New Sentinel-3 Altimetry Hydro-Cryo Level-2 Thematic Products

Full Mission Reprocessing with Baseline Collection 005 – Validation Results

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OSTST Meeting, San Juan, 7-11 November 2023

Full mission reprocessing (FMR) - Intro

WHAT ?

- First Sentinel 3 full mission reprocessing
- For Both S3A & B missions
- New Level-2 Altimetry Hydro-Cryo thematic products with Baseline Collection 005 (BC005)

WHY ?

- Improved data quality
- Processing optimized over 3 thematic surfaces
  - Inland waters (HY)
  - Sea Ice (SI)
  - Land Ice (LI)

HOW ?

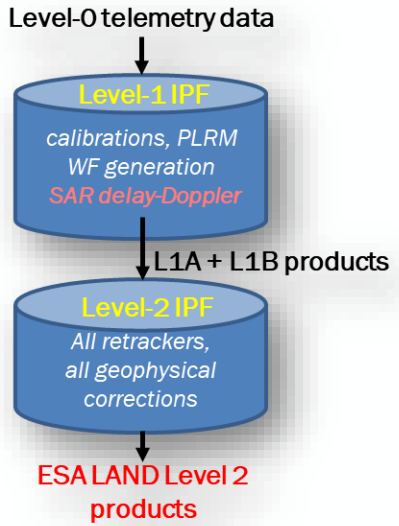
- Homogeneous Sentinel-3 dataset
- Coverage from Beginning Of Mission (BOM) up to date
- BC005 replacing the older S3 BC

FMR – IPF updates

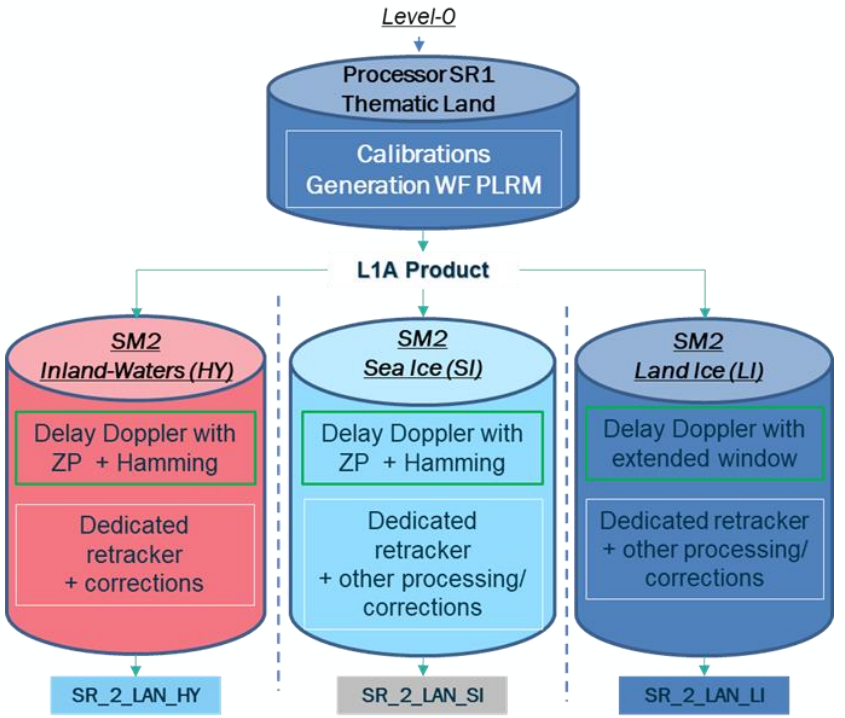
Instrument Processing Facility (IPF) undergone major updates

Old BC004 Land Products

- One L2 product for all surfaces
- Delay Doppler processing @ L1
- Pole-to-pole coverage



New BC005 Thematic Products



- Three L2 products for
  - Inland waters (HY)
  - Sea ice (SI)
  - Land ice (LI)
- Delay Doppler processing @ L2
- Surface driven processing improvements
- Equator-to-equator coverage for SI and LI

FMR – IPF updates

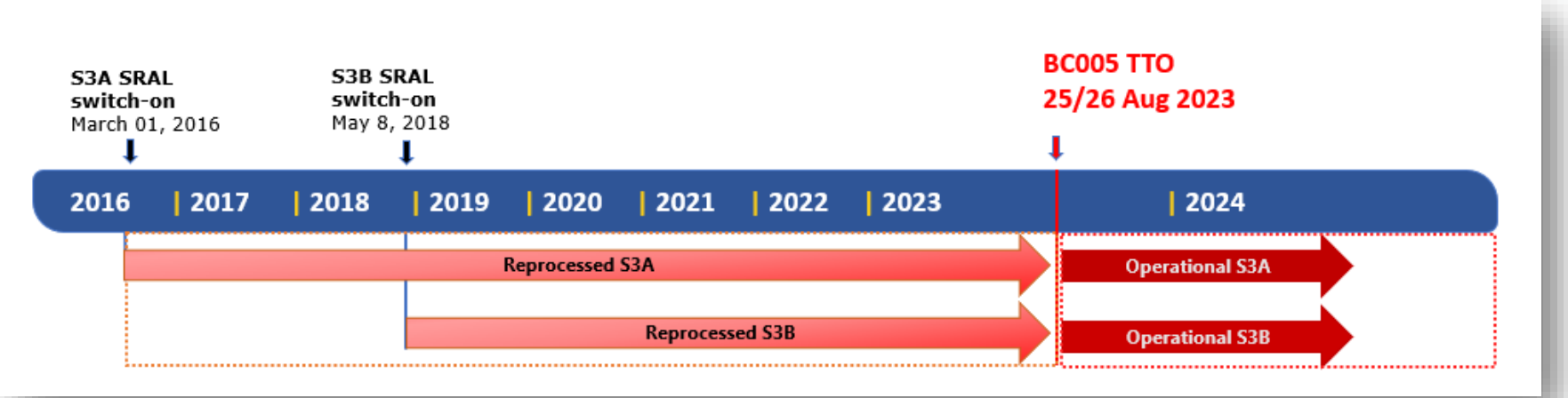
Instrument Processing Facility (IPF) undergone major updates

List of Sentinel 3 Altimetry Land products

Product Type	Product Identification Name	Baseline Collection	
		BC004	BC005
Level 1A	SR_1_SRA__A	✓	✓
Level 1B	SR_1_SRA___	✓	
Level 1BS	SR_1_SRA_BS	✓	
Level 1B	SR_1_LAN_RD	✓	
Level 2	SR_2_LAN___	✓	
Level 2	SR_2_LAN_HY		✓
Level 2	SR_2_LAN_LI		✓
Level 2	SR_2_LAN_SI		✓

FMR – data coverage and access

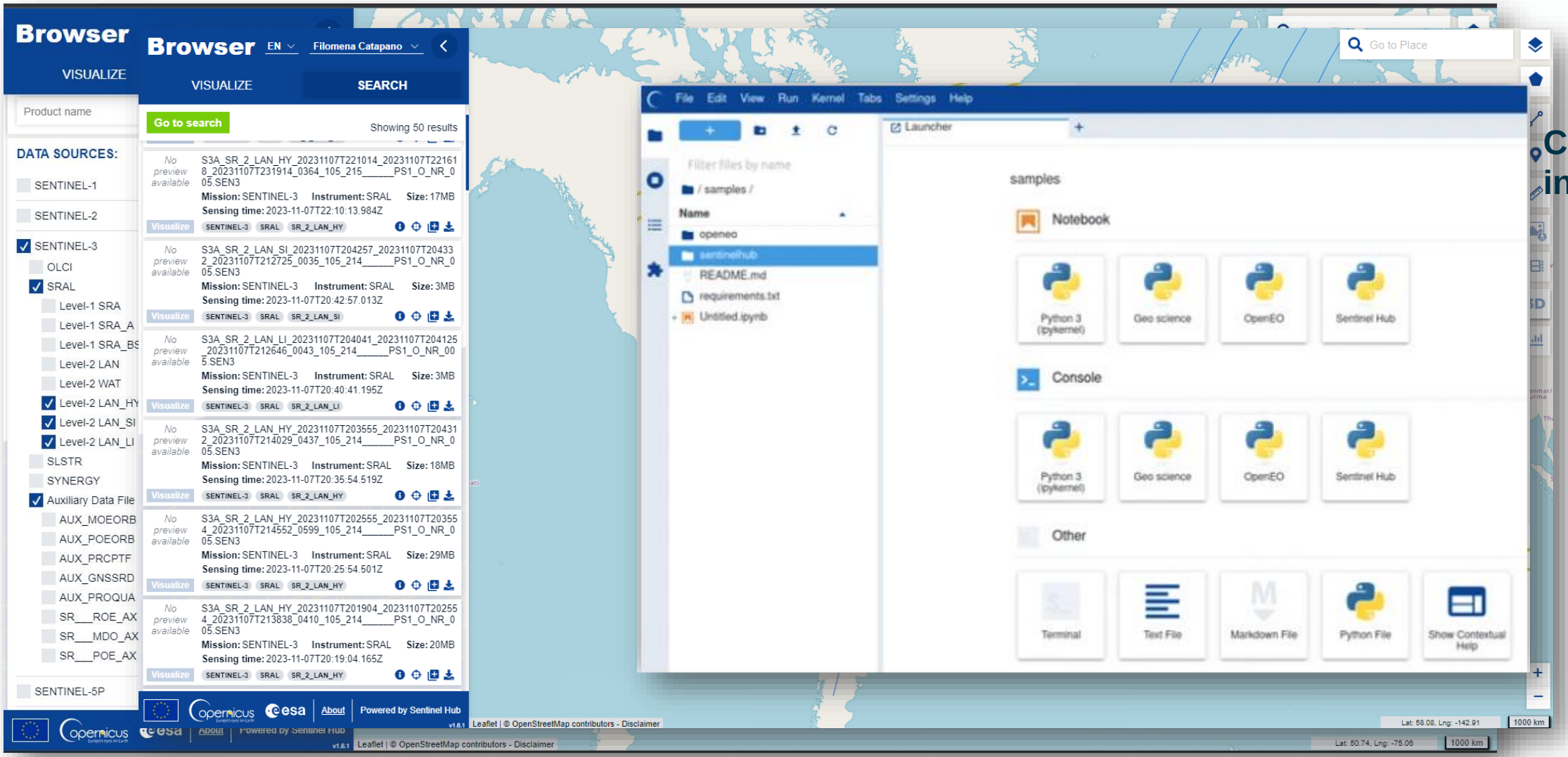
- BC005 replacing the old products to have consistent and homogenous S3 dataset
- Old Land data products are not generated starting from September 2023 (sensing time August 2023)
- Reprocessing is for NTC products only



- New data access @ Copernicus Data Space Ecosystem (CDSE)
  https://dataspace.copernicus.eu

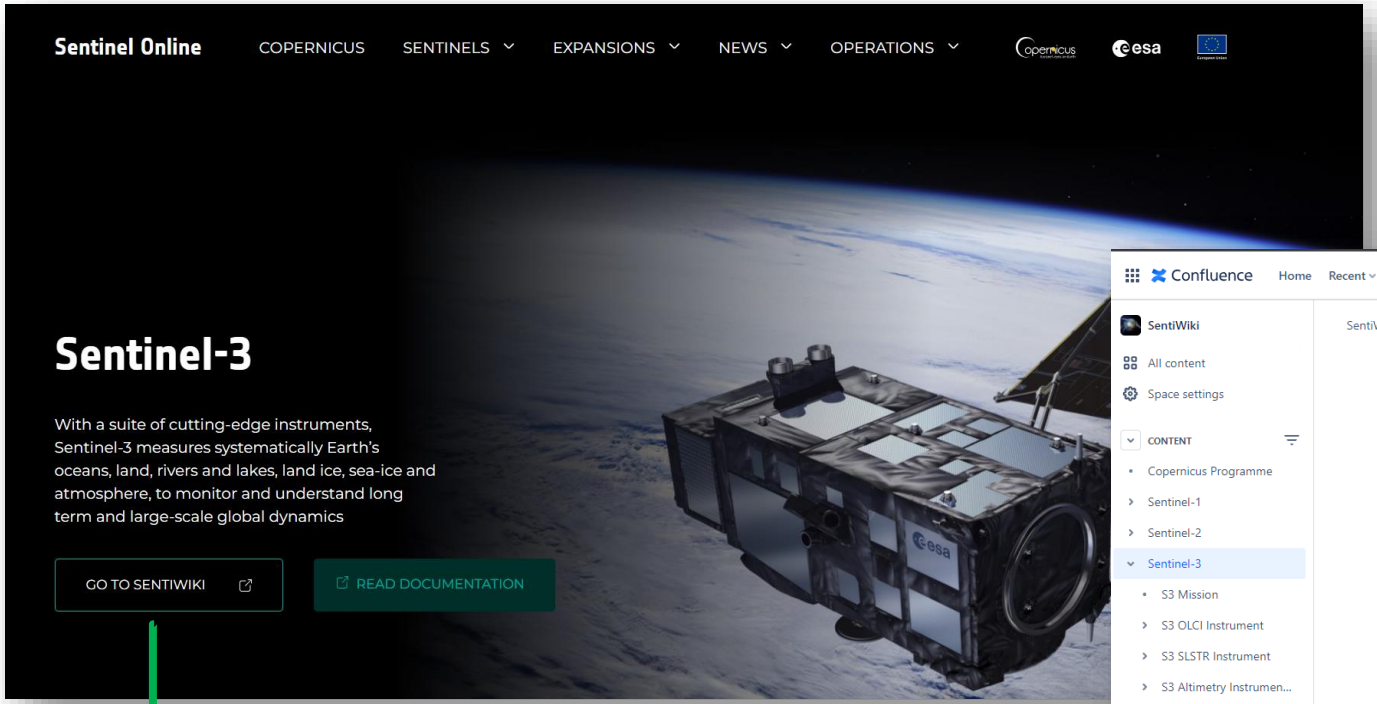
- CDSE offers a new user interface with API, Jupyter Notebooks, dedicated Workspace, OpenEO …

FMR – data coverage and access

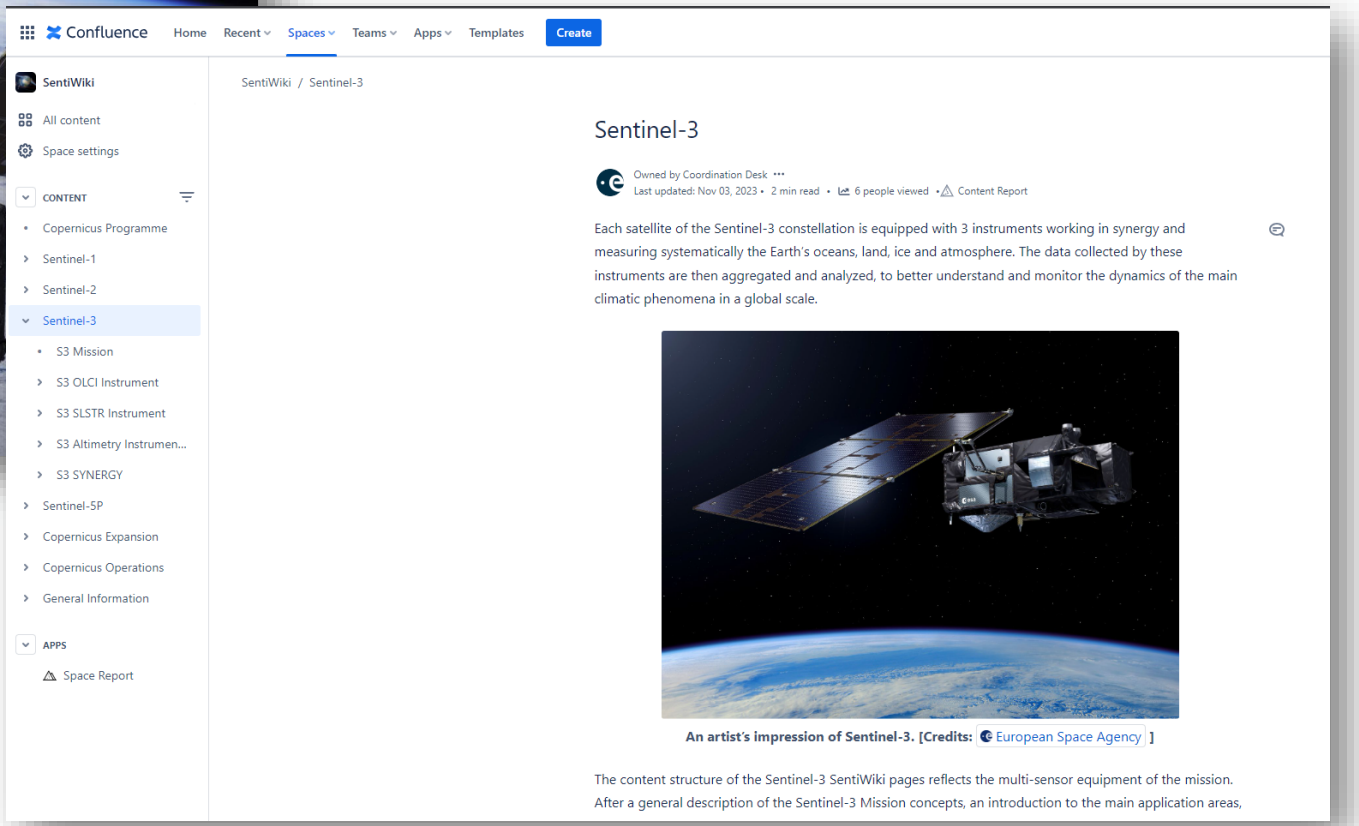


CDSE interface

New Sentinel-3 web pages layout - SentiWiki



Feedback & support to
eosupport@copernicus.esa.int

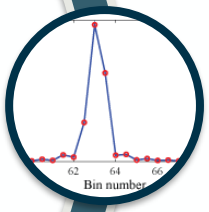


FMR – BC005 validation results for HY

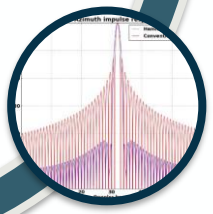
Inland waters

WHAT'S NEW

Dedicated mask for inland water areas

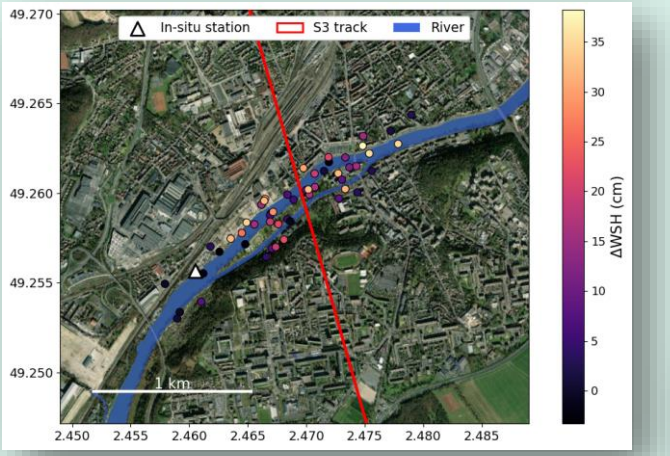


Zero-padding processing to improve water surface height



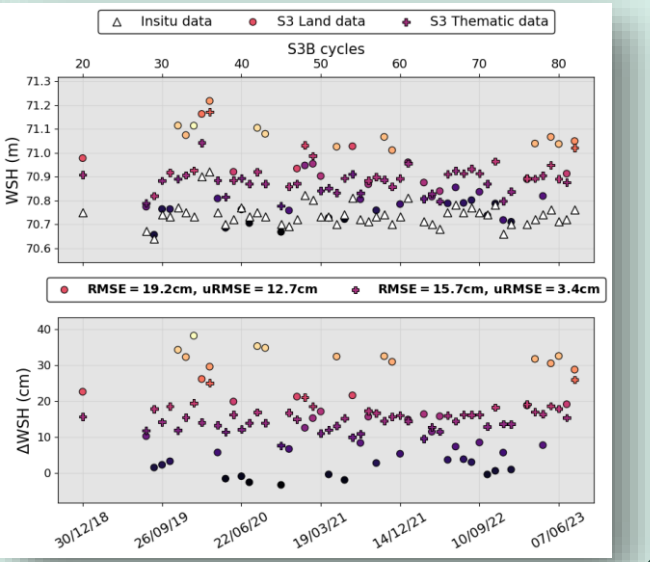
Hamming window filter to reduce waveform contamination

Validation results over rivers



Example for ideal single river case – Oise river (FR)

uRMSE over low slope rivers **reduced by a factor of 4 !**



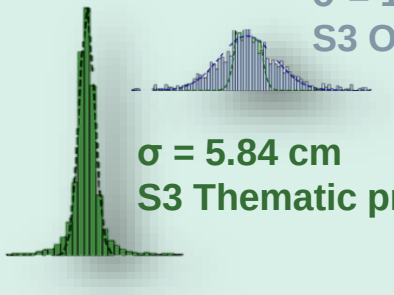
Statistical analysis performed over ideal river with low slope. Performances over ideal rivers are similar to lakes.

FMR – BC005 validation results for HY

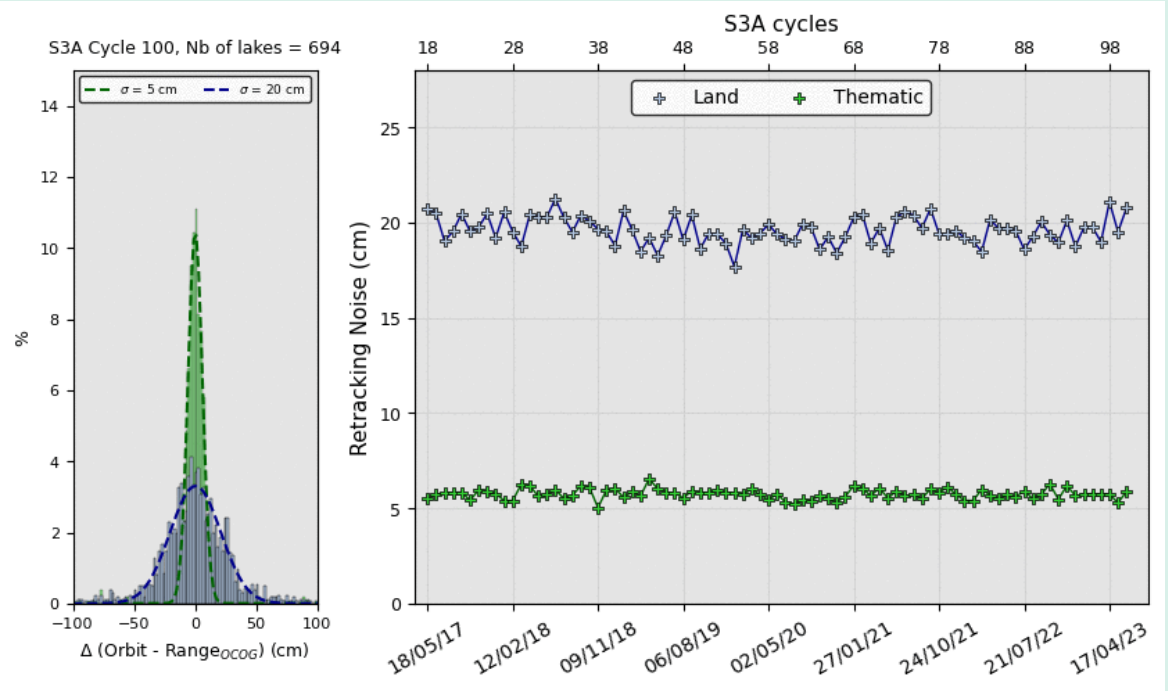
Inland waters

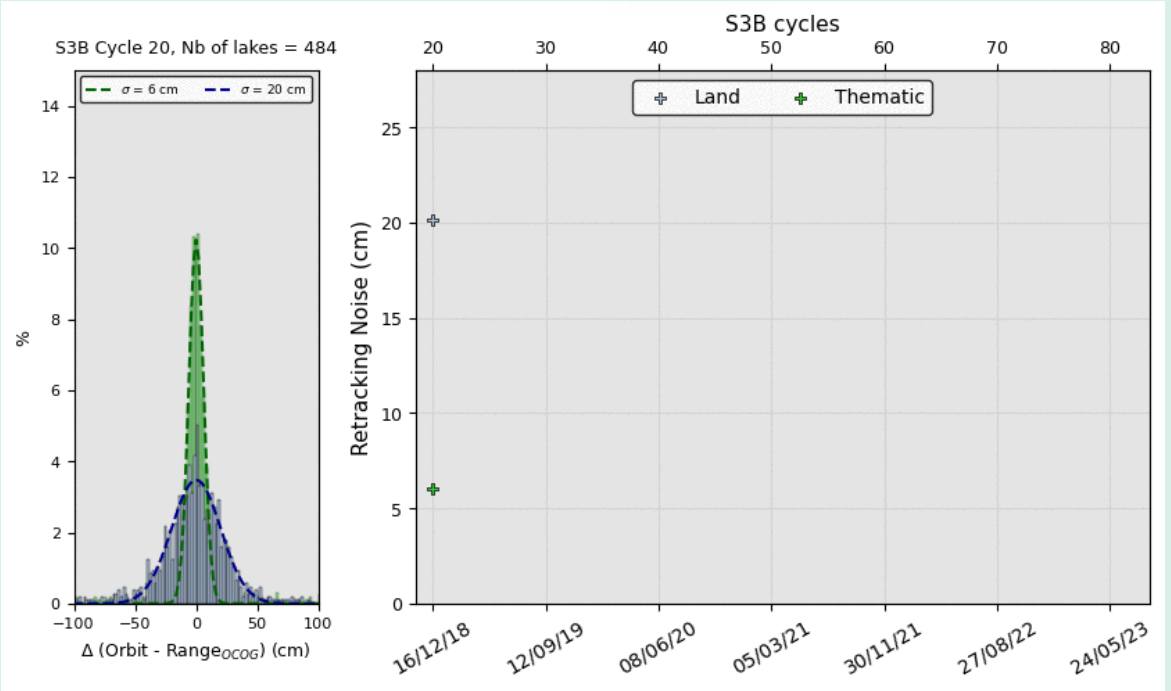
Validation results over lakes

Off-set center of gravity (OCOG) retracking noise over lakes
reduced by a factor of 4 !



Retracking noise distribution statistical analysis over lakes from 1 to 5 km^2 at low latitudes.

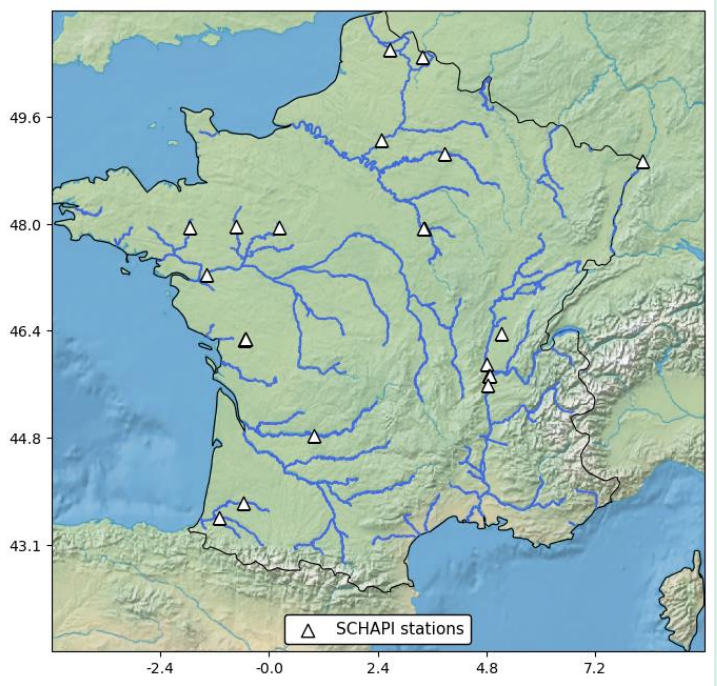




FMR – BC005 validation results for HY

Inland waters

In-situ comparison over rivers



Comparison with 22 in-situ SCHAPI stations including 2 complex rivers.

Discrepancies with respect to in-situ **decreased by 3 cm !**

Median uRMSE is 23 cm !

OLTC for S3

Improve/define your targets @ www.altimetry-hydro.eu

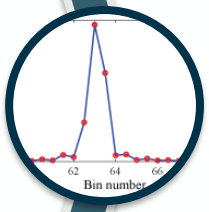
- Nadir acquisition for hydrological targets.
- Open loop tracking mode used on-board.
- More than 170k targets – latest update for S3 in September 2023.
- 97% performance of waveform acquisition.

FMR – BC005 validation results for SI

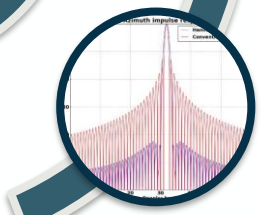
Sea Ice

WHAT'S NEW

Dedicated mask for sea ice areas

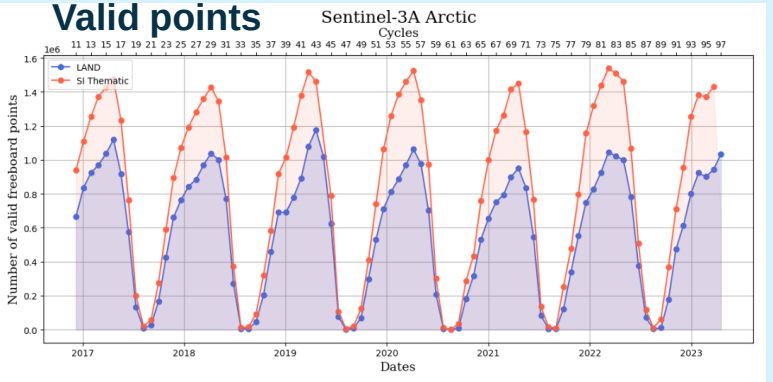


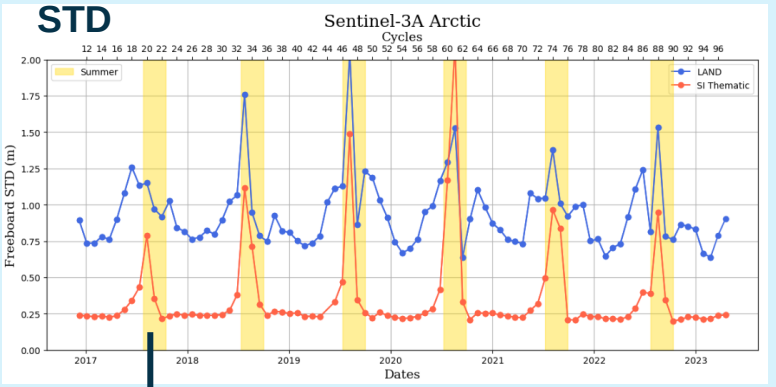
Zero-padding processing to improve waveform sampling



Hamming window filter to reduce waveform contamination

Improved data coverage





Summer

S3 Thematic
S3 Land

25% more of Freeboard (FB) valid data (i.e., not NaN) with respect to older baseline collection.

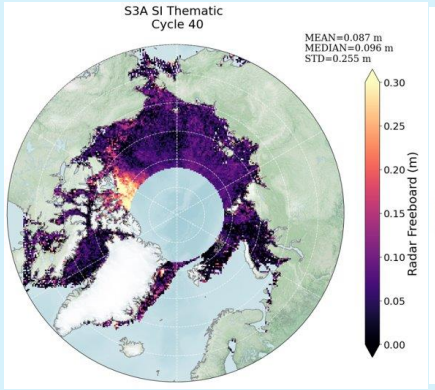
STD is also lower and more stable. Mean STD value is **down to 25 cm with BC005, reduced by 50 cm !**

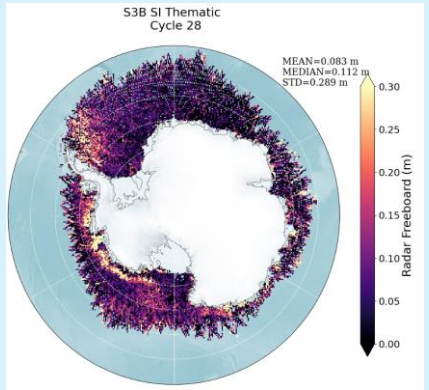
FMR – BC005 validation results for SI

Sea Ice

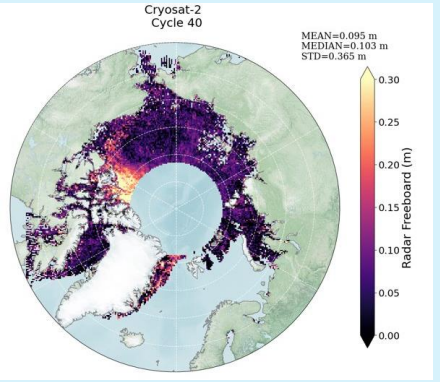
Validation against CryoSat-2

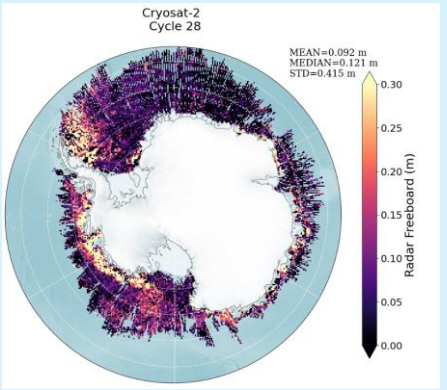
S3 BC005





CS2





S3A and CS2 – arctic
S3B and CS2 – antarctic

Comparison including SARIn data from CS2, baseline E.

Freeboard agreement largely **improved up to 90% !**

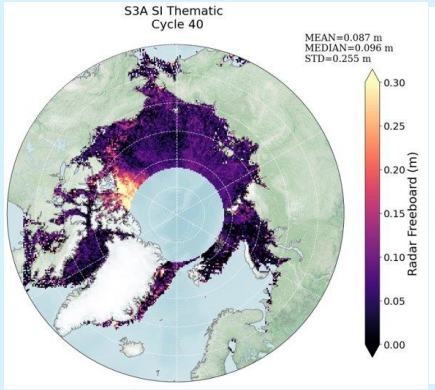
STD is also more stable for S3 and significantly reduced.

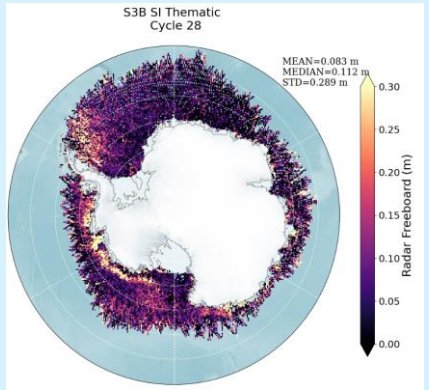
FMR – BC005 validation results for SI

Sea Ice

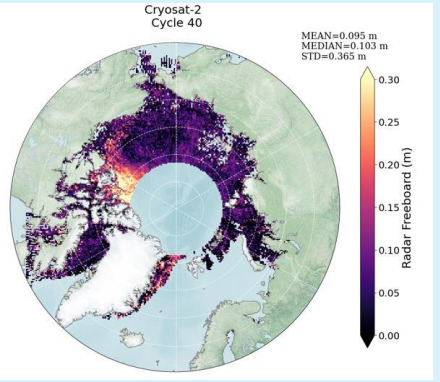
Validation against CryoSat-2

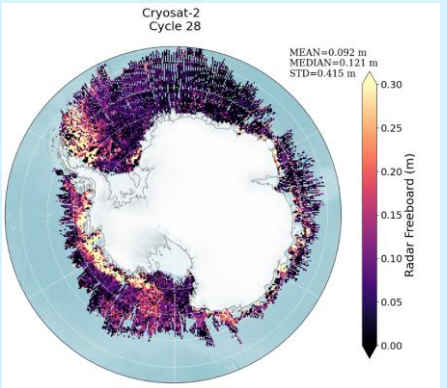
S3 BC005



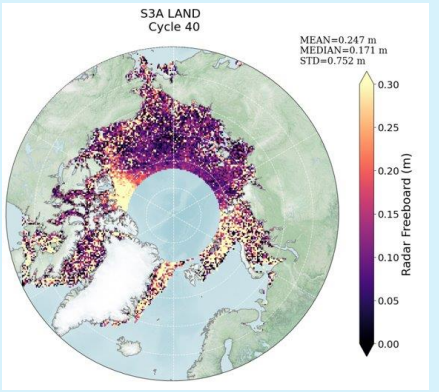


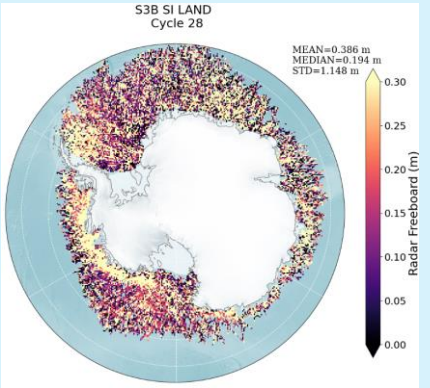
CS2



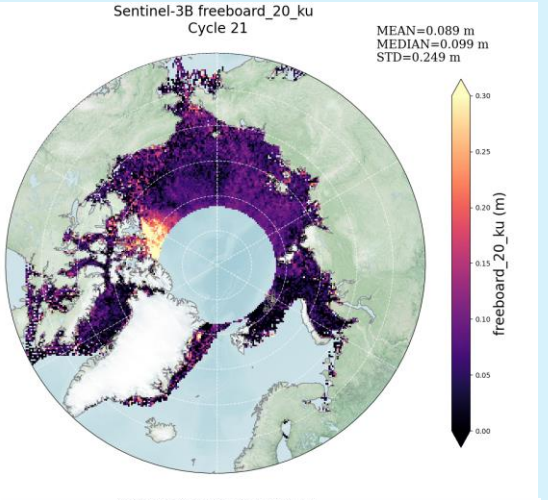


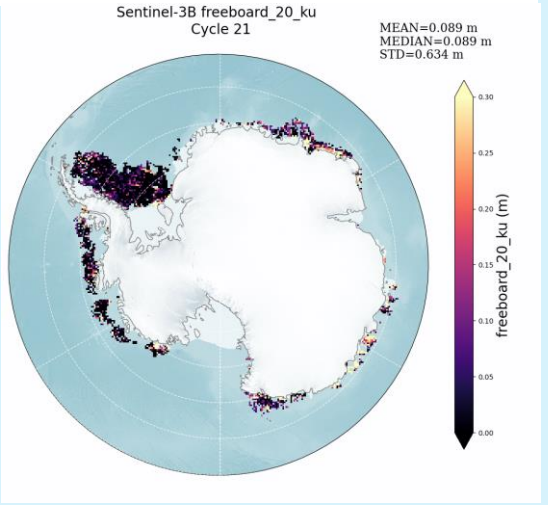
S3 BC004





S3 FB evolution



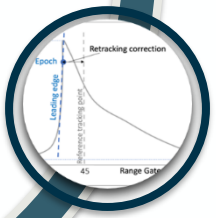


FMR – BC005 validation results for LI

Land Ice

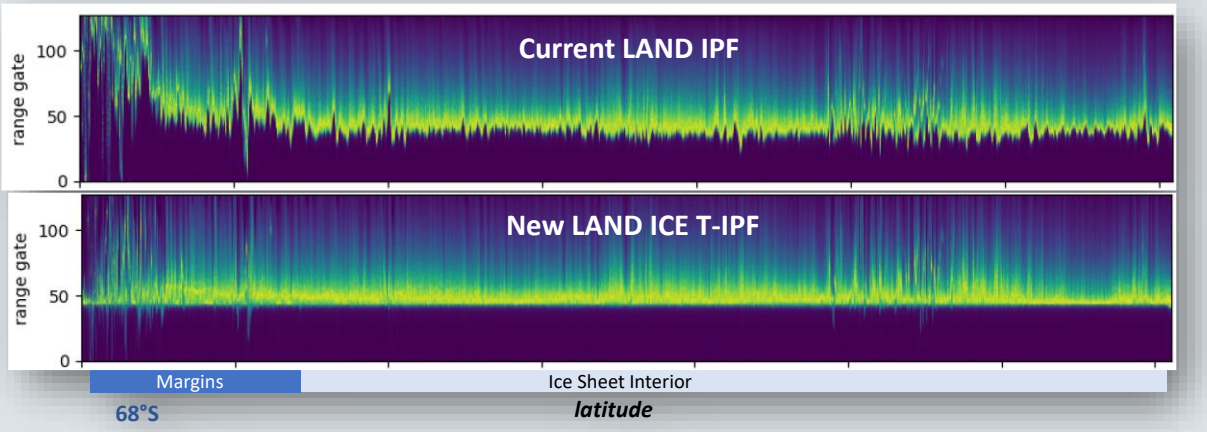
WHAT'S NEW

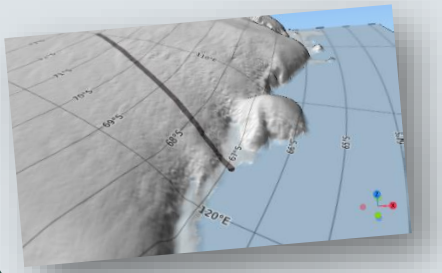
Dedicated mask for land ice areas



Extended window for waveform processing

Improved relocation method



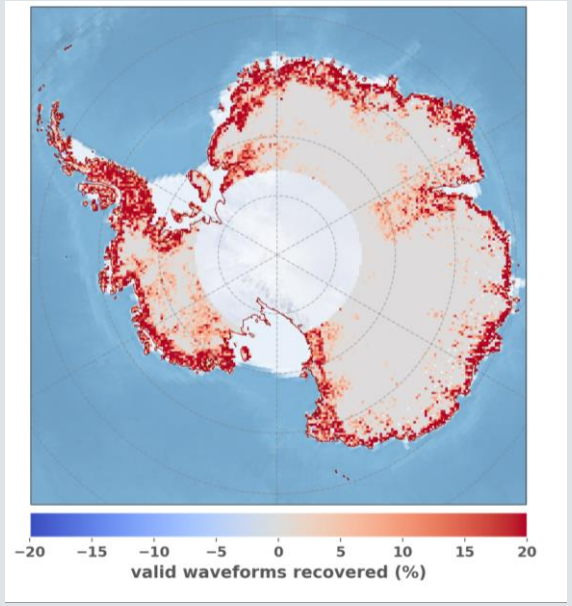


Relocation method largely improved due to extended window for retracking.
Optimized waveform processing over rough and/or steeply sloping surfaces.

FMR – BC005 validation results for LI

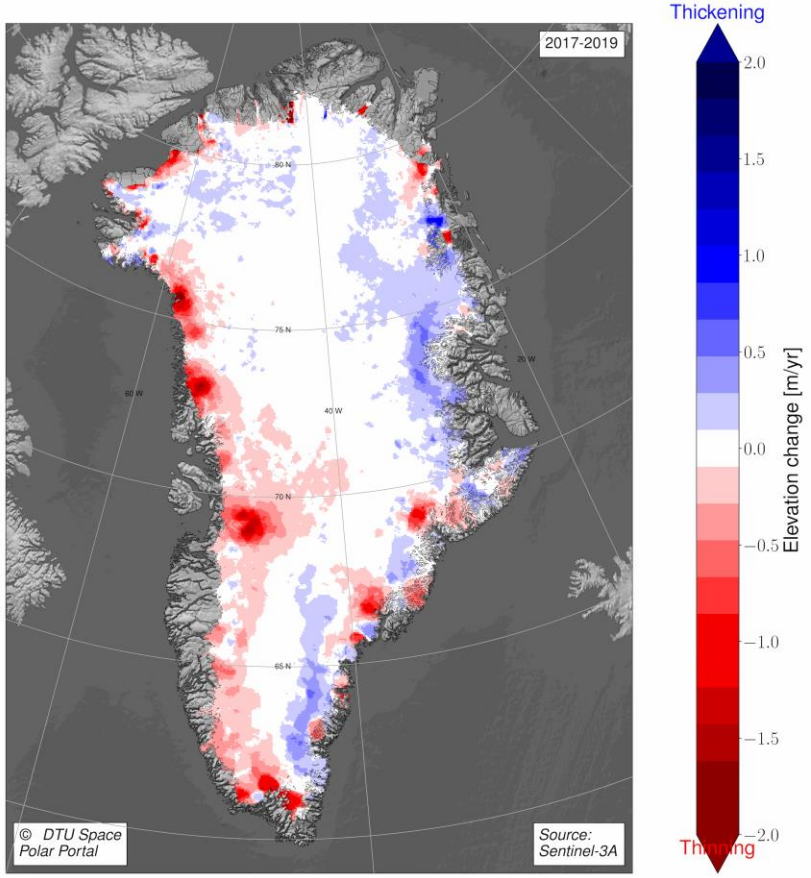
Land Ice

Improved data coverage



Recovered waveforms **up to 25%** with respect to previous baseline.

Elevation change detected by S3



BC005 – what's next?

Short-term plan

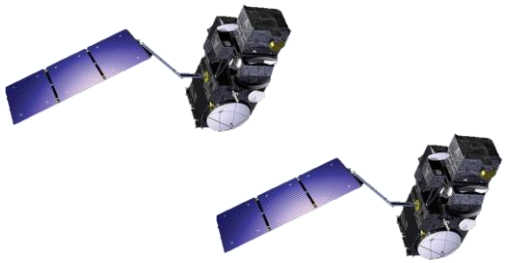
Inland waters
- OLTC flag providing more details on acquisitions mode
- Ice flag for targets covered by ice

Sea Ice
- To include sea ice thickness as core parameter in L2 (needs for more ADFs)
- To improve freeboard computation by applying some filtering to improve coherence among S3A/B and wrt CS2

Land Ice
- Relocation method to be improved – AMPLI method under dev in CLS (paper under prep) → long-term
- Dedicated flag for ice sheet/shelf surface

Take home messages

- Three Sentinel-3 Level-2 Altimetry Hydro-Cryo Thematic products
- Improved processing over three thematic surfaces (HY, SI, LI)
- BC005 available from BOM up to date
- CDSE new data access interface



Full mission reprocessing web page

https://sentinels.copernicus.eu/web/sentinel/technical-guides/sentinel-3-altimetry/products-and-algorithms/baseline-collection-005-processing-status

S3 SRAL Level-2 User Handbook

https://sentinels.copernicus.eu/documents/247904/4871083/Sentinel-3+SRAL+Land+User+Handbook+V1.1.pdf/ebd1444d-240f-70ab-f8fc-e84b67b022cd?t=1673614240693

Work InProgress…

BC005 validation results – paper in prep

Thank you !