

Surface Water and Ocean Topography (SWOT) Project

Release Note Beta Pre-Validated KaRIn Products

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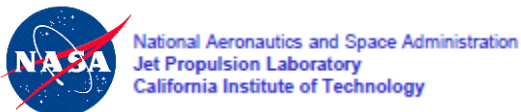


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1 Purpose

This document is the Release Note for the public release of “Beta Pre-Validated” Surface Water and Ocean Topography (SWOT) Ka-band Radar Interferometer (KaRIn) Science Data Products. The primary purpose of this release is to familiarize users with science data products from in-flight KaRIn data.

Users working with these beta pre-validated KaRIn science data products are requested to acknowledge the following:

1. The data in this release are to be referred to as “beta pre-validated” data products.
2. Users acknowledge that there are known deficiencies in these data products that the joint NASA/CNES project continues to work towards resolution as the project progresses.
3. By using these data, users agree to not present science results from these data products in the peer-reviewed literature beyond product validation and other relevant product assessment efforts.

All KaRIn data is currently being reprocessed with the best available algorithms and calibrations to generate “Pre-Validated” science data products. These “Pre-Validated science data products are planned for release in January 2024.

2 Scope of Product Release

This “beta pre-validated” product release includes:

1. Reprocessed global low rate (LR) ocean products spanning March 30 – July 10, 2023 from the calibration phase (1-day orbit).
2. Forward processed global low rate (LR) ocean products spanning September 7 – November 21, 2023 from the science phase (21-day orbit), using consistent software and calibrations as used for the reprocessed data.
3. Reprocessed global high rate (HR) hydrology products spanning April 8-22, 2023 from the calibration phase (1-day orbit).

A reprocessing of data from the 1-day repeat calibration phase (see Table 1) of the SWOT mission has been performed. This reprocessing of data from the calibration phase aimed to generate a self-consistent time series of products across the calibration phase using the best available ground processing algorithms and instrument calibrations at the time the reprocessing effort started. Numerous changes to ground processing algorithms and instrument calibrations were applied when operationally processing incoming data during the calibration phase. This resulted with an inconsistent time series, with evolving maturity, in the operational products.

The beta pre-validated product reprocessing focused only on data during the calibration phase of the SWOT mission. Reprocessing of data from the commissioning phase has not been performed because a variety of changes to the configuration of the SWOT platform as well as the KaRIn instrument were performed during that phase. The KaRIn instrument achieved its final in-flight configuration on March 30, 2023.

This release also includes forward processed ocean (low-rate) KaRIn beta pre-validated products from September 7 – November 21, 2023, during the science phase of the mission. Hydrology

(high rate) products for this period are not being released at this time. The operational (forward) processing of SWOT products adopted the software and calibration parameters used in the calibration phase reprocessing on September 7, 2023. No additional beta pre-validated KaRIn products will be generated.

The KaRIn products in this release are considered to be “beta pre-validated” products because they do not use the best available algorithms and calibrations that are being used for ongoing reprocessing to generate the “pre-validated” products.

The operational (forward) processing of SWOT products changed to the “pre-validated” product processing configuration on November 22, 2023 using improved algorithms and calibrations as compared to those used to generate the beta products. Reprocessed and forward processed “pre-validated” products, spanning the calibration and science phases, are planned to start being released by in January 2024 after completing basic assessments by the project team.

Note that SWOT nadir altimeter and microwave radiometer Operational and Interim Geophysical Data Records (OGDRs and IGDRs) have already been publicly available since July 2023. A reprocessing of the IGDR products for the period from March 29 to July 10, 2023 was performed at that time. These have also been reprocessed to generate a self-consistent time series during this period. By their very definition, IGDRs are considered to be partially validated. The SWOT OGDRs and IGDRs continue to be publicly available for both the calibration and science phases of the mission.

Table 1. SWOT Orbit and Mission Phase Timeline

Date	Orbit and Mission Phase
December 16, 2022	Launch
December 16 - 24, 2023	Launch and Early Operations Phase (LEOP)
December 16 – January 14, 2023	Orbit Maneuvers and Drift
January 14, 2023	Start of 1-day Repeat Orbit
January 3 – March 30, 2023	Commissioning Phase
March 30 – July 10, 2023	Calibration Phase
July 11 – July 20, 2023	Orbit Maneuvers and Drift
July 21, 2023	Start of 21-day Repeat Orbit
July 21, 2023	Science Phase Begins (no useful KaRIn data until July 26)

2.1 KaRIn Beta Pre-Validated Products

2.1.1 KaRIn Low Rate Ocean Products

All of reprocessed “beta pre-validated” global KaRIn Low Rate (LR) Ocean Products from the calibration phase and corresponding forward processed data from the science phase are available to users. The data record spans March 30 – July 10, 2023 and September 7 – November 21, 2023. There are some gaps in this time span that are due either because the raw data were not

available or because the available data could not be processed with the adopted version of the science data processing software. The LR products include:

1. Level 1B KaRIn Low Rate Interferogram Data Product (L1B_LR_INTF)
2. Level 2 KaRIn Low Rate Sea Surface Height Data Product (L2_LR_SSH)

A key byproduct of the LR reprocessing is the so-called crossover calibration, which is a critical input to the KaRIn high rate (HR) science data products. Users are advised that the crossover calibration may not be useful in some portions of the released beta products. Users may need to use their own approaches to mitigate the cross track slopes in the reported sea surface height anomalies that the crossover calibration is intended to correct.

2.1.2 KaRIn High Rate Hydrology Products

Two weeks (April 8-22, 2023) of KaRIn High Rate (HR) Hydrology Products from the calibration phase are available to users. The processing of HR data is significantly more computationally intensive than LR data. Note that the HR products are more dependent on some calibration parameters (especially the crossover calibration), so some of the products from this 2-week period do not have useful data. In addition, some data are missing due to processing anomalies that have been significantly mitigated for the ongoing reprocessing of “pre-validated” products. If multiple versions of the same data product file are found, please use the version with the highest product counter. The HR products include:

1. Level 1B KaRIn High Rate Single Look Complex Product (L1B_HR_SLC)
2. Level 2 KaRIn High Rate Water Mask Pixel Cloud Product (L2_HR_PIXC)
3. Level 2 KaRIn High Rate River Single Pass Vector Product (L2_HR_RiverSP)
4. Level 2 KaRIn High Rate Lake Single Pass Vector Product (L2_HR_LakeSP)
5. Level 2 KaRIn High Rate Raster Product (L2_HR_Raster)

2.2 Nadir Altimeter and Advanced Microwave Radiometer Interim Geophysical Data Records (IGDRs)

All data from the onboard Poseidon-3C Nadir Altimeter (NALT) and Advanced Microwave Radiometer (AMR) during the calibration phase have similarly been reprocessed to generate a self-consistent IGDR product during the calibration phase. These reprocessed data are publicly available at the same locations from the NASA PO.DAAC and CNES AVISO data distribution centers as previously announced (see section 4.2). These data products are critical inputs to the KaRIn science data products.

Users are advised that the NALT and AMR near-real-time Operational Geophysical Data Records (OGDRs) have not been reprocessed, as they are superseded by the higher accuracy IGDRs.

The currently ongoing reprocessing for “pre-validated” products will include the so-called NALT and AMR Geophysical Data Record products.

3 User Documentation

3.1 Product Description Documents

Product description documents for all of the products in this release are available at:

<https://podaac.jpl.nasa.gov/swot?tab=datasets>

Users are advised that the exact format of the products in this release may have small deviations from the format provided in the available product description documents, due to the ongoing evolution of algorithms. Users are advised to trust the metadata (e.g., netCDF attributes) in the released products.

3.2 Algorithm Theoretical Basis Documents

Algorithm Theoretical Basis Documents describe the algorithms that are used to perform the ground processing of instrument data. These documents are available at:

<https://podaac.jpl.nasa.gov/swot?tab=datasets>

4 Data Access

SWOT data can be accessed from both the CNES and NASA PO.DAAC data centers. Access details are provided below.

4.1 KaRIn Beta Pre-Validated Products

4.1.1 NASA PO.DAAC

The KaRIn beta pre-validated datasets in this release are available through NASA Earthdata Search client (https://search.earthdata.nasa.gov/search?q=SWOT_*_1.1) and downloadable using [PO.DAAC scripts](#) by their unique collection IDs, which are given in the table below with usage examples for each dataset. Collection IDs SWOT_*_1.1 represent reprocessed data from the calibration phase. In addition, operational (forward) processed LR data from September 7 to November 21 are available in data collection query https://search.earthdata.nasa.gov/search?q=SWOT_*_1.0. Additional tips for searching HR data products can be found in the PO.DAAC Cookbook - [SWOT Chapter](#).

Table 2. PO.DAAC KaRIn Beta Pre-Validated Data Collection IDs and Examples to Access

NASA PO.DAAC Collection ID	Dataset Name	Example data access script (Obtain PO.DAAC data download tool)
SWOT_L1B_LR_INTF_1.1	Level 1B KaRIn Low Rate Interferogram Data Product (Reprocessed calibration phase data)	INTF products for 2021-03-29 to 2023-07-10: podaac-data-downloader -c SWOT_L1B_LR_INTF_1.1 -d ./SWOT_L1B_LR_INTF_1.1/ --start-date 2023-03-29T00:00:00Z --end-date 2023-07-10T23:59:59Z
SWOT_L2_LR_SSH_1.1	Level 2 KaRIn Low Rate Sea Surface Height Data Product	SSH products for 2021-03-29 to 2023-07-10:

	(Reprocessed calibration phase data)	podaac-data-downloader -c SWOT_L2_LR_SSH_1.1 -d ./SWOT_L2_LR_SSH_1.1/ --start-date 2023-03-29T00:00:00Z --end-date 2023-07-10T23:59:59Z
SWOT_L1B_LR_INTF_1.0	Level 1B KaRIn Low Rate Interferogram Data Product (Operational forward processed science phase data from September 7, 2023 onward)	INTF products for 2023-09-07 to 2023-11-21: podaac-data-downloader -c SWOT_L1B_LR_INTF_1.0 -d ./SWOT_L1B_LR_INTF_1.0/ --start-date 2023-09-07T00:00:00Z --end-date 2023-10-13T23:59:59Z
SWOT_L2_LR_SSH_1.0	Level 2 KaRIn Low Rate Sea Surface Height Data Product (Operational forward processed science phase data from September 7, 2023 onward)	SSH products for 2023-09-07 to 2023-11-21: podaac-data-downloader -c SWOT_L2_LR_SSH_1.0 -d ./SWOT_L2_LR_SSH_1.0/ --start-date 2023-09-07T00:00:00Z --end-date 2023-10-13T23:59:59Z
SWOT_L1B_HR_SLC_1.1	Level 1B KaRIn High Rate Single Look Complex Product	SLC products for 2023-04-10 to 2023-04-25: podaac-data-downloader -c SWOT_L1B_HR_SLC_1.1 -d ./SWOT_L1B_HR_SLC_1.1/ --start-date 2023-04-08T00:00:00Z --end-date 2023-04-25T23:59:59Z
SWOT_L2_HR_PIXC_1.1	Level 2 KaRIn High Rate Water Mask Pixel Cloud Product	PIXC products for 2023-04-10 to 2023-04-25: podaac-data-downloader -c SWOT_L2_HR_PIXC_1.1 -d ./SWOT_L2_HR_PIXC_1.1/ --start-date 2023-04-08T00:00:00Z --end-date 2023-04-25T23:59:59Z
SWOT_L2_HR_RiverSP_1.1	Level 2 KaRIn High Rate River Single Pass Vector Product	RiverSP products for 2023-04-10 to 2023-04-25: podaac-data-downloader -c SWOT_L2_HR_RiverSP_1.1 -d ./SWOT_L2_HR_RiverSP_1.1/ --start-date 2023-04-08T00:00:00Z --end-date 2023-04-25T23:59:59Z
SWOT_L2_HR_LakeSP_1.1	Level 2 KaRIn High Rate Lake Single Pass Vector Product	LakeSP products for 2023-04-10 to 2023-04-25: podaac-data-downloader -c SWOT_L2_HR_LakeSP_1.1 -d ./SWOT_L2_HR_LakeSP_1.1/ --start-date 2023-04-08T00:00:00Z --end-date 2023-04-25T23:59:59Z
SWOT_L2_HR_Raster_1.1	Level 2 KaRIn High Rate Raster Product	Raster products for 2023-04-10 to 2023-04-25: podaac-data-downloader -c SWOT_L2_HR_Raster_1.1 -d ./SWOT_L2_HR_Raster_1.1/ --start-date 2023-04-08T00:00:00Z --end-date 2023-04-25T23:59:59Z

Resources for users of SWOT datasets distributed by the PO.DAAC

Note: At the time of this Release Note, data access examples provided in the resources below are being updated to use beta pre-validated SWOT data, but some delay may occur. (Users may still encounter remnants of examples using SWOT simulated data for a limited time. If that is the case a similar pattern can be used with the “beta pre-validated” datasets using the SWOT collection ID listed in the table above.)

Search, Download, and Access:

- [PO.DAAC Cookbook - SWOT Chapter](#)
https://podaac.github.io/tutorials/quarto_text/SWOT.html
 - [SWOT Search & Download](#) section, [Earthdata Search tutorial](#), and [Tips for Searching SWOT HR data products](#).
 - [In-cloud Access](#)
 - [GIS Workflows](#)
 - Note: the SWOT Chapter in the PO.DAAC Cookbook will continue to be updated as new/more SWOT data become publicly available.
- [PO.DAAC Data Subscriber/Downloader](#) (Download Access, Command Line)
 - [Video tutorial on using the podaac-data-subscriber](#)

Subsetting and Visualization:

- PO.DAAC HiTIDE <https://hitide.podaac.earthdatacloud.nasa.gov/> (For exploring, subsetting, and accessing SWOT LR and PO.DAAC oceanography data)

4.1.2 CNES AVISO

Identical KaRIn L2_LR_SSH products are also available at the CNES AVISO distribution center (<https://www.aviso.altimetry.fr/en/data/products/sea-surface-height-products/global/swot-karin-low-rate-ocean-products.html>). They can be accessed via FTP/SFTP using AVISO+ credentials . The L1B_LR_INTF products are available by specific request only..

CNES AVISO FTP/SFTP access

- FTP access: `ftp://ftp-access.aviso.altimetry.fr:21/`
- SFTP access: `sftp://ftp-access.aviso.altimetry.fr:22/`

FTP/SFTP server directory main tree

- `/swot_st/swot_beta_products/karin/l2_lr_ssh/PIB0`

The KaRIn “beta pre-validated” products in this release are listed below along with the corresponding Digital Object Identifier (DOI) landing pages:

KaRIn L2_LR_SSH product files

- * SWOT_L2_KaRIn_SSH_Basic_1.0 (<https://doi.org/10.24400/527896/a01-2023.013>)
- * SWOT_L2_KaRIn_SSH_WindWave_1.0 (<https://doi.org/10.24400/527896/a01-2023.014>)
- * SWOT_L2_KaRIn_SSH_Expert_1.0 (<https://doi.org/10.24400/527896/a01-2023.015>)
- * SWOT_L2_KaRIn_SSH_Unsmoothed_1.0 (<https://doi.org/10.24400/527896/a01-2023.016>)

4.1.3 CNES Hydroweb.next

The KaRIn “beta pre-validated” Reprocessed global High Rate (HR) hydrology products spanning April 8-22, 2023 from the calibration phase (1-day orbit) can be accessed via the CNES Hydroweb.next portal: <https://hydroweb.next.theia-land.fr>.

4.2 Nadir Altimeter and Advanced Microwave Radiometer Interim Geophysical Data Records (IGDRs)

As mentioned earlier, the SWOT NALT and AMR IGDR products have also been reprocessed to generate a self-consistent time series during the calibration phase. These reprocessed IGDR products have already been publicly available since July 2023. The reprocessed NALT and AMR IGDR products are publicly available at the same previously announced locations at the CNES AVISO and NASA PO.DAAC distribution centers. Access information for these OGDR and IGDR products is repeated below. Note again that the OGDR products have not been reprocessed.

4.2.1 CNES AVISO

The SWOT Nadir Altimeter and Radiometer (O/I)-GDR can be accessed on the AVISO+ web portal and through a new platform of the AVISO+ CNES Data Center's long-term archive catalog, accessible directly using AVISO+ credentials. Further information on SWOT data access can be found via the dedicated webpage on AVISO+:

<https://www.aviso.altimetry.fr/en/missions/current-missions/swot/access-to-data.html>

The (O/I)-GDR products in this release are listed below along with the corresponding Digital Object Identifier (DOI) landing pages:

Poseidon-3C Nadir Altimeter

* SWOT_L2_NALT_OGDR_1.0 (<https://doi.org/10.24400/527896/a01-2023.006>)

* SWOT_L2_NALT_IGDR_1.0 (<https://doi.org/10.24400/527896/a01-2023.005>)

Advanced Microwave Radiometer

* SWOT_L2_RAD_OGDR_1.0 (<https://doi.org/10.24400/527896/a01-2023.008>)

* SWOT_L2_RAD_IGDR_1.0 (<https://doi.org/10.24400/527896/a01-2023.007>)

4.2.2 NASA PO.DAAC

Reprocessed NALT and AMR data are available from two groups of collections at PO.DAAC: a) acquisitions before November 16 are available at the same locations as previously announced and discoverable through collection identifiers matching this pattern:

SWOT_L2_{NALT/RAD}_{O/I}GDR_1.0; and b) acquisitions after November 16 are available from four new collections with collection identifiers matching this pattern:

SWOT_L2_{NALT/RAD}_{O/I}GDR_2.0. These datasets are listed below with links to the corresponding dataset landing pages on the PO.DAAC web portal

(<https://podaac.jpl.nasa.gov/swot>), as well as specific examples on using PO.DAAC scripts for data download.

Table 3. PO.DAAC Nadir Altimeter and Radiometer Operational and Interim Geophysical Data Record Data Collection IDs and Examples to Access

NASA PO.DAAC Collection ID	Dataset Name	Example data access script (Obtain PO.DAAC data download tool)
SWOT_L2_NALT_OGDR_1.0	Poseidon-3C Nadir Altimeter (NALT) OGDR, DOI: 10.5067/SWOT-NALT-OGDR-1.0	OGDR products from 2023-06-21 to 2023-11-16: podaac-data-subscriber -c SWOT_L2_NALT_OGDR_1.0 -d ./SWOT_L2_NALT_OGDR_1.0/ --start-date 2023-06-21T00:00:00Z
SWOT_L2_NALT_OGDR_2.0	https://podaac.jpl.nasa.gov/dataset/SWOT_L2_NALT_OGDR_2.0 , DOI: same as SWOT_L2_NALT_OGDR_1.0	OGDR products since 2023-11-16: podaac-data-subscriber -c SWOT_L2_NALT_OGDR_2.0 -d ./SWOT_L2_NALT_OGDR_2.0/ --start-date 2023-11-16T00:00:00Z
SWOT_L2_NALT_IGDR_1.0	Poseidon-3C Nadir Altimeter (NALT) IGDR, DOI: 10.5067/SWOT-NALT-IGDR-1.0	OGDR products from 2023-06-21 to 2023-11-16: podaac-data-subscriber -c SWOT_L2_NALT_IGDR_1.0 -d ./SWOT_L2_NALT_IGDR_1.0/ --start-date 2023-03-29T00:00:00Z
SWOT_L2_NALT_IGDR_2.0	https://podaac.jpl.nasa.gov/dataset/SWOT_L2_NALT_IGDR_2.0 , DOI: same as SWOT_L2_NALT_IGDR_1.0	IGDR products since 2023-11-16: podaac-data-subscriber -c SWOT_L2_NALT_IGDR_2.0 -d ./SWOT_L2_NALT_IGDR_2.0/ --start-date 2023-11-16T00:00:00Z
SWOT_L2_RAD_OGDR_1.0	Advanced Microwave Radiometer (AMR) OGDR, DOI: 10.5067/SWOT-RAD-OGDR-1.0	OGDR products from 2023-06-21 to 2023-11-16: podaac-data-subscriber -c SWOT_L2_RAD_OGDR_1.0 -d ./SWOT_L2_RAD_OGDR_1.0/ --start-date 2023-06-21T00:00:00Z
SWOT_L2_RAD_OGDR_2.0	https://podaac.jpl.nasa.gov/dataset/SWOT_L2_RAD_OGDR_2.0 , DOI: same as SWOT_L2_RAD_OGDR_1.0	OGDR products since 2023-11-16: podaac-data-subscriber -c SWOT_L2_RAD_OGDR_2.0 -d ./SWOT_L2_RAD_OGDR_2.0/ --start-date 2023-11-16T00:00:00Z
SWOT_L2_RAD_IGDR_1.0	Advanced Microwave Radiometer (AMR) IGDR, DOI: 10.5067/SWOT-RAD-IGDR-1.0	OGDR products from 2023-06-21 to 2023-11-16: podaac-data-subscriber -c SWOT_L2_RAD_IGDR_1.0 -d ./SWOT_L2_RAD_IGDR_1.0/ --start-date 2023-03-29T00:00:00Z

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SWOT_L2_RAD_IGDR_2.0	https://podaac.jpl.nasa.gov/dataset/SWOT_L2_RAD_IGDR_2.0 , DOI: same as SWOT_L2_RAD_IGDR_1.0	IGDR products since 2023-11-16: podaac-data-subscriber -c SWOT_L2_RAD_IGDR_2.0 -d ./SWOT_L2_RAD_IGDR_2.0/ --start-date 2023-11-16T00:00:00Z
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Appendix A. **Acronyms**

AMR	Advanced Microwave Radiometer
ATBD	Algorithm Theoretical Basis Document
CNES	Centre National d'Études Spatiales
IGDR	Interim Geophysical Data Record
JPL	Jet Propulsion Laboratory
KaRIn	Ka-band Radar Interferometer
NALT	Nadir Altimeter
NASA	National Aeronautics and Space Administration
OGDR	Operational Geophysical Data Record
SWOT	Surface Water Ocean Topography
TBC	To Be Confirmed
TBD	To Be Determined