PROGRAMME OF THE EUROPEAN UNION

Copernicus Europe's eyes on Earth

IMPLEMENTED BY EUMETSAT

Sentinel-3 Marine Altimetry Status

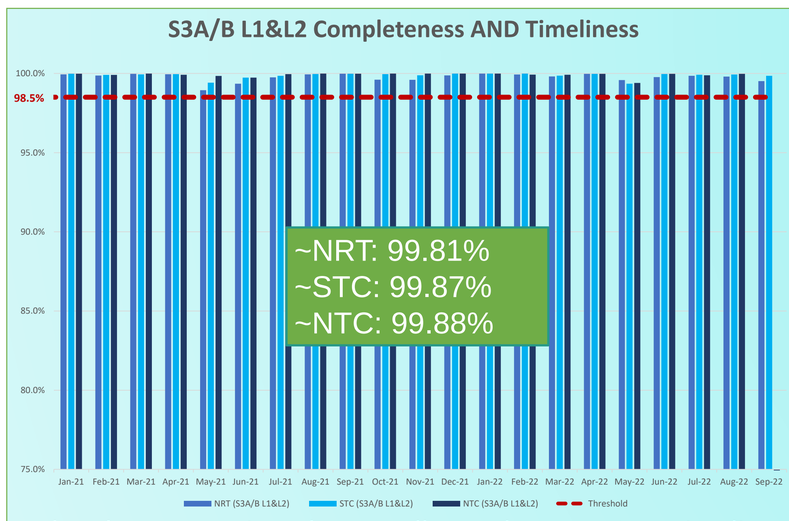
Introduction

The Copernicus Sentinel-3 (S3) Payload Data Ground Segment (PDGS) is distributed between EUMETSAT (***Eu****ropean Organisation for the Exploitation of* ***Met****eorological* ***Sat****ellites*) and ESA (European Space Agency). The Sentinel-3 Marine Centre is located at EUMETSAT.

The Marine Centre is where NRT and offline (STC/NTC) marine products are systematically generated and the marine calibration, validation, quality control and mission performance activities are carried out. Marine Products/Data are archived in a long-term archive, made available online (Data Store: data.eumetsat.int) and via EUMETCast satellite data distribution.

This poster shows the performance of the S3 Marine Altimetry Data Production, in terms of completeness and timeliness. It also addresses the latest improvements to the product quality (BC005) and the status of the full mission reprocessing.

Data Production (completeness AND timeliness)

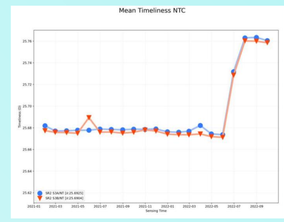


Requirements: the user products are expected to be generated at least for 98.5% of the planned science measurement data within the predefined timeliness thresholds.

Timeliness	Completeness	Threshold
NRT	98.5%	< 3 hours
STC	98.5%	< 48 hours
NTC	98.5%	< 30 days

The plot summarizes the overall completeness AND timeliness of the altimetry data produced by the Marine Centre ground segment. It includes the data from both Sentinel-3A and B and from L1 and L2 products. Spacecraft unavailability are visible in this plot but not on the other ones:

Marine Centre Data Productions is Beyond requirements!!



The orbit solution has a major impact on the overall altimetry data quality, especially SSH. For all timeliness the data is produced with the best solution above 99.5% of the time, either it be NRT, STC or NTC.

The above charts shows the mean timeliness value at generation in the PDGS. From the left to the right, NRT, STC, and NTC timeliness. The value includes both S3A and S3B Level 2 data. **On average the NRT data is available less than 2 hours after sensing.** After April 2022 an increase is visible due to the changes on ESA's Production Services that provide L0 data to EUMETSAT. **On average the STC data is available after 40 hours after sensing.** For NTC a large increase in processing time can be seen since June 2022, due to the application on Range Walking processing in NTC, still **on average the NTC data is available after 25.7 days after sensing.**

Baseline Collection 005

Major update for Sea Level retrievals

Correction of SAR Range drift (mostly impacting S3A)
- Range Walk (applied at SAR L1, only NTC).
- Adapted CoG CAL1

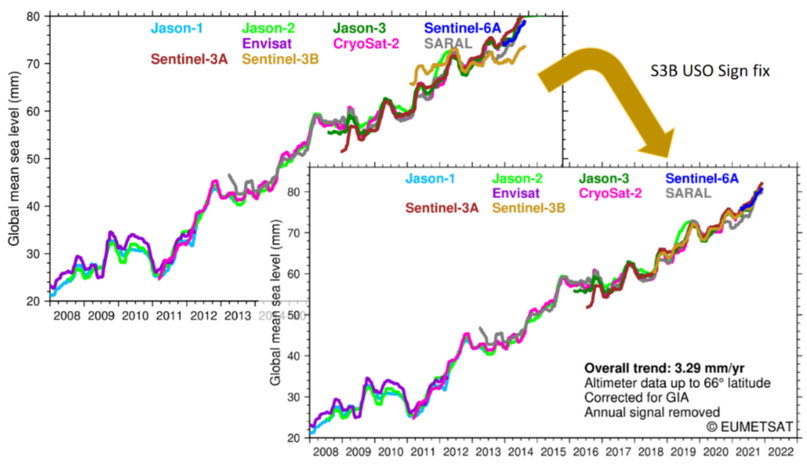
Correction of USO sign (impacting only S3B)
- Correct reading at L1

GPD+ WTC correction applied at NTC
- If used instead radiometer WTC allows for the recovery of about 10-15% more valid data points https://www.eumetsat.int/new-algorithm-gpd-improves-s3-sral-mwr-wtc

Dynamic Atmospheric Correction (DAC/MOG2D) available in NRT and applied to the SSHA.
- SLA error reduction around 2 cm rms

New Mean Sea Surface Models
- Combined 21 (SIO, CNES/CLS 15, DTU 15) – new default model
- DTU 21

Tide updates
- New Pole Tide (Desai 2017)
- Internal tides and long tide non-equilibrium now applied to calculate SSHA.



Better instrumental Processing

New Sea State Bias (Tran 2021) derived from S3A SAR/PLRM for Ku-band, instead of Jason-2. For C-band J2 SSB remains.
Real Zero Masking from L1B data applied at SAR L2 (all timeliness).

Removal of CAL2 application to CAL1.
New CAL2 normalization, by plateau instead of max

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

More information to the user: Processing Baseline; All system bias; etc.
No-more (land-)ice variables being generated by Marine products.

More info: https://www.eumetsat.int/new-sentinel-3-altimetry-processing-baseline-collection-005

More information to the users

Processing Baseline information also available (see below) Every time a change happens it the field will be updated. Available also on the manifest

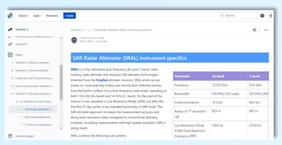
SM__WAT.005.YY.XX → new nomenclature for BC 005 PBs

```
:institution = "MAR" ;
:source = "IPF-SM-2 07.02" ;
:history = " " ;
:contact = "ops@eumetsat.int" ;
:creation_time = "2022-09-25T04:34:21Z" ;
:processing_baseline = "SM__WAT.005.01.01" ;
:references = "S3IPF - Product Data Format Specification - SRAL and MWR Level 2 Marine (EUM/SEN3/SPE/20/1191479 v3A)" ;
```

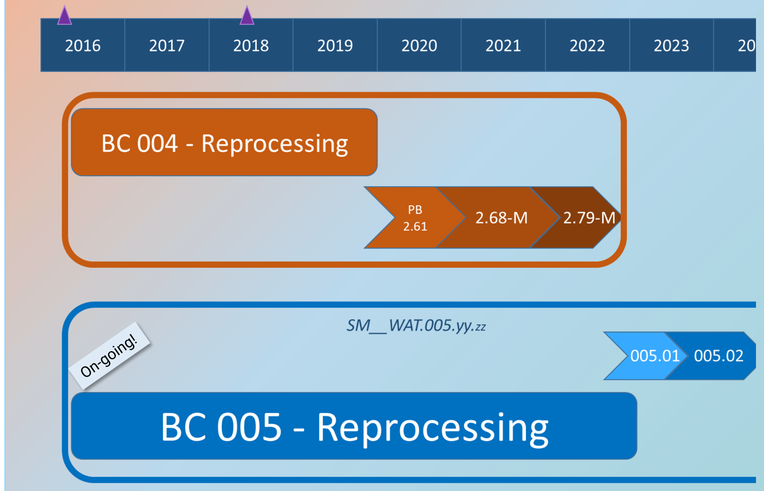
Users can see all these static bias in the products (and also on Product Notices)

```
:masking_applied_to_stack = "zero_mask_from_l1b_stack" ;
:wet_tropo_applied_to_ssha = "rad_wet_tropo_cor_01" ;
:system_bias_range_lrm_plrm_ku_added = 0.002 ;
:system_bias_range_lrm_c_added = 0.0025 ;
:system_bias_range_sar_added = 0.012 ;
:system_bias_swh_lrm_plrm_ku_added = 0. ;
:system_bias_swh_lrm_c_added = 0. ;
:system_bias_swh_sar_added = -0.06 ;
:system_bias_sig0_lrm_plrm_ku_added = -1.631 ;
:system_bias_sig0_lrm_c_added = 0.223 ;
:system_bias_sig0_sar_added = -0.461 ;
```

New Knowledge Base website for Altimetry S3 and S6.
- Replaces Product Handbook
- Contains new Cyclic and Annual Reports
  - Cyclic reports now also include 20Hz observations on the Coastal Zone and Polar Oceans
  - Quarterly:
    - SRAL and MWR instrumental report (from the Marine data)
  - Annual:
    - High latitudes
    - Tide Gauges
    - SWH & Wind
- Data Download
  - Data Store
    - Including Python API



Past, Present and Future



Reprocessing BC 005 is on-going
- preview released to S3VT (2022)
- Final release Q1/2023 for all users

Consistency between beginning of mission and "live" Operational data (once the reprocessing is done)

Several studies on-going or kicking off early 2023 to support operational implementation

Medium Term (BC 006) ~2024/25

Improved Polar Ocean retrievals
- Sea Level in to the Sea Ice leads, consistent with "open" ocean

Improved Coastal Processing
- Dedicated processing

Improve Sea Level for Climate quality (even more)
- Numerical retracking for SAR (and PLRM)

Improved models
- MSS, Tides, etc.

One L2 product with all, or "thematic" products? under discussion …

Take home message: Sentinel-3 is being produced within the requirements in terms of timelines, availability and quality. Improvements have been made to the product quality recently (BC005) and full mission reprocessing is on-going to provide to the users a consistent time-series for the Global Ocean since beginning of mission to the live data.

Bruno Lucas[1], Carolina Nogueira Loddo[1], Estelle Obligis[1], Remko Scharroo[1], Cristina Martin-Puig[1], Hassan Farahani[2], Hendrik Merx[2]

[1] EUMETSAT, Eumetsat Allee 1, Darmstadt, Germany
[2] HE Space Operations, Darmstadt, Germany (on behalf of EUMETSAT)

OSTST 2022, Venice (IT)
EUM/RSP/VWG/22/1335124

eumetsat1 @eumetsat eumetsat

EUMETSAT Altimetry
https://eumetsat.int/altimetry-services

EUMETSAT knowledge bases
https://eumetsatspace.atlassian.net/wiki/spaces/EUM/overview

Contact: s3..stm@eumetsat.int