGM2008) since the version used previously on the product had an error.
- Elevation from sea-ice/ocog retrackers now uses high frequency dynamic atmospheric pressure correction (`hf_fluct_cor + inv_bar_cor`).
- Correction of S3B cycle number on the first pass of the cycle — netCDF only.

Improved radiometer quality flag (`rad_along_track_avg_flag_01`), especially during lunar calibration events.

4.3.1.1 Geophysical retrievals impact

The Processing Baseline (PB) SM__WAT.005.02 is an update to the recent Baseline Collection 005 (BC 005). It provides an update of the mean values of the geophysical retrievals Sea Level, Wind and Waves, keeping the same quality as the rest of BC005. This PB will be used on the ongoing full mission reprocessing.

This PB brings several relevant evolutions and anomaly fixes to the Sentinel-3 Altimetry Marine Products.

The updates affect mostly Level-2 products, with the largest impacts being on SSHA (better alignment between SAR and PLRM).

Impacts (wrt to SM__WAT.005.01)

SSHA	NR/ST	NT
S3A SAR	+10.7 mm	+7.7 mm

S3A PLRM	- 21.0 mm	- 24.7 mm
S3B SAR	+3.6 mm	+2.5 mm
S3B PLRM	- 30.1 mm	- 30.9 mm

SWH	NR/ST	NT
S3A SAR	- 2.8 mm	+0.1 mm
S3A PLRM	+2.4 mm	+2.5 mm
S3B SAR	-4.9 mm	+0 mm
S3B PLRM	+2.5 mm	+ 2.6 mm

Wind Speed (1p)	NR/ST	NT
S3A SAR	+0.5 cm/s	+1.3 cm/s
S3A PLRM	-4.1 cm/s	-4.1 cm/s
S3B SAR	-1.4 cm/s	-0.4 cm/s
S3B PLRM	-8,7 cm/s	-8.7 cm/s

4.3.2 Anomalies or limitations closed by this release

ID	**Title**	**Closure PB**
EUM/Sen3/AR/7504	Incorrect Geoid information	SM__WAT.005.02
EUM/Sen3/AR/7728	Cycle number is wrong for S3B on the first pass of the cycle	SM__WAT.005.02
EUM/Sen3/AR/7569	Elevation from sea-ice/ocog do not use MOG2D	SM__WAT.005.02
EUM/Sen3/AR/7568	Radiometer quality flag is not accurate during the Moon Calibration	SM__WAT.005.02

EUM/Sen3/AR/7504 - Incorrect Geoid information
It has been identified that the geoid information present on the Sentinel-3 has an error of about 40 cm, w.r.t. to the real EGM2008 geoid.
Corrected with SM__WAT.005.02, affects all data produced before

EUM/Sen3/AR/7728 - Cycle number is wrong for S3B on the first pass of the cycle
It's been observed that the altimetric cycle number present on the netcdf for S3B is not correct for the first pass of cycle N, where pass 1 is reported but also cycle N-1, instead of cycle N. This has now been fixed. The manifest was not touched as it follows Sentinel-3 standards.
Corrected with SM__WAT.005.02, affects all data produced before

EUM/Sen3/AR/7569 - Elevation from sea-ice/ocog do not use MOG2D
Contrary to what was stated in the PFS (and netcdf comments) the processor was not applying the MOG2D correction (hf_fluc_) to elevations associated with OCOG and sea ice re-trackers.
Corrected with SM__WAT.005.02, affects all data produced before

EUM/Sen3/AR/7568 - Radiometer quality flag is not accurate during the Lunar Calibration

It was identified that during the Lunar Calibration events, where there is no valid MWR Wet tropospheric correction, the quality flag (rad_along_track_avg_flag_01) does not reflect this, still informing users of the good quality of the data.
Corrected with SM__WAT.005.02, affects all data produced before

4.3.3 Detailed updates at Level 1

Both SRAL and MWR L1 processors were updated, but there is no impact/difference to users.

4.4 SM__WAT.005.01

4.4.1 Detailed updates of the PB SM__WAT.005.1

4.4.1.1 Level 2

- Updates to the SSHA
  - New Mean Sea Surfaces
    - Combined MSS, CNES/CLS15, SIO, DUT15 (new default MSS)
    - DTU21 (including accuracies information; not used in the SSHA)
  - New Pole Tide solution (Desai 2017)
  - Internal tides and long tide non-equilibrium now applied to calculate SSHA
  - Dynamic Atmospheric Correction (DAC/MOG2D) available in NRT and applied to the SSHA
  - New Sea State Bias (Tran 2021) derived from S3A SAR/PLRM for Ku-band
  - Real Zero Masking from L1B data applied at SAR L2 (all timeliness)
  - Range Walk (applied at SAR L1, only NTC)
- Wet Tropospheric Correction
  - GPD+ Wet Tropospheric Correction available for NTC timeliness (not yet applied to the SSHA)
  - Composite wet tropo variables removed
- More information to the user as part of the products (manifest file and netCDF global attributes):
  - Processing Baseline; All system bias; etc.
- No-more (land-)ice variables being generated by Marine products
  - Variables are still present but empty
- Wind and Waves: Updates to mean values of SWH and Wind Speed due to Range Walk, Zero Masking and system bias updates for better alignment

4.4.1.2 Level 1

SRAL

- Correction of USO reading (relevant only for S3B data)
- Removal of CAL2 application to CAL1
- CAL1 range correction generated using CoG (centre of gravity) method
- New CAL2 normalization, by plateau instead of max
- Range Walk correction is now applied to SAR mode (NTC only currently)

MWR

- Improvements to data processing during Moon Calibration events

4.4.2 Anomalies or limitations closed by release SM__WAT.005.01

ID	Title	Closure PB
EUM/Sen3/AR/7240	S3B USO Correction does not take into account the negative sign	SM__WAT.005.01
Notice #5	Sea State Bias (SSB) is still not optimized for Sentinel-3	SM__WAT.005.01
Notice #18 EUM/Sen3/AR/5963	S3A SRAL Range PTR (Point Target Response) is less stable than expected	SM__WAT.005.01 SR__L1M.005.00
EUM/Sen3/AR/7154	Quasi-duplicated 20Hz in rare occasions	SM__WAT.005.01
EUM/Sen3/AR/7294	Improved data availability during Moon Calibration operations	SM__WAT.005.01 MW__L1_.005.00

EUM/Sen3/AR/7240 – S3B USO Correction does not take into account the negative sign
Over time S3B derived Sea Level has shown an abnormal behaviour not following the same trend as other altimeters.
After investigation MPC has discovered that this issue is due to the fact that the SR1 IPF was not reading the sign of the USO correction that needs to be applied to the measurements to account for USO variation. This USO correction arrives in the SR_1_USO_AX ADF from CNES.
On S3B the value is negative, on S3A the value is positive, thus there was no issue with the sign.
Affects: S3B only, SRAL L1 + L2 dataset processor with SR1 version <= 6.21
For old data only: A possible workaround for users to correct the old S3B Sea Level dataset (until the full mission reprocessing is available) following the instructions present in the following page: https://www.eumetsat.int/altimetry-marine-products
Corrected: SM__WAT.005.01/SR__L1M.005.00

Notice #5 – Sea State Bias (SSB) is still not optimized for Sentinel-3
The SSB correction at lunch of S3, was the Jason-2 SSB solution. This has been improved with SM__WAT.005.01 where updated SSB corrections are available for Ku-band SAR and PLRM based on S3A data. These new tables were produced by MPC (Tran 2021). For C-band still the Jason-2 solution is used.
Corrected: SM__WAT.005.01/SR__L1M.005.00

Notice #18 - S3A SRAL Range PTR (Point Target Response) is less stable than expected (EUM/Sen3/AR/5963)
The S3A SRAL Range PTR (Point Target Response) has a shape evolving in time, with the main lobe width decreasing in time, while the first left side-lobe is shifting in time. The first right side side-lobe is stable.
These changes are just partially corrected for with the current calibration scheme and this affects the long-term stability for range and wave-height of both SAR and PLRM modes, but SAR mode is more impacted.
This change was stronger in the early life of S3A, prior to 2018 and during that time the SAR measurements show a drift w.r.t. to the reference mission.
With PB SM__WAT.005.01/SR__L1M.005.00 improvements have been made to the processing (Range Walk, CAL1 CoG) to better account for this.

The dataset produced with SM__WAT.005.01 should exhibit a better stability w.r.t. to the reference mission for a long term analysis and climate usage.
Further improvements are expected to come from Numerical Retracking in the future.
Corrected: SM__WAT.005.01/SR__L1M.005.00

EUM/Sen3/AR/7154 - Quasi-duplicated 20Hz in rare occasions
On rare occasions, mostly during periods where there were downlink issues and multiple L1 existed for the same sensing, there were occasions where 20Hz would be almost duplicated. The L2 processor now takes this into account, producing 20Hz with the expected temporal spacing.
Corrected: SM__WAT.005.01

EUM/Sen3/AR/7294 - Improved data availability during Moon Calibration operations
During the OLCI instrument Moon Calibration activities there would be a large degraded sensing time without data. The processors (MW1 and SM2) were improved to better handle this situation.
Corrected: SM__WAT.005.01/MW__L1_.005.00