CryoSat Ice Baseline-E

Operational & Reprocessed Data Quality Control

L. Toonen[(1)], E. Turner[(1)], M. Williams[(1)], A. Di Bella[(2)]

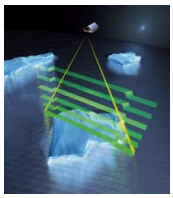
[(1)] Telespazio UK Ltd (UK), e-mail: liv.toonen@telespazio.com; [(2)] Randstad c/o ESA/ESRIN (Italy);

IDEAS-QA4EO

TELESPAZIO a LEONARDO and THALES company

CryoSat Mission

- Launched in April 2010, CryoSat is **ESA's dedicated ice mission**. It was designed to measure changes in the thickness of polar sea ice, and the elevation of the ice sheets and mountain glaciers.
- CryoSat's sophisticated **SAR Interferometric Radar Altimeter (SIRAL)** can measure high-resolution geophysical parameters over all ocean and ice environments.
- To enable their full scientific and operational exploitation, the CryoSat products are continuously evolving, through updates and improvements to the **Instrument Processing Facilities (IPFs)**.
- The Quality Assurance for Earth Observation (IDEAS-**QA4EO**) service (formerly IDEAS+) is a Telespazio UK led consortium providing support to the ESA/ESRIN Sensor Performance and Algorithms office.
- Since launch, IDEAS-QA4EO have supported the CryoSat mission, covering all operational activities, IPF validations, testing activities, reprocessing campaigns, and user support.

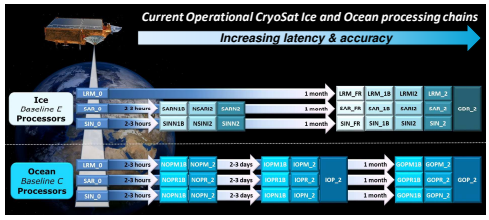


CryoSat Ice Processors

- **SIRAL** operates in three modes: Low Resolution Mode (LRM), Synthetic Aperture Radar (SAR) and SAR Interferometric (SARIn).
- CryoSat Level 0 (L0) data is processed operationally to science Level 1B (L1B) and Level 2 (L2) products using two independent processing chains: **Ice** and **Ocean.** Both processors generate a range of operational products with increasing latencies and accuracies.

Ice
- Near Real Time (NRT) SAR & SARIn products
- Offline LRM, SAR, SARIn products
- Global Data Record (GDR) products

Ocean
- NRT Ocean Products (NOP)
- Intermediate Ocean Products (IOP)
- Geophysical Ocean Products (GOP)



Operational Data Quality Control

Since launch, IDEAS-QA4EO has performed routine **Quality Control (QC)** on all CryoSat products. These activities aim to add value to the datasets: to detect anomalies, support investigations, and prevent the distribution of poor-quality data products to users. QC reports, published daily, are a valuable tool for users to understand the quality of the data they are using.

Daily Checks

- Real-time monitoring of L0 data and auxiliary file availability
- Daily checks of L1, L2, L2i products
- Investigation of anomalies and data gaps
- Adding value by quickly following up on missing auxiliary files, unexpected data gaps, or other issues that might affect the data completeness or quality.

L0 Data Unavailability Periods: https://earth.esa.int/eogateway/missions/cryosat/data/data-unavailability-periods

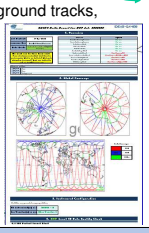
Scan me

- Investigation of the L0 data gaps due to planned and unplanned data unavailability periods.
- Full list of unavailability periods available for users.

Daily Performance Reports: https://qras.earth.esa.int/

Scan me

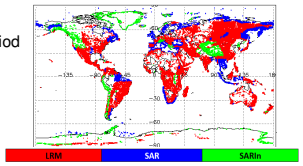
- Reports include: mission/instrument news, global plots of data ground tracks, format and contents of data, missing auxiliary files or calibration files, list of flags
- To give users insight of the quality of the data soon after the data is published.
- Makes users aware of which flags are raised in the products.
- Users may wish to filter out products/records with certain flags.



Monthly/ Cyclic Performance Reports: https://qras.earth.esa.int/

Scan me

- Reports contain information on L1B and L2 ice products of a 30-day reporting period
- It helps user to be aware of:
  - Mission/ instrument news affecting the reporting period
  - Expected changes or gaps in the data
  - The current mode map and data coverage
  - Long term monitoring of key L2 parameters



CryoSat Product Anomalies: https://earth.esa.int/eogateway/missions/cryosat/data/product-anomalies

Documents providing an overview of the anomalies that are known to affect the CryoSat ice and ocean products and a description of the impact these have on the data.

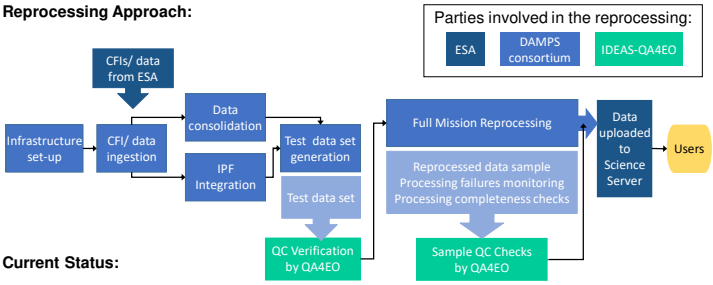
- The **Sea State Bias** (sea_state_bias_01_ku) is unfilled in all L2 LRM products due to an error in the code. The SSB is expected in all L2 LRM products over open ocean.
- Occasionally **short NRT products** are generated due to delayed arrival of some L0 inputs. A proposal to update the task table selection policy will force the processor to wait for full coverage.
- A number of **processing failures** still affect the Ice Baseline-E IPFs and are being monitored and investigated in operations.

Reprocessed Data Quality Control

The **Ice Baseline-E reprocessing campaign** is currently underway to reprocess all CryoSat Ice products with the latest Baseline-E IPFs.

- Reprocessing period: **16th July 2010 – 22nd August 2021**
- Reprocessing is being performed by the **DAMPS consortium** at ACRI.

Reprocessing Approach:



Current Status:

- Reprocessed data is being uploaded in batches to the Science Server (science-pds.cryosat.esa.int)
- Reprocessing is in the final stage and due to be completed by May 2023.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Reprocessing complete												
QC checks complete												
Data upload complete												

The IDEAS-QA4EO CryoSat QC team plays a key role in CryoSat **reprocessing campaigns**.

Main responsibilities include:

- Preparation of a detailed **Reprocessing Guidelines Document** for transfer of knowledge, advice and recommendations to the reprocessing team.
- Support to **data consolidation**, **integration** and **testing** of the processors and execution of the reprocessing campaign.
- **Verification of test data** before the full mission reprocessing starts.
- Systematic **quality control** of a sample of products from every month of data generated.
- Support to the investigation of **anomalies and processing failures.**

Main Evolutions of Baseline-E:

Scan me to get see the complete evolutions document

- Improvements to LRM and SARIn **land ice retracking**.
- **Compression** of the L1B and L2 netCDF products.
- Improved filtering of outliers to improve **interpolated Sea Surface Height Anomaly (SSHA)** accuracy. Filtering out long range off-nadir leads = a small increase in SSHA. Expected to have greatest impact on freeboard over thick sea ice, where off-nadir leads have a greater impact.
- Improved **interpolation of SSHA** across file boundaries and mode changes, using data from adjacent files.
- Modification of the Warren **Snow Depth** according to sea ice type (new flags introduced). This corrected snow depth is then used to compute a delay correction to the sea ice floe height, where the sea ice type is known (currently only in the Arctic).
- Addition of **20Hz Pseudo-LRM (PLRM) estimates** to the L1B SAR and SARIn products.
- Generation of a new **L1B Stack (L1B-S) product**, available to specialist users on demand.

CryoSat Users! We need your feedback!

Please complete our quick survey about data QC.

What quality information do you need? What do you like/ dislike? Any suggestions?

PV 2023 CONFERENCE

PV2023: Adding value (to) and preserving Scientific & Technical data: 2nd – 4th May 2023, ID: 3178, Poster pitch: 2nd May 17:46