



SWOT-Nadir validation and cross calibration activities

Annual Report 2025

Reference: SALP-RP-MA-EA-23750-CLS

Issue: 1.4

Date: April 28, 2026

Contract: CNES/SALP 2025-27 No 250176

Customer:	CNES	Document Ref.:	SALP-RP-MA-EA-23750-CLS
Contract :	CNES/SALP 2025-27 No 250176	Date:	April 28, 2026
		Issue	1.4

Project:	MISSION PERFORMANCE SERVICE FOR SN MISSION		
Title:	SWOT-Nadir validation and cross calibration activities Annual Report 2025		
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Change Log

Version	Date	Changes
1.0	February 12, 2026	First version
1.1	February 18, 2026	Add L1/L2 Library Table + Fixes on editing figures
1.2	February 27, 2026	CNES review taken into account
1.3	March 20, 2026	Executive summary
1.4	April 28, 2026	Xover Multimission minor changes

Acronyms

AMR	Advanced Microwave Radiometer
CLS	Collecte Localisation Satellites
CMEMS	Copernicus Marine Service
CNES	Centre National d'Etudes Spatiales
CNG	Consigne Numerique de Gain (= Automatic Gain Control)
C2N	Cryosat-2
DAC	Dynamical Atmospheric Correction
DEM	Digital Elevation Model
DV	Default Value
DIODE	Détermination Immédiate d'Orbite par Doris Embarqué
DORIS	Doppler Orbitography and Radiopositioning Integrated by Satellite
DUACS	Data Unification and Altimeter Combination System
ECMWF	European Centre for Medium-range Weather Forecasting
FES	Finite Element Solution
GDR	Geophysical Data Record
GIM	Global Ionosphere Maps
GMSL	Global Mean Sea Level
GOT	Global Ocean Tide
GPS	Global Positioning System
IGDR	Interim Geophysical Data Record
JPL	Jet Propulsion Laboratory (Nasa)
L2P	Along-track Sea Level Anomalies Level-2+
MLE	Maximum Likelihood Estimator
MOE	Medium Orbit Ephemeris
MQE	Mean Quadratic Error
MSS	Mean Sea Surface
OGDR	Operational Geophysical Data Record
PLTM	PayLoad TeleMetry
POE	Precise Orbit Ephemeris
POS-3C	POSEIDON-3C
SALP	Service d'Altimétrie et de Localisation Précise
Sigma0	Backscatter coefficient
SHM	Safe Hold Mode
SSH	Sea Surface Height
SSHA	Sea Surface Height Anomalies
SLA	Sea Level Anomaly
SLR	Satellite Laser Ranging
SSR	Solid State Recorder
SSB	Sea State Bias
STD	Standard Deviation
SWOT	Surface Water Ocean Topography
SWH	Significant Wave Height
TM	TeleMetry
WTC	Wet Tropospheric Correction

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1 Introduction

Surface Water Ocean Topography (SWOT) is a joint project including NASA, Centre National d'Etudes Spatiales (CNES), the Canadian Space Agency and the UK Space Agency. The SWOT satellite carries onboard a wide-swath altimeter-interferometer in Ka-Band (KaRIn), a classical nadir-looking altimeter, as well as the usual complement on altimetry satellites: precise location systems and radiometer.

The SWOT Nadir Quality Assessment report are generated under SALP contract supported by CNES at the CLS Environment & Climate Business Unit. Cyclic assessment are made and are available on [AVISO website](#) [1].

A detailed description of the mission is available on [AVISO website](#) [2]. Products description can be found in the [SWOT Level-2 Nadir Altimeter products User Guide](#) [3]. and in the [SWOT User Handbook](#) [4].

This document presents the synthesis report concerning validation activities of SWOT Nadir data for the year 2025.

In 2025, GDR-S 2.01 standard became the new standard applicable to SWOT Level 2 Nadir Altimeter (NALT) products. The modifications relative to the previous GDR-F 1.04 standard are detailed in this [Release Note](#) [5]. Information about previous GDR-F 1.04 standard are available in [Jason-3 UserHandbook](#) [6].

1.1 Overview

The present document assesses SWOT Nadir data quality and mission performance **over ocean**. After an executive summary in the following pages, dedicated sections of this report deal with:

- description of data processing,
- data coverage / availability,
- monitoring of rejected spurious data,
- analysis of relevant parameters derived from instrumental measurements and geophysical corrections,
- system performance via analyses at crossover points,
- system performance via along-track Sea Level Anomalies monitoring.
- synthesis of the GDR-S2 reprocessing

This document focuses only on the operational 21-days "science" repetitive orbit phase. A specific document dedicated to the 1-day "calval" repetitive orbit phase can be found on [AVISO website](#) [7].

2 Processing Status

2.1 Data used

Metrics provided in this document are based on SWOT Nadir dataset from cycles 024 to 040 for **GDR** products (corresponding to 2024-11-12 02:50:38 to 2025-11-01 19:36:58). **IGDR**'s metrics are provided up to cycle 042 (up to 2025-12-13 13:07:04).

In this report, time series are displayed with a starting time at the beginning of the Science Phase (Cycle 001 corresponding to 2023-07-21 05:33:45).

Note that **GDR** data have been reprocessed in 2025. As a consequence, all **GDR** used in this report follow an homogeneous standard GDR-S 2.01. **IGDR** data contains standard GDR-F 1.04 and standard GDR-S 2.01. First **IGDR** pass produced with standard GDR-S 2.01 was cycle 032 pass 223 (sensing time 20250505_231228) as mentioned in [Release Note](#).

Both **IGDR** and **GDR** data used are 1Hz data unless specified otherwise.

2.2 List of events

Table 1 shows the different maneuver types and their expected impact on data. Colored maneuvers affect data edited over the ocean, corresponding to the vertical lines in the temporal monitoring. As shown in Figure 1, GNC calibration mainly occurs on land and thus does not require a specific color. Only **CALGYR_SLOT** and **YAWFLIP_SLOT** (orange and blue lines) directly impact data validity. **OCM_SLOT** and **NON_REF_ALT** impact data availability and as a consequence validity statistics are affected.

Maneuver type	Expected impact
CALGYR_SLOT (gyroscope calibration)	Data rejected on editing criteria at DV on retracking and radiometer output variables
CNG Calibration (POSEIDON-3C in calibration mode)	Data unavailable
OCM_SLOT (burst for station keeping maneuver)	Data partially rejected or data unavailable
NON_REF_ALT (avoidance maneuver)	Data rejected or unavailable at the beginning and end of a maneuver in the burst period
SADM_CRUISE_SLOT (change of solar panel position)	No rejected data, no loss of coverage
YAWFLIP_SLOT (satellite flip-over)	Data rejected on editing criteria at DV on retracking and radiometer output variables

Table 1: Types of maneuvers and expected impacts

Table 4 shows the maneuvers during the Science phase of the SWOT Nadir mission.

Warning: As mentioned in [Cyclic Report n°29](#), users should not use any data from the two avoidance maneuvers of Cycle 029 because they are degraded and this is not detected by the editing process. Consequently, over this cycle data from passes 164 to 169 and data from passes 366 to 371 should not be used.

Start	End	Cycle	Pass	Name of the event
2023-08-15 09:15:24	2023-08-15 09:19:54	2	121	SADM_CRUISE_SLOT
2023-08-24 19:39:13	2023-08-24 19:43:43	2	385	SADM_CRUISE_SLOT
2023-08-25 20:43:57	2023-08-25 21:20:59	2	414	OCM_SLOT
2023-08-27 11:07:23	2023-08-27 11:29:52	2	459	YAWFLIP_SLOT
2023-08-30 12:52:07	2023-08-30 12:56:37	2	545	SADM_CRUISE_SLOT
2023-09-08 12:59:49	2023-09-08 13:04:19	3	213	SADM_CRUISE_SLOT

Start	End	Cycle	Pass	Name of the event
2023-10-06 17:13:26	2023-10-06 17:50:30	4	417	OCM_SLOT
2023-10-27 14:06:10	2023-10-27 14:43:12	5	417	OCM_SLOT
2023-11-02 15:56:04	2023-11-02 16:00:34	6	4	SADM_CRUISE_SLOT
2023-11-11 05:43:32	2023-11-11 05:48:02	6	244	SADM_CRUISE_SLOT
2023-11-13 19:28:23	2023-11-13 19:50:14	6	316	YAWFLIP_SLOT
2023-11-16 12:38:04	2023-11-16 12:42:34	6	392	SADM_CRUISE_SLOT
2023-11-17 10:54:05	2023-11-17 11:31:07	6	418	OCM_SLOT
2023-11-24 23:00:43	2023-11-24 23:05:13	7	44	SADM_CRUISE_SLOT
2023-12-15 21:28:44	2023-12-15 22:05:47	8	46	OCM_SLOT
2023-12-23 02:48:25	2023-12-23 03:25:39	8	248	OCM_SLOT
2023-12-23 03:25:39	2023-12-23 09:40:01	8	248	NON_REF_ALT
2023-12-23 09:40:01	2023-12-23 10:17:15	8	256	OCM_SLOT
2024-01-12 21:00:52	2024-01-12 21:37:55	9	245	OCM_SLOT
2024-01-19 09:04:56	2024-01-19 09:09:26	9	427	SADM_CRUISE_SLOT
2024-01-27 17:42:51	2024-01-27 17:47:21	10	77	SADM_CRUISE_SLOT
2024-01-30 07:27:39	2024-01-30 07:50:26	10	149	YAWFLIP_SLOT
2024-02-02 00:37:24	2024-02-02 00:41:54	10	225	SADM_CRUISE_SLOT
2024-02-09 17:50:40	2024-02-09 18:27:43	10	441	OCM_SLOT
2024-02-10 11:00:51	2024-02-10 11:05:21	10	461	SADM_CRUISE_SLOT
2024-03-15 21:10:32	2024-03-15 21:47:35	12	256	OCM_SLOT
2024-04-05 08:48:44	2024-04-05 08:53:24	13	246	SADM_CRUISE_SLOT
2024-04-05 17:40:48	2024-04-05 18:17:51	13	256	OCM_SLOT
2024-04-14 05:28:48	2024-04-14 05:33:28	13	494	SADM_CRUISE_SLOT
2024-04-17 02:05:41	2024-04-17 02:27:40	13	574	YAWFLIP_SLOT
2024-04-19 22:41:42	2024-04-19 22:46:22	14	70	SADM_CRUISE_SLOT
2024-04-29 05:41:30	2024-04-29 05:46:10	14	330	SADM_CRUISE_SLOT
2024-05-03 21:14:17	2024-05-03 21:51:21	14	460	OCM_SLOT
2024-05-04 12:40:02	2024-05-04 21:43:01	14	478	CALGYR_SLOT
2024-05-24 19:26:13	2024-05-24 20:03:17	15	462	OCM_SLOT
2024-06-07 08:21:55	2024-06-07 08:59:17	16	257	OCM_SLOT
2024-06-07 17:47:45	2024-06-07 18:25:06	16	268	OCM_SLOT
2024-06-17 03:16:33	2024-06-17 03:21:13	16	530	SADM_CRUISE_SLOT
2024-06-26 13:39:55	2024-06-26 13:44:35	17	211	SADM_CRUISE_SLOT
2024-06-29 10:16:38	2024-06-29 10:38:58	17	291	YAWFLIP_SLOT
2024-07-02 05:09:28	2024-07-02 05:14:08	17	369	SADM_CRUISE_SLOT
2024-07-05 19:02:56	2024-07-05 19:40:00	17	469	OCM_SLOT
2024-07-11 01:50:16	2024-07-11 01:54:56	18	33	SADM_CRUISE_SLOT
2024-08-02 20:45:31	2024-08-02 21:22:34	19	86	OCM_SLOT
2024-08-23 20:50:00	2024-08-23 21:27:04	20	90	OCM_SLOT
2024-09-06 23:51:30	2024-09-06 23:56:10	20	486	SADM_CRUISE_SLOT
2024-09-13 20:45:28	2024-09-13 21:22:33	21	94	OCM_SLOT
2024-09-15 10:12:17	2024-09-15 10:16:57	21	138	SADM_CRUISE_SLOT
2024-09-17 23:57:00	2024-09-18 00:18:56	21	210	YAWFLIP_SLOT
2024-09-20 15:23:44	2024-09-20 15:28:24	21	284	SADM_CRUISE_SLOT
2024-09-29 00:03:33	2024-09-29 00:08:13	21	518	SADM_CRUISE_SLOT
2024-10-04 10:25:57	2024-10-04 19:28:56	22	86	CALGYR_SLOT
2024-10-11 13:51:14	2024-10-11 14:28:18	22	286	OCM_SLOT
2024-11-01 07:00:01	2024-11-01 07:37:06	23	281	OCM_SLOT

Start	End	Cycle	Pass	Name of the event
2024-11-15 18:49:49	2024-11-15 19:26:52	24	103	OCM_SLOT
2024-11-25 18:37:34	2024-11-25 18:42:14	24	383	SADM_CRUISE_SLOT
2024-12-03 16:59:06	2024-12-03 17:03:46	25	21	SADM_CRUISE_SLOT
2024-12-06 04:56:38	2024-12-06 05:33:41	25	91	OCM_SLOT
2024-12-06 10:09:59	2024-12-06 10:32:45	25	97	YAWFLIP_SLOT
2024-12-09 05:02:56	2024-12-09 05:07:36	25	175	SADM_CRUISE_SLOT
2024-12-18 06:53:45	2024-12-18 06:58:25	25	429	SADM_CRUISE_SLOT
2024-12-20 21:40:50	2024-12-20 22:17:52	25	502	OCM_SLOT
2024-12-29 14:06:36	2024-12-29 14:43:42	26	161	OCM_SLOT
2024-12-29 14:43:42	2024-12-29 17:32:23	26	162	NON_REF_ALT
2024-12-29 17:32:23	2024-12-29 18:09:29	26	165	OCM_SLOT
2025-01-10 21:40:49	2025-01-10 22:17:52	26	506	OCM_SLOT
2025-02-03 11:18:35	2025-02-03 11:23:15	27	582	SADM_CRUISE_SLOT
2025-02-07 20:29:40	2025-02-07 21:06:44	28	120	OCM_SLOT
2025-02-12 18:16:41	2025-02-12 18:21:21	28	258	SADM_CRUISE_SLOT
2025-02-15 14:53:36	2025-02-15 15:15:28	28	338	YAWFLIP_SLOT
2025-02-18 09:46:41	2025-02-18 09:51:21	28	416	SADM_CRUISE_SLOT
2025-02-27 04:45:35	2025-02-27 04:50:15	29	78	SADM_CRUISE_SLOT
2025-03-02 06:59:22	2025-03-02 07:36:28	29	164	OCM_SLOT
2025-03-02 07:36:28	2025-03-02 10:25:09	29	165	NON_REF_ALT
2025-03-02 10:25:09	2025-03-02 11:02:15	29	168	OCM_SLOT
2025-03-07 20:29:11	2025-03-07 21:06:15	29	320	OCM_SLOT
2025-03-09 12:19:55	2025-03-09 12:57:14	29	366	OCM_SLOT
2025-03-09 12:57:14	2025-03-09 15:45:42	29	367	NON_REF_ALT
2025-03-09 15:45:42	2025-03-09 16:23:01	29	370	OCM_SLOT
2025-04-04 03:12:39	2025-04-04 03:49:43	30	499	OCM_SLOT
2025-04-23 23:09:34	2025-04-23 23:14:14	31	471	SADM_CRUISE_SLOT
2025-05-02 12:56:53	2025-05-02 13:01:33	32	127	SADM_CRUISE_SLOT
2025-05-05 04:24:36	2025-05-05 04:47:00	32	201	YAWFLIP_SLOT
2025-05-07 21:34:16	2025-05-07 21:38:56	32	277	SADM_CRUISE_SLOT
2025-05-09 18:29:22	2025-05-09 19:06:25	32	329	OCM_SLOT
2025-05-16 09:39:45	2025-05-16 09:44:25	32	515	SADM_CRUISE_SLOT
2025-06-20 11:38:11	2025-06-20 12:15:50	34	329	OCM_SLOT
2025-06-20 15:55:23	2025-06-20 16:33:00	34	334	OCM_SLOT
2025-07-12 09:27:32	2025-07-12 09:32:12	35	358	SADM_CRUISE_SLOT
2025-07-21 00:57:08	2025-07-21 01:01:48	36	16	SADM_CRUISE_SLOT
2025-07-23 16:24:52	2025-07-23 16:46:55	36	90	YAWFLIP_SLOT
2025-07-26 11:17:33	2025-07-26 11:22:13	36	168	SADM_CRUISE_SLOT
2025-08-04 06:15:42	2025-08-04 06:20:22	36	414	SADM_CRUISE_SLOT
2025-08-08 02:48:50	2025-08-08 03:25:53	36	522	OCM_SLOT
2025-08-10 13:14:13	2025-08-10 22:17:11	37	6	CALGYR_SLOT
2025-09-19 21:32:44	2025-09-19 22:09:47	38	551	OCM_SLOT
2025-09-27 17:44:07	2025-09-27 17:48:47	39	187	SADM_CRUISE_SLOT
2025-10-06 16:07:13	2025-10-06 16:11:53	39	437	SADM_CRUISE_SLOT
2025-10-09 12:44:07	2025-10-09 13:06:47	39	517	YAWFLIP_SLOT
2025-10-10 19:46:27	2025-10-10 20:23:30	39	553	OCM_SLOT
2025-10-12 07:37:14	2025-10-12 07:41:54	40	11	SADM_CRUISE_SLOT
2025-10-21 11:11:14	2025-10-21 11:15:54	40	267	SADM_CRUISE_SLOT

Start	End	Cycle	Pass	Name of the event
2025-11-14 14:43:55	2025-11-14 15:20:58	41	359	OCM_SLOT
2025-12-09 17:21:59	2025-12-09 17:26:39	42	477	SADM_CRUISE_SLOT
2025-12-12 21:29:16	2025-12-12 22:06:20	42	566	OCM_SLOT
2025-12-18 17:27:48	2025-12-18 17:32:28	43	146	SADM_CRUISE_SLOT
2025-12-21 10:38:40	2025-12-21 11:00:31	43	222	YAWFLIP_SLOT
2025-12-24 05:31:29	2025-12-24 05:36:09	43	300	SADM_CRUISE_SLOT
2026-01-01 17:37:39	2026-01-01 17:42:19	43	538	SADM_CRUISE_SLOT
2026-01-16 21:11:43	2026-01-16 21:48:45	44	378	OCM_SLOT

Table 2: Maneuvers on Science Phase SWOT Nadir mission.

Table 3 lists the POSEIDON-3C (POS-3C) CNG calibrations during the Science phase of the SWOT Nadir mission. Note that this type of calibration always lasts 33 minutes and 3 seconds.

The corresponding locations of POS-3C CNG calibrations can be found in figure 1.

Start Date	End Date	Cycle	Pass
2023-09-18 18:22:00	2023-09-18 18:55:03	3	499
2023-12-21 03:44:00	2023-12-21 04:17:03	8	193
2024-03-23 13:07:00	2024-03-23 13:40:03	12	471
2024-06-25 22:30:00	2024-06-25 23:03:03	17	193
2024-09-07 11:07:00	2024-09-07 11:40:03	20	499
2024-12-10 20:30:00	2024-12-10 21:03:03	25	221
2025-03-24 04:15:00	2025-03-24 04:48:03	30	193
2025-06-15 15:16:00	2025-06-15 15:39:03	34	193
2025-09-17 00:39:00	2025-09-17 01:12:03	38	471

Table 3: POS-3C Calibration (CNG) on Science Phase SWOT Nadir mission.

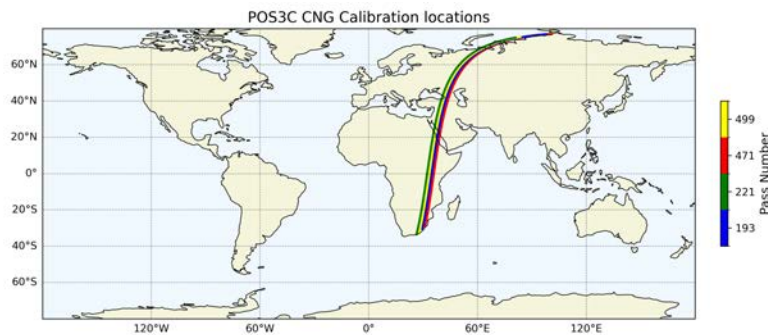


Figure 1: Different POS-3C CNG calibration locations

Other events that impact data availability occurred for the period are listed in this table:

Start	End	Cycle	Pass	Name of the event
2023-08-25 21:02:17	2023-08-25 21:02:19	2	414	Station keeping maneuver
2023-09-27 22:13:00	2023-09-27 08:33:00	4	171	SSR anomaly
2023-10-06 17:31:47	2023-10-06 17:31:49	4	418	Station keeping maneuver
2023-10-13 00:29:50	2023-10-13 02:39:22	5	10	SSR anomaly
2023-10-13 10:20:30	2023-10-13 12:22:02	5	21	SSR anomaly
2023-10-27 14:24:31	2023-10-27 14:24:32	5	418	Station keeping maneuver
2023-11-14 17:52:06	2023-11-14 19:36:58	6	342	SSR anomaly
2023-11-17 11:12:25	2023-11-17 11:12:27	6	418	Station keeping maneuver
2023-12-15 21:47:05	2023-12-15 21:47:07	8	46	Station keeping maneuver
2023-12-23 03:06:45	2023-12-23 03:06:56	8	248	Station keeping maneuver
2024-01-12 21:19:13	2024-01-12 21:19:15	9	245	Station keeping maneuver
2024-01-15 23:13:21	2024-01-16 04:40:00	9	331	SSR anomaly
2024-01-17 11:38:05	2024-01-17 14:41:57	9	374	SSR anomaly

Start	End	Cycle	Pass	Name of the event
2024-02-09 18:09:00	2024-02-09 18:09:02	10	441	Station keeping maneuver
2024-02-25 00:35:00	2024-02-25 03:17:00	11	284	SSR anomaly
2024-03-02 14:28:00	2024-03-02 16:21:00	11	469	SSR anomaly
2024-03-07 04:59:00	2024-03-07 06:57:00	12	14	SSR anomaly
2024-03-15 21:28:53	2024-03-15 21:28:55	12	257	Station keeping maneuver
2025-04-05 17:59:09	2025-04-05 17:59:11	30	545	Station keeping maneuver
2025-05-03 21:32:38	2025-05-03 21:32:41	32	165	Station keeping maneuver
2024-05-12 23:10:56	2024-05-12 23:22:34	15	130	SSR anomaly
2024-05-19 01:49:15	2024-05-19 03:24:30	15	301	SSR anomaly
2025-05-24 19:44:34	2025-05-24 19:44:37	33	166	Station keeping maneuver
2024-06-07 08:40:16	2024-06-07 08:40:32	16	257	Station keeping maneuver
2024-06-07 18:06:06	2024-06-07 18:06:22	16	268	Station keeping maneuver
2024-07-05 19:21:17	2024-07-05 19:21:19	17	469	Station keeping maneuver
2024-08-02 21:03:52	2024-08-02 21:03:53	19	87	Station keeping maneuver
2024-08-23 21:08:21	2024-08-23 21:08:24	20	91	Station keeping maneuver
2024-09-13 21:03:49	2024-09-13 21:03:52	21	94	Station keeping maneuver
2024-10-11 14:09:35	2024-10-11 14:09:38	22	286	Station keeping maneuver
2024-11-01 07:18:22	2024-11-01 07:18:25	23	282	Station keeping maneuver
2024-11-15 19:08:10	2024-11-15 19:08:12	24	103	Station keeping maneuver
2024-12-06 05:14:59	2024-12-06 05:15:01	25	91	Station keeping maneuver
2024-12-20 21:59:11	2024-12-20 21:59:12	25	502	Station keeping maneuver
2024-12-29 14:24:57	2024-12-29 14:25:01	26	162	Station keeping maneuver
2024-12-29 17:50:44	2024-12-29 17:50:48	26	166	Station keeping maneuver
2025-02-03 04:29:24	2025-02-03 04:41:02	27	574	SSR anomaly
2025-02-07 20:48:01	2025-02-07 20:48:03	28	121	Station keeping maneuver
2025-03-02 07:17:43	2025-03-02 07:17:47	29	165	Station keeping maneuver
2025-03-02 10:43:30	2025-03-02 10:43:34	29	169	Station keeping maneuver
2025-03-07 20:47:32	2025-03-07 20:47:34	29	320	Station keeping maneuver
2025-03-09 12:38:16	2025-03-09 12:38:31	29	367	Station keeping maneuver
2025-03-09 16:04:03	2025-03-09 16:04:17	29	371	Station keeping maneuver
2025-03-29 08:04:56	2025-03-29 08:05:22	30	337	SSR anomaly
2025-04-04 11:34:08	2025-04-04 13:41:04	30	509	SSR anomaly
2025-04-04 03:31:00	2025-04-04 03:31:03	30	500	Station keeping maneuver
2025-05-10 17:31:00	2025-05-10 20:42:00	32	356	SSR anomaly
2025-05-26 19:00:47	2025-05-26 19:17:28	33	221	SSR anomaly
2025-05-26 21:59:36	2025-05-26 23:43:27	33	225	SSR anomaly
2025-06-20 11:56:32	2025-06-20 11:57:03	34	329	Station keeping maneuver
2025-06-20 16:13:44	2025-06-20 16:14:14	34	334	Station keeping maneuver
2025-06-26 19:26:26	2025-06-26 19:38:21	34	506	SSR anomaly
2025-08-01 14:44:25	2025-08-01 19:40:48	36	340	SSR anomaly
2025-08-17 11:19:10	2025-08-17 11:55:07	37	200	SSR anomaly
2025-09-10 13:00:46	2025-09-10 14:55:14	38	289	SSR anomaly
2025-09-19 21:51:05	2025-09-19 21:51:07	38	552	Station keeping maneuver
2025-10-01 11:48:54	2025-10-01 12:00:46	39	292	SSR anomaly
2025-10-10 20:04:48	2025-10-10 20:04:50	39	553	Station keeping maneuver

Table 4: Events on Science Phase SWOT Nadir mission.

2.3 Tracking and acquisition mode

SWOT Nadir is able to track data with several onboard tracker modes: POSEIDON-3C instrument implements three main tracking modes:

- The autonomous acquisition and tracking mode (M1)
- The DIODE acquisition and autonomous tracking mode (M2)
- The DIODE & DEM mode (M3)

and certain automatic transitions can also be authorized by the user, as is the case in M4 to M4bis modes. The different tracking modes are described in the article of Guérin *et al.* [31]. The status of tracking and acquisition modes are detailed in table 5. The acquisition mode as shown corresponds to the netcdf field *alt_state_acq_mode_flag* which is the 20Hz altimeter state flag.

Cycle	Acquisition Mode
Cycle 001 to cycle 004 until 2023-10-09	Autonomous acquisition and tracking mode (M1)
Cycle 004 since 2023-10-09 to Cycle 040	DIODE + DEM tracking with automatic transition and direct transition from Open Loop to Closed Loop (M4bis mode)

Table 5: SWOT Nadir Acquisition Mode.

- From Cycle 001 to Cycle 004 (until 2023-10-09), autonomous acquisition and tracking mode was activated (fig. 2).

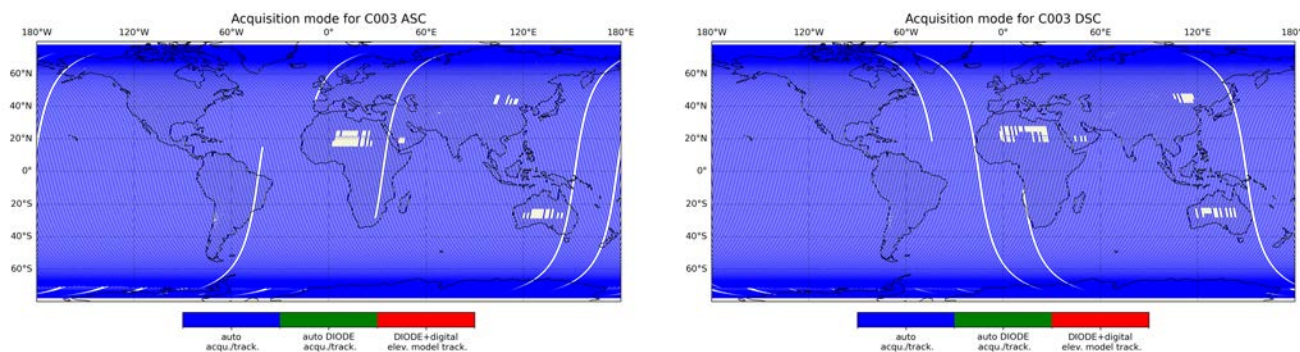


Figure 2: Acquisition mode for Cycle 003. 8 = autonomous acquisition / tracking, 9 = autonomous DIODE acquisition / tracking, 10 = DIODE + Digital Elevation Model tracking

- From Cycle 004 (since 2023-10-09) to Cycle 040, DIODE + DEM tracking with auto transition and direct transition from Open Loop to Close Loop mode was activated (fig. 3).

Over the considered period, autonomous tracking mode (which comes from the L2 field *alt_state_track_trans_flag*) for SWOT Nadir is always authorized.

2.4 Models and standards

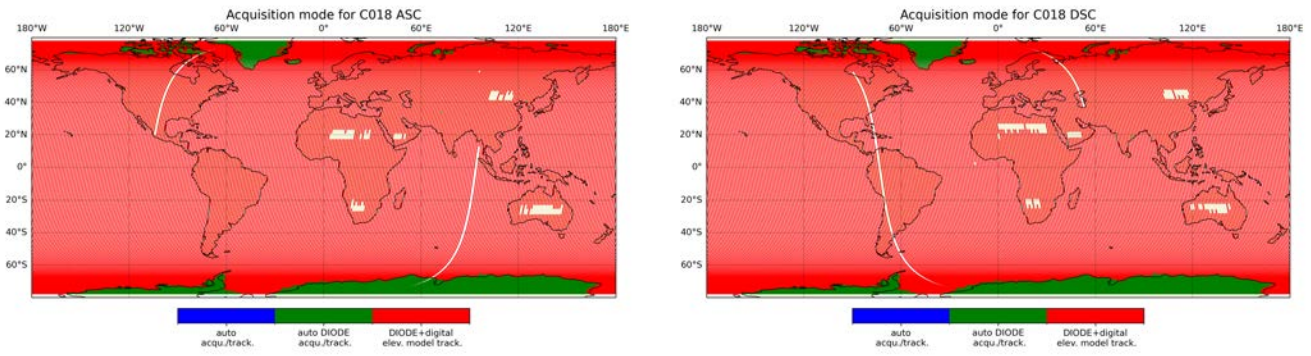


Figure 3: Acquisition mode for Cycle 018. 8 = autonomous acquisition / tracking, 9 = autonomous DIODE acquisition / tracking, 10 = DIODE + Digital Elevation Model tracking

Processing Pilot, L1 Library and L2 Library changes are described in respectively Table 6, Table 7 and Table 8 within the period:

Processing Pilot	IGDR	GDR-F	GDR-S2
5.0.4	C001 to C005/P092	/	/
5.1.0	C005/P093 to C022/P352	C001 to C019	/
5.2.4	C022/P353 to C031/P471	C020 to C028	/
5.2.6	C031/P472 to C040/P029	/	C029 to C035
5.3.0	/	/	C001 P552, C006 P342 and C021 P366
5.4.1	/	/	C001 P005 to C028
5.4.3	C040/P030 to C043	/	C036 to C040

Table 6: Processing Pilot Version

L1 Library	IGDR	GDR-F	GDR-S2
V5.8.4	C001 to C032 P194	C001 to C028	/
V6.2.1	/	/	C001 to C028
V6.2p1	C032 P195 to C042	/	C029 to C040

Table 7: L1 library version

L2 Library	IGDR	GDR-F	GDR-S2
V6.10p1p2p3p4p5	C001 to C032 194	C001 to C028	/
V7.2.3	/	/	C001 to C028
V7.2p1p3	C032 P195 to C042	/	C029 to C040

Table 8: L2 library version

3 Data coverage and edited measurements

3.1 Missing measurements

3.1.1 Over land and ocean

Determination of missing measurements relative to the theoretically expected orbit ground pattern is an essential tool to detect missing telemetry or satellite events for instance. Figure 4 shows the percentage of available measurements for SWOT Nadir for all kinds of surfaces observed, computed with respect to a theoretical possible number of measurements. In average SWOT Nadir provides 98.42% of measurements over the last year for GDR (C024 - C040) and 98.226% for IGDR (C024 - C042) (figure 5). Since the beginning of the mission 97.367% of ocean measurements are available for GDR, and 97.236% for IGDR.

The changes in behavior in Sep and in Oct 2023 are discussed in the [2024 Annual Report \[14\]](#).

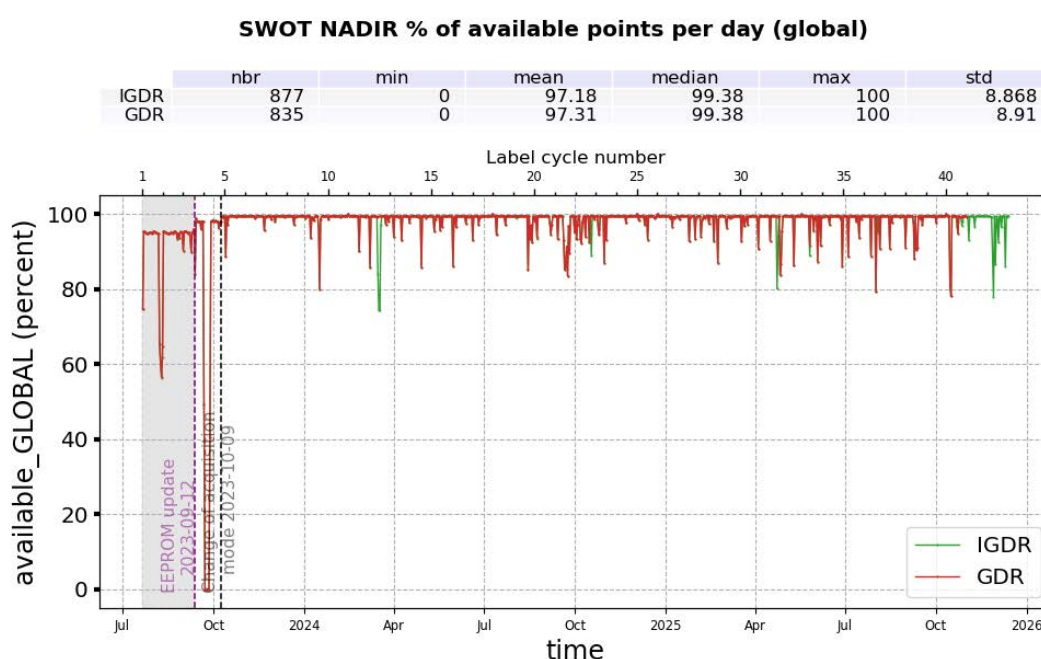


Figure 4: Global data availability per day

3.1.2 Over ocean

The selection over ocean is applied regarding the L2 surface type flag and including Caspian Sea. The behaviour of SWOT Nadir over ocean is good. In average SWOT Nadir provides 99.039% of measurements over the last year for GDR (C024 - C040) and 98.811% for IGDR (C024 - C042) (figure 5). Since the beginning of the mission 98.11% of ocean measurements are available for GDR, and 97.958% for IGDR. Looking at data over ocean, SWOT Nadir is nearly always available (ocean is fully covered) out of specific events (see figure 5).

Table 9 lists all the data gaps over ocean for the period between C024 and C040.

Table 12 in Annex lists all the data gaps over ocean since the beginning of the Science Phase.

SWOT NADIR % of available points per day (ocean)

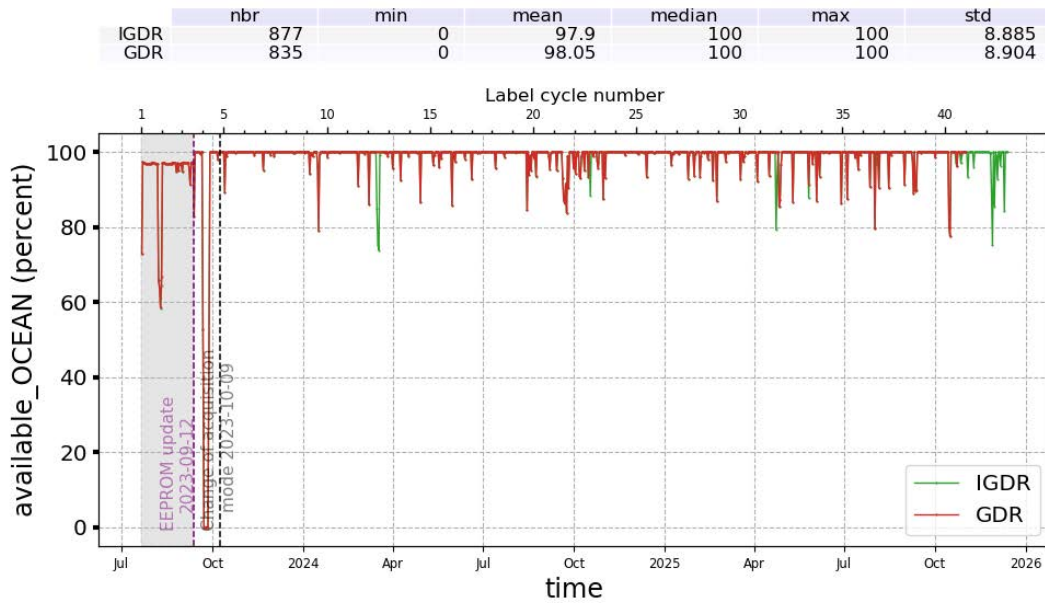


Figure 5: SWOT Nadir data availability over ocean (per day)

Cycle	Start	End	Details
C024	2024-11-21 18:59:07	2024-11-21 19:27:53	Passes 271 to 272 : 12.65% and 13.03% due to IVK Scheduling anomaly COR.
C025	2024-12-04 10:57:41	2024-12-04 12:30:03	Passes 042 to 044 : 4.82%, 9.26% and 2.73% due to IVK gap before and after downlink.
C025	2024-12-10 20:30:01	2024-12-10 21:03:02	Pass 221 : 19.01% due to SWOT/POS3C Special calibrations (CAL CNG) (22.795N, 35.821E).
C025	2024-12-11 01:26:11	2024-12-11 01:47:28	Pass 227 : 0.19% due to data gap (-72.735N, -84.509E).
C025	2024-12-13 09:24:39	2024-12-13 11:06:47	Passes 292 to 294 : 57.77%, 100.00% and 34.00% due to data (APID) not received at the ASX station.
C025	2024-12-21 23:57:38	2024-12-21 00:02:25	Pass 505 : 10.09% due to data gap (-44.745N, -53.409E).
C026	2025-01-01 22:59:47	2025-01-01 22:59:52	Pass 256 : 0.34% due to data gap ((77.68N, 35.92E) to (77.671N, 36.963E)).
C026	2025-01-07 22:40:00	2025-01-08 00:02:50	Passes 423 to 425 : 38.52%, 68.24% and 19.86% due to multiple PLTM gaps at KRX station.
C026	2025-01-09 19:51:29	2025-01-09 20:18:44	Pass 476 : 14.30% due to multiple PLTM gaps at KRX station.
C027	2025-01-14 10:52:35	2025-01-14 11:18:01	Passes 021 : 1.95% and 12.67% due to data gap
C027	2025-01-17 23:27:35	2025-01-17 23:52:55	Pass 120 : 0.61% due to
C027	2025-01-24 11:05:06	2025-01-24 12:42:04	Passes 301 to 303 : 12.38%, 100% and 93.27% due to PLTM gap at IVK station

Cycle	Start	End	Details
C027	2025-01-25 07:02:09	2025-01-25 07:13:10	Pass 325 : 26.16% due to multiple PLTM gaps at IVK station
C027	2025-01-30 09:43:12	2025-01-30 10:59:37	Passes 468 : 86.55% and 92.71% due to PLTM gaps at IVK station
C027	2025-01-30 21:14:27	2025-01-30 21:24:05	Pass 481 : 6.63% due to PLTM gaps at IVK station
C027	2025-01-31 11:11:44	2025-01-31 11:20:45	Passes 497 : 6.45% and 10.68% due to PLTM gaps at KRX station
C027	2025-02-02 04:00:02	2025-02-02 04:00:17	Pass 545 : 0.55% due to data gap
C027	2025-02-03 04:29:24	2025-02-03 04:41:02	Pass 574 : 25.19% due to a SSR reconfiguration resulting in an absence of data
C028	2025-02-05 21:52:12	2025-02-05 23:11:29	Passes 066 to 067 : 84.13% and 95.56% due to PLTM gaps.
C028	2025-02-06 19:37:21	2025-02-06 21:31:02	Passes 091 to 093 : 12.86%, 14.87% and 2.61% due to multiple PLTM gaps.
C028	2025-02-09 19:40:45	2025-02-09 19:48:28	Pass 175 : 4.94% due to multiple PLTM gaps.
C028	2025-02-13 21:56:33	2025-02-13 22:25:56	Pass 290 : 70.12% due to multiple PLTM gaps.
C028	2025-02-18 09:20:45	2025-02-18 11:05:26	Passes 415 to 417 : 11.56%, 100.00% and 74.10% due to
C028	2025-02-21 20:00:23	2025-02-21 20:08:55	Pass 512 : 15.92% due to data gaps.
C028	2025-02-22 06:29:53	2025-02-22 08:07:08	Passes 524 to 526 : 87.23%, 100.00% and 11.29% due to a power outage at HBX station.
C028	2025-02-22 18:26:54	2025-02-22 19:49:44	Passes 538 to 539 : 82.14% and 94.10% due to
C029	2025-03-02 06:29:44	2025-03-02 07:52:55	Passes 164 : 15.10% and 50.76% due to a burst in the beginning of an avoidance maneuver.
C029	2025-03-02 10:47:03	2025-03-02 11:30:03	Pass 169 : 39.23% due to a burst in the end of an avoidance maneuver.
C029	2025-03-07 20:12:22	2025-03-07 20:54:00	Pass 320 : 62.83% due to an OCM SLOT maneuver.
C029	2025-03-09 12:28:22	2025-03-09 13:16:17	Pass 367 : 20.39% due to a burst in the beginning of an avoidance maneuver.
C029	2025-03-09 15:52:07	2025-03-09 16:23:21	Pass 371 : 63.55% due to a burst in the end of an avoidance maneuver.
C030	2025-03-18 11:50:27	2025-03-18 15:13:38	Passes 034 to 038 : 6.60%, 8.01%, 84.62%, 100.00% and 14.92% due to multiple PLTM gaps at Kiruna [KRX] station.
C030	2025-03-21 18:38:14	2025-03-21 19:16:31	Pass 126 : 82.02% due to gaps in the received pass at Inuvik [IVB] station.
C030	2025-03-22 06:40:16	2025-03-22 06:50:00	Pass 140 : 21.96% due to multiple PLTM gaps at Kiruna [KRX] station.
C030	2025-03-24 04:15:01	2025-03-24 04:48:02	Pass 193 : 19.31% due to the CNG calibration.
C030	2025-03-25 06:42:55	2025-03-25 07:33:23	Passes 224 : 1.63% and 1.36% due to multiple PLTM gaps at Kiruna [KRX] station.

Cycle	Start	End	Details
C030	2025-03-29 08:04:56	2025-03-29 08:05:22	Pass 337 : 0.98% due to a SSR anomaly.
C030	2025-04-03 06:43:38	2025-04-03 08:07:07	Passes 476 : 12.11% and 8.26% due to multiple PLTM gaps at Kiruna [KRX] station.
C030	2025-04-03 11:02:50	2025-04-03 11:25:55	Pass 481 : 0.40% due to multiple PLTM gaps at Kiruna [KRX] station.
C030	2025-04-04 11:34:08	2025-04-04 13:41:04	Passes 509 to 512 : 12.67%, 100.00%, 100.00% and 16.86% due to a SSR anomaly.
C031	2025-04-16 20:14:39	2025-04-16 21:53:41	Passes 271 to 273 : 12.64%, 100% and 87.53% due to data lost.
C031	2025-04-23 03:09:02	2025-04-23 03:11:40	Pass 447 : 3.50% due to downlink not received.
C031	2025-04-26 15:29:43	2025-04-26 19:17:54	Passes 546 to 550 : 91.90%, 100%, 100%, 100%, 100% and 37.41% due to downlink not received.
C031	2025-04-27 15:30:36	2025-04-27 18:39:15	Passes 574 to 577 : 93.94%, 100%, 100% and 86.37% due to downlink not received.
C032	2025-04-28 04:35:45	2025-04-28 05:34:25	Passes 005 : 69.08% and 32.36% due to downlink not received.
C032	2025-05-10 17:31:06	2025-05-10 20:42:15	Passes 356 to 360 : 85.90%, 100.00%, 100.00%, 100.00% and 3.21% due to data lost.
C033	2025-05-26 19:00:47	2025-05-26 19:17:28	Passes 221 : 21.91% and 3.90% due to SSR anomaly.
C033	2025-05-26 21:59:36	2025-05-26 23:43:27	Passes 225 to 227 : 65.53%, 100.00% and 34.24% due to SSR anomaly.
C033	2025-05-30 14:53:08	2025-05-30 15:48:39	Passes 329 : 100.00% and 9.90% due to
C033	2025-06-01 12:31:34	2025-06-01 12:43:22	Pass 382 : 27.41% due to
C033	2025-06-03 05:44:57	2025-06-03 08:48:31	Passes 430 to 433 : 57.02%, 100.00%, 100.00% and 90.88% due to
C033	2025-06-06 15:34:32	2025-06-06 17:28:49	Passes 525 to 527 : 5.98%, 100.00% and 99.40% due to data lost.
C034	2025-06-15 15:16:01	2025-06-15 15:49:02	Pass 193 : 21.16% due to CNG Calibration.
C034	2025-06-19 08:21:10	2025-06-19 08:28:08	Pass 297 : 1.70% due to data gap.
C034	2025-06-27 15:57:06	2025-06-27 15:57:11	Pass 530 : 0.21% due to data gap.
C034	2025-06-28 05:33:00	2025-06-28 09:10:51	Passes 545 to 550 : 14.30%, 100.00%, 100.00%, 60.34%, 100.00% and 13.24% due to downlink not received.
C035	2025-07-04 09:28:43	2025-07-04 12:05:07	Passes 134 to 137 : 86.02%, 100.00%, 100.00% and 82.10% due to passes lost at HBX station.
C035	2025-07-12 00:58:23	2025-07-12 01:18:16	Pass 348 : 50.33% due to antenna issue at HBX station.
C035	2025-07-15 05:58:34	2025-07-15 07:23:31	Passes 438 : 84.82% and 89.60% due to passes lost at IVK station.
C035	2025-07-17 16:01:07	2025-07-17 16:40:30	Passes 505 : 14.63% due to passes lost at IVK station.

Cycle	Start	End	Details
C036	2025-07-27 02:40:14	2025-07-27 03:58:12	Passes 186 : 84.44% and 87.04% due to only a few seconds received at IVB station.
C036	2025-07-27 14:34:05	2025-07-27 15:46:51	Passes 200 : 89.03% and 52.35% due to downlink not received at KRB.
C036	2025-08-01 14:44:25	2025-08-01 19:40:48	Passes 340 to 345 : 85.80% and 100.00% and 100.00% and 100.00% and 100.00% due to a SSR anomaly.
C036	2025-08-03 13:52:00	2025-08-03 13:56:50	Pass 395 : 0.40% due to downlink lost.
C036	2025-08-05 05:05:57	2025-08-05 07:35:37	Passes 440 to 443 : 4.11%, 100.00%, 100.00% and 77.92% due to downlink lost at HBX station.
C037	2025-08-15 07:27:05	2025-08-15 09:41:37	Passes 139 to 142 : 9.34%, 100.00%, 100.00% and 7.87% due to downlink lost.
C037	2025-08-15 12:41:49	2025-08-15 12:49:59	Pass 145 : 25.21% due to bad frames received (weak x-band signal).
C037	2025-08-17 11:19:10	2025-08-17 11:55:07	Pass 200 : 36.38% due to SSR onboard anomaly.
C037	2025-08-23 21:38:18	2025-08-23 21:38:34	Pass 380 : 0.21% due to data gap.
C037	2025-08-31 04:41:24	2025-08-31 04:42:01	Pass 584 : 1.42% due to data gap.
C038	2025-08-31 11:10:13	2025-08-31 12:44:11	Passes 007 to 009 : 13.73%, 100.00% and 86.47% due to pass lost
C038	2025-09-09 23:38:05	2025-09-09 02:40:13	Passes 246 to 249 : 87.94%, 100.00%, 100.00% and 76.21% due to antenna anomaly
C038	2025-09-09 06:52:13	2025-09-09 07:02:58	Pass 254 : 10.21% due to PLTM gaps
C038	2025-09-11 16:39:30	2025-09-11 18:48:19	Passes 322 to 324 : 94.46%, 100.00% and 56.97% due to station anomaly
C038	2025-09-12 04:23:45	2025-09-12 06:53:17	Passes 335 to 338 : 15.71%, 100.00%, 100.00% and 7.80% due to station anomaly
C038	2025-09-17 00:39:00	2025-09-17 01:12:02	Pass 471 : 20.55% due to CNG calibration
C039	2025-09-23 06:24:31	2025-09-23 06:25:06	Passes 061 : 1.08% and 0.38% due to data gap.
C039	2025-10-01 11:48:00	2025-10-01 11:53:37	Pass 292 : 12.53% due to context integrity anomaly.
C039	2025-10-01 13:23:48	2025-10-01 13:38:45	Pass 294 : 30.59% due to HDR recording issue.
C040	2025-10-15 18:44:36	2025-10-16 06:12:02	Passes 108 to 121 : 90.53%, 100.00%, 5.41%, 95.51%, 100.00%, 8.42%, 73.75%, 100.00% and 75.65% due to downlink degraded.
C040	2025-10-23 00:02:07	2025-10-23 00:54:50	Passes 310 : 92.24% and 30.69% due to pass lost.
C040	2025-10-26 22:03:53	2025-10-26 22:08:12	Pass 419 : 11.99% due to pass lost.
C040	2025-10-27 07:18:42	2025-10-27 07:39:38	Passes 430 : 3.13% and 0.30% due to multiple data gaps.
C040	2025-11-01 01:14:11	2025-11-01 01:15:06	Pass 563 : 2.75% due to pass lost.

Table 9: List of all missing GDR SWOT Nadir data over ocean from C024 to C040

3.2 Edited measurements

Editing criteria allow selecting only measurements considered as valid over ocean. This editing process is structured in 3 main steps:

1. Latitude monotony is checked;
2. Measurements over land are removed, only measurements over ocean are kept;
3. Measurements over ice are removed;
4. Threshold criteria are applied on altimeter, radiometer and geophysical parameters as described in the following table 10. This step includes the rejection of measurements at Default Value (DV).

The percentage of valid measurements over ocean is monitored on a daily basis. Over the last year, the percentage of valid measurements ($\text{valid_nbr_points}/\text{available_nbr_points}$) over ocean is 82.244% (see Figure 6).

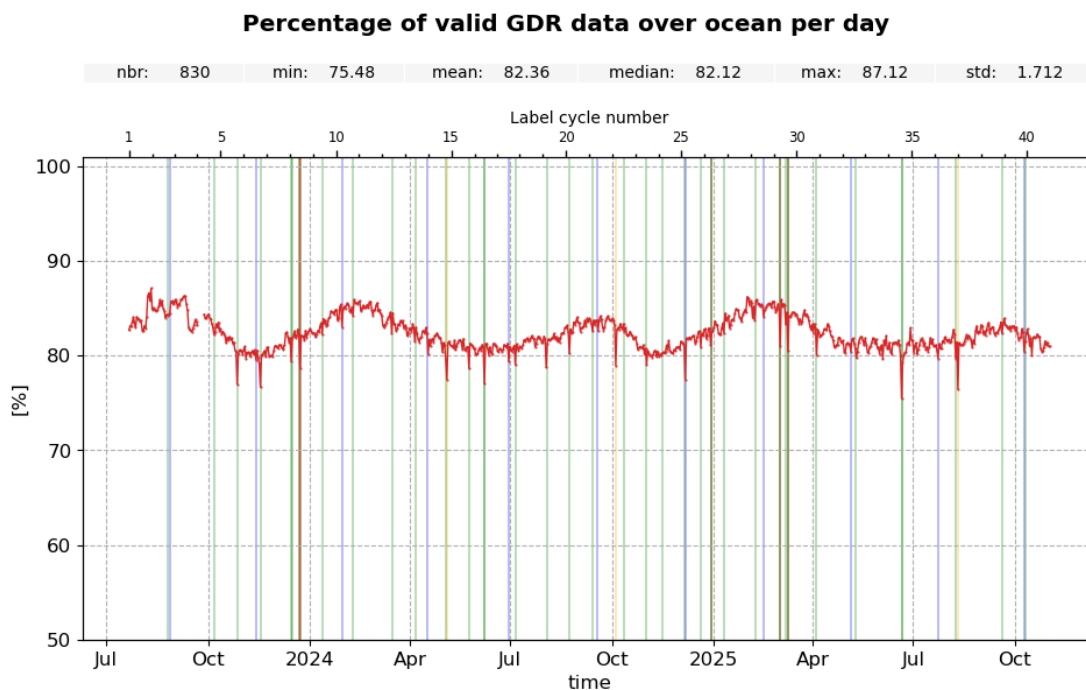


Figure 6: SWOT Nadir ocean data editing average by day.

3.2.1 Maneuvers

Maneuvers impact either availability or validity, or both. The following editing statistics include maneuver zones for which data is available.

Note that for the following figures, the peaks of edited measurements correspond to maneuvers that took place during the study period and listed in table 4. Maneuvers will be highlighted by the colored vertical lines on the editing figures to follow. Each color corresponds to a specific maneuver as highlighted in Table 1. Figure 7 (left) displays the days on which a maneuver occurred as the count per day of measurements taken during a maneuver. A count of 0 means there was not any maneuver on this day. The map (Fig. 7, right) shows the spatial distribution of measurements concerned by maneuvers over ocean.

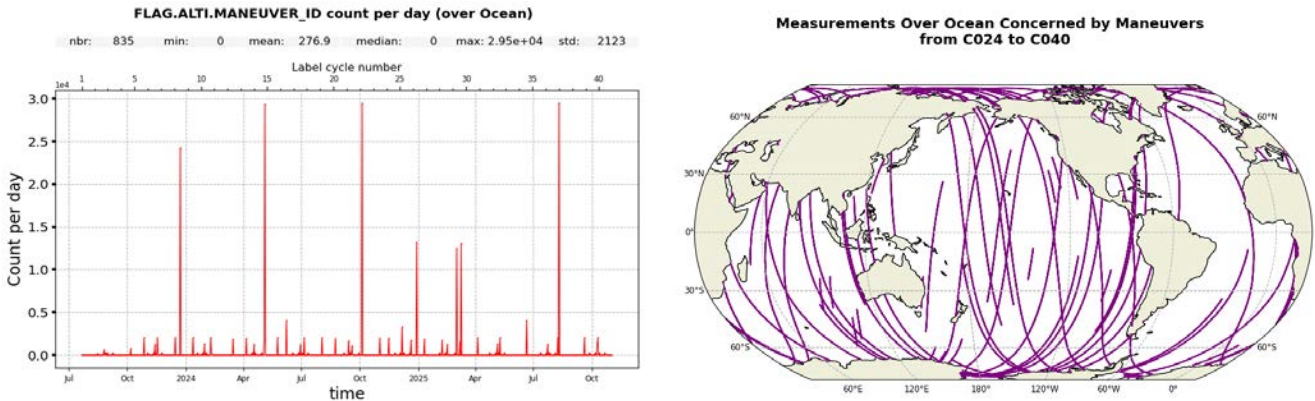


Figure 7: Points concerned by maneuvers.

3.2.2 Flagging quality : ice

The GDR ice flag (from L2 variable *ice_flag*) is used to remove the ice and sea ice data. Figure 8 shows daily percentage of measurements edited by this criterion over ocean and Figure 9 shows location of those points. Over the last year, 15.006% of data were edited by this criterion over ocean and no anomalous trend is detected, only the annual seasonal signal is visible mainly due to ice coverage annual variations in north and south hemispheres.

Figure 9 (right) shows the exact location of each point edited by the flag ice criterion over ocean. The map highlights some points that are considered as ice by the flag in incoherent locations near coastlines for $|\text{latitudes}| > 50^\circ$ and for latitudes $> 40^\circ$ near the north of Japan and around Gulf of Main. Those points reflect a bad behavior of the ice flag algorithm in those areas. Note that this anomaly concerned only the closest points to the coast.

3.2.3 Thresholds

3.2.3.1 Overview

After quality flag analysis, instrumental parameters have also been analyzed from comparison with thresholds. The average of total edited measurements following threshold criterion is around 2.75% (Figure 10). For each criterion, daily percentage of edited measurements is monitored (detailed later). This allows the detection of anomalies in the number of removed data, which could be of instrumental, geophysical or algorithmic origins. Note that all outliers are on maneuver slots (colored lines).

Threshold criteria applied on altimeter, radiometer and geophysical parameters are described in the following table 10. The last column represents the mean of rejected data on each criterion over GDR cycles 001 to 040.

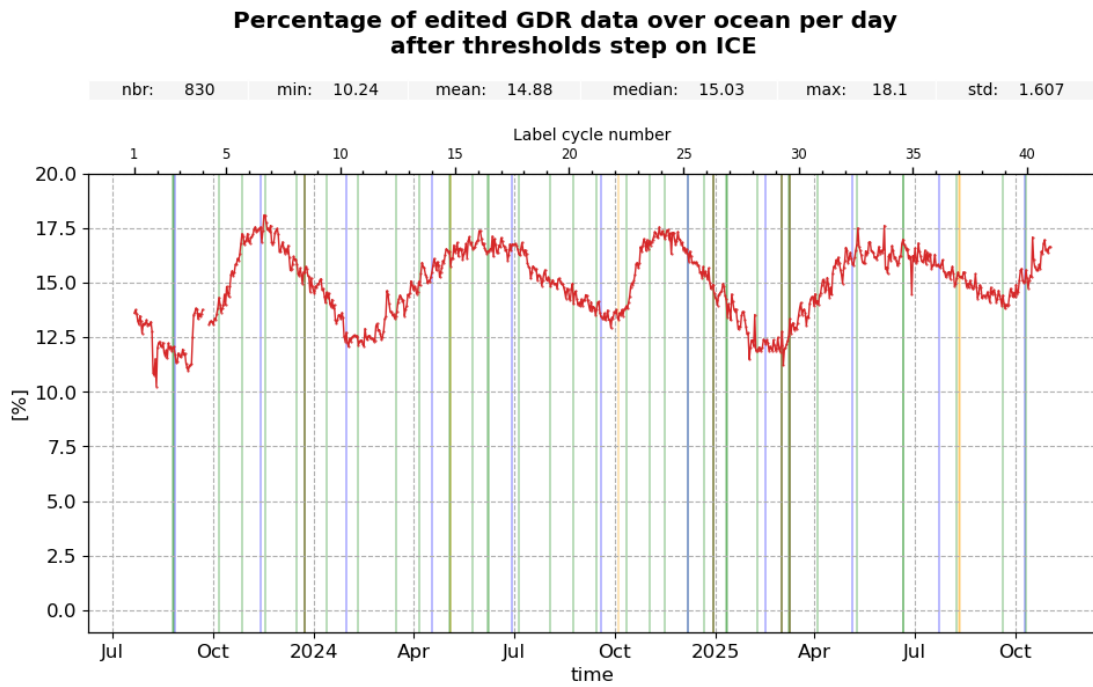


Figure 8: Daily monitoring of the percentage of edited measurements by ice flag criterion over ocean.

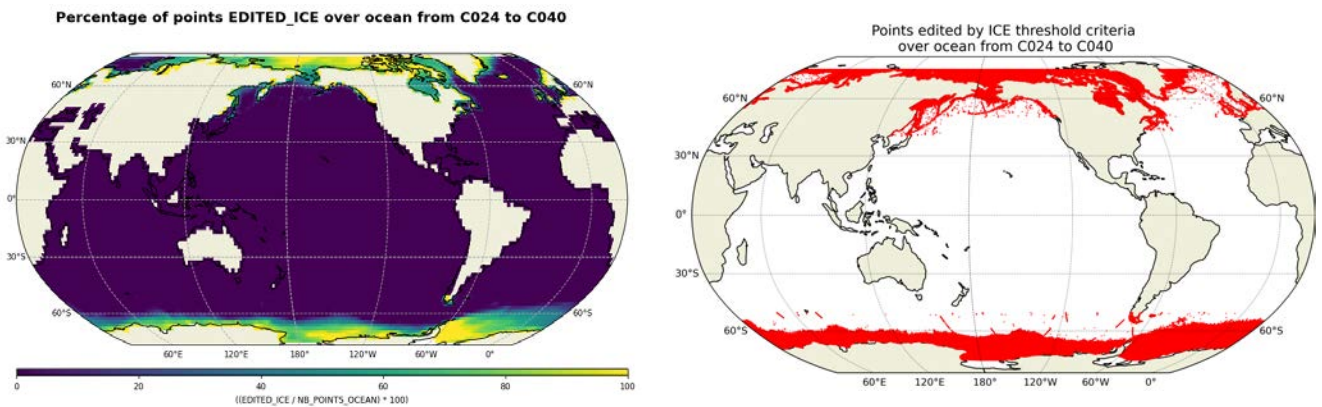


Figure 9: Maps of edited measurements by ice flag criterion over ocean (left: geobox, right: raw)

Parameters	Min threshold	Max threshold	Unit	% rejected (DV included)
Sea surface height anomaly	-2	2	m	1.65
Sea surface height	-130	100	m	0.455
Range Number	10	20		0.58
Range STD	0	0.2	m	1.156
Sigma0	7	30	dB	0.384
Sigma0 Number	10	20		0.572
Sigma0 STD	0	1	dB	1.204
Significant Wave Height	0	11	m	0.397
Altimeter wind speed	0	30	m.s ⁻¹	0.772
Sea State Bias	-0.5	0	m	0.351
Filtered ionospheric correction	-0.4	0.04	m	0.763
Square off nadir angle	-0.2	0.64	deg ²	0.389
Equilibrium tide	-0.5	0.5	m	0.0
Inverted barometer correction	-2	2	m	0.0
Dry tropospheric correction	-2.5	-1.9	m	0.0
Internal tide	-5	5	m	0.0
Ocean tide height	-5	5	m	0.0
Pole tide height	-15	15	m	0.0
Solid Earth tide height	-1	1	m	0.0
Radiometer Wet Tropospheric Correction (WTC)	-0.5	-0.001	m	0.183
Global statistics of edited measurements by thresholds				2.75

Table 10: Table of parameters used for editing and the corresponding percentages of edited measurements for each parameter for SWOT Nadir GDR for Cycle 024to 040.

Percentage of edited GDR data over ocean per day after thresholds step on THRESHOLD

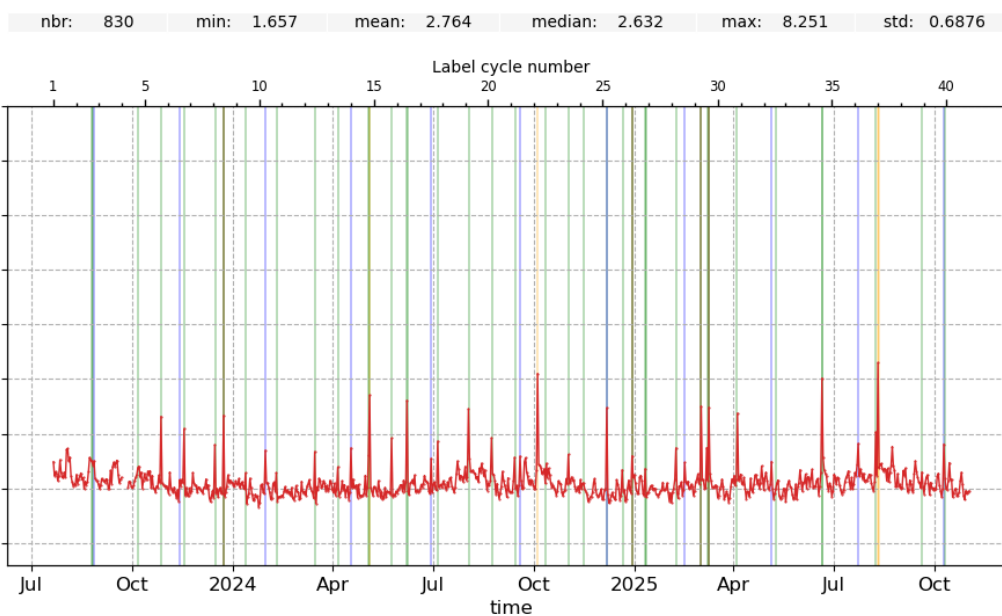


Figure 10: SWOT Nadir data editing by thresholds over ocean averaged by day.

3.2.3.2 Individual thresholds: 20Hz range measurement number and standard deviation

1Hz range measurements computed with less than 10 elementary measurements ($range_number < 10$) are rejected. These are considered as not consistent to compute 1Hz resolution range. Waveforms are distorted by rain cells, which makes them often meaningless for SSH calculation. As a consequence, edited measurements due to several altimetric criteria are often correlated with wet areas.

The average percentage of removed measurements using this criterion is 0.58% (Figure 11, left). Some parts of passes are edited over ocean because of undefined retracking outputs or/and radiometer wet tropospheric correction due to maneuvers that directly impact data. They correspond to the part of passes in figure 12 and to the peaks visible in figure 11.

Using the threshold editing on 20Hz measurements standard deviation (Figure 11, right), 1.156% of data are removed in average. As for 20Hz range number & std criterion, edited measurements are correlated with wet areas (Figure 12).

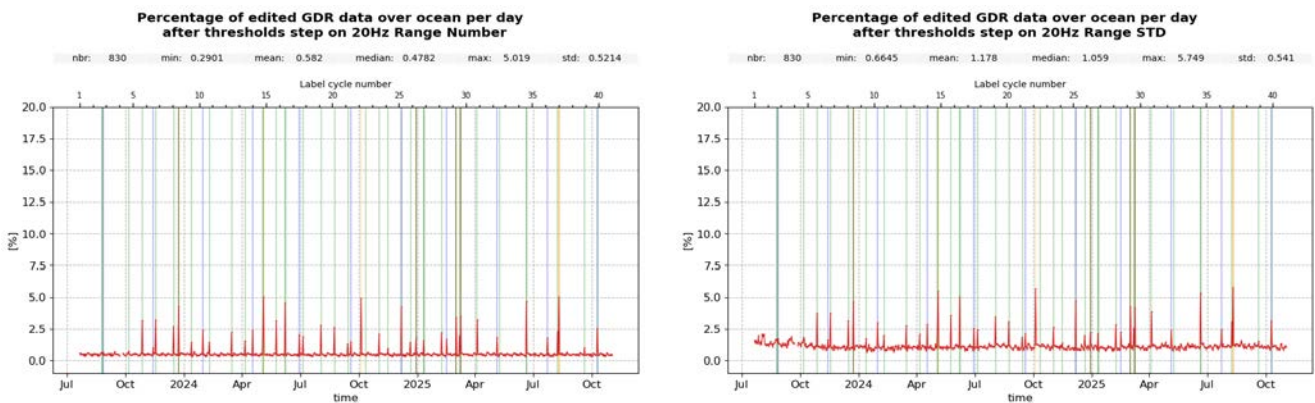


Figure 11: Percentage of edited measurements by 20Hz range measurement threshold criterion.

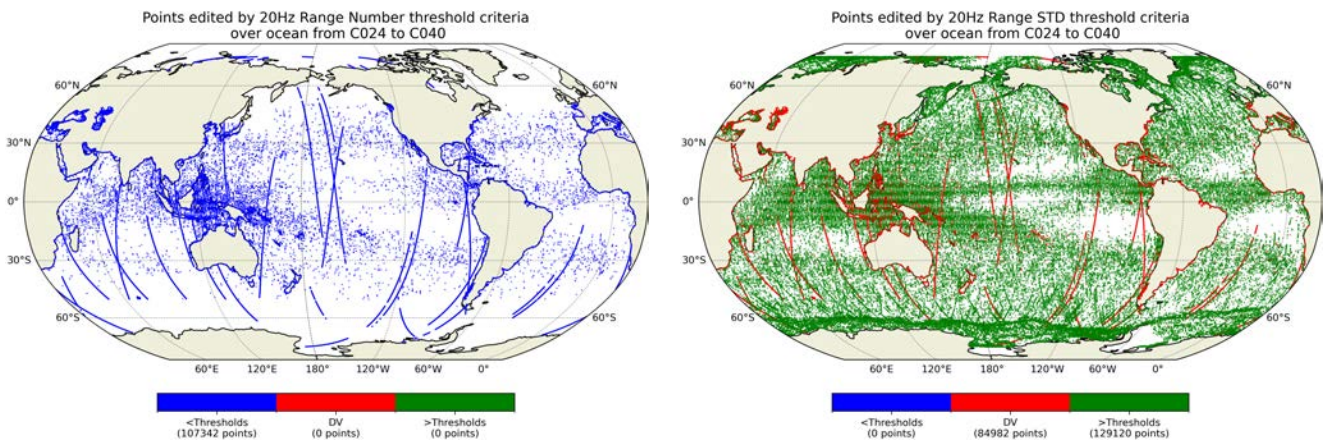


Figure 12: Map of edited measurements by 20Hz range measurements threshold criterion

3.2.3.3 Individual thresholds: SWH

The percentage of edited measurements due to SWHs criterion is represented on Figure 13, and is about 0.397%. The peaks visible in figure 13 left correspond to the portions of passes at DV visible in figure 13 right, they are related to maneuvers as explained in section 3.2.3.2.

Note that some parts of passes are edited in regions of high latitudes ($|\text{latitudes}| \sim 50^\circ$) because they are above the upper bound ($\text{SWH} > 11 \text{ m}$). They often represent coherent oceanic signal during high wave regimes. If needed users can increase the upper threshold on SWH to study those specific points.

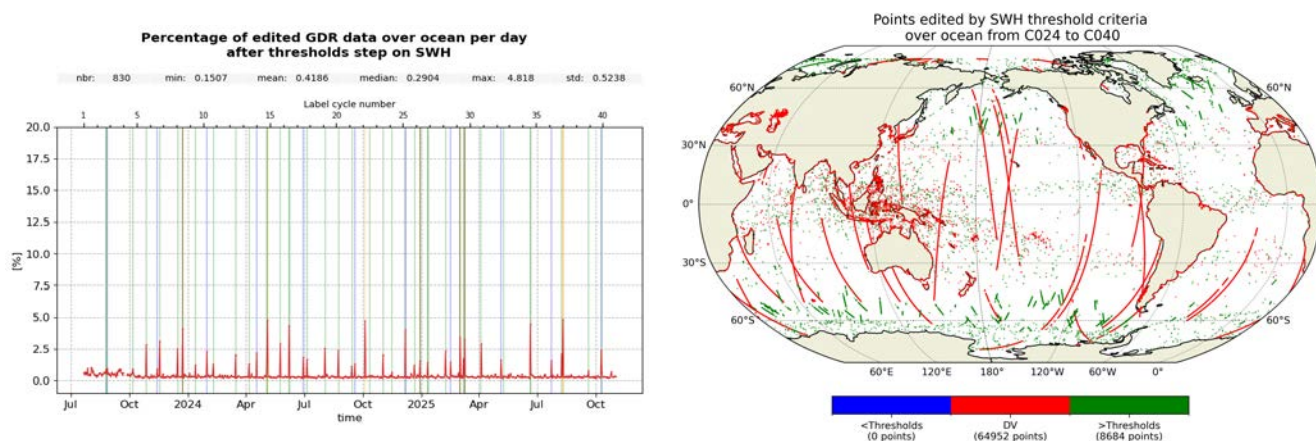


Figure 13: Edited measurements by SWH threshold criterion.

3.2.3.4 Individual thresholds: 20Hz Sigma0 Number

The percentage of edited measurements due to 20Hz Sigma0 Number criterion is 0.572% and is represented on Figure 14. Peaks and part of passes rejected are related to maneuvers as explained in section 3.2.3.2.

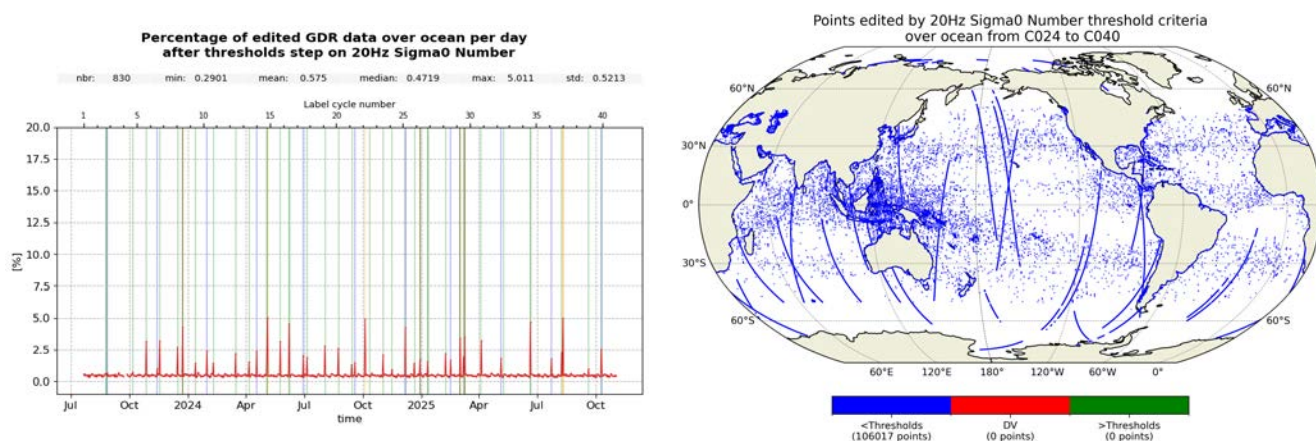


Figure 14: Edited measurements by 20Hz Sigma0 Number threshold criterion.

3.2.3.5 Individual thresholds: 20Hz Sigma0 Std

The percentage of edited measurements due to 20Hz Sigma0 Std criterion is 1.204% and is represented on Figure 15. Peaks and part of passes rejected are related to maneuvers as explained in section 3.2.3.2.

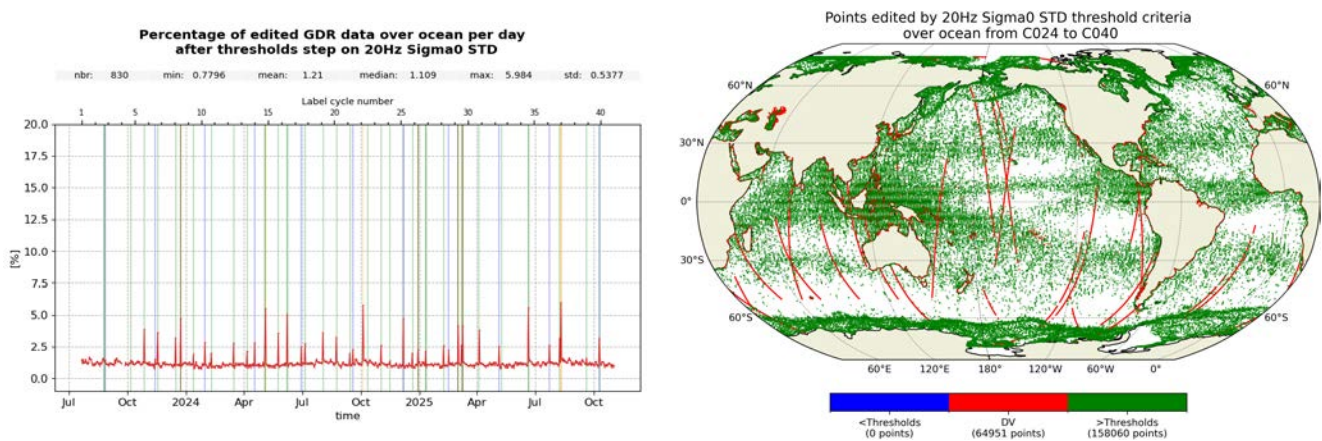


Figure 15: Edited measurements by 20Hz Sigma0 Std threshold criterion.

3.2.3.6 Individual thresholds: Sigma0

The percentage of edited measurements due to Sigma0 criterion is 0.384% and is represented on Figure 16. Peaks and part of passes rejected are related to maneuvers as explained in section 3.2.3.2.

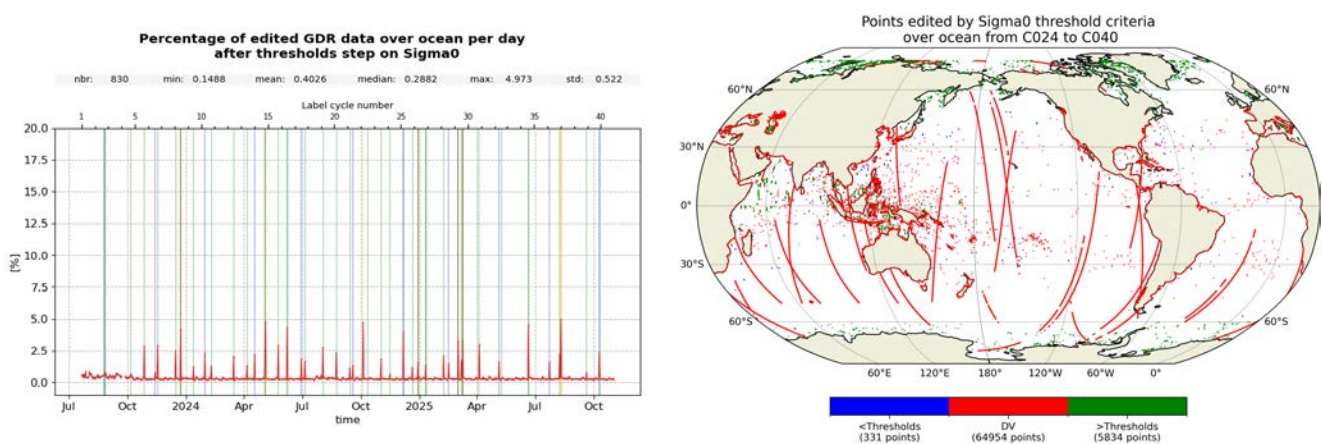


Figure 16: Edited measurements by Sigma0 threshold criterion.

3.2.3.7 Individual thresholds : Altimeter wind speed

The percentage of edited measurements due to altimeter wind speed criterion is represented on figure 17. Measurements are usually edited because of default values (section 3.2.3.6). This is the case when sigma itself is at default value (as seen in section 3.2.3.6), or when it shows very high values (higher than 25 dB), which occurs during sigma bloom situations and also over sea ice. Indeed, the wind speed algorithm (which uses Sigma0 and SWH) can not retrieve values for sigma0 higher than 25 dB.

Caution: there are negative altimeter wind speed values in the product but in our internal validation database negative values are set to DV.

Nevertheless, sea state bias is available even for negative wind speed values. Therefore, the percentage of edited altimeter wind speed data is higher than the percentage of edited sea state bias data (see part 3.2.3.8).

The figure 17 showing percentage of measurements edited by altimeter wind speed criterion is correlated with figures 13 (SWH) and 18 (SSB).

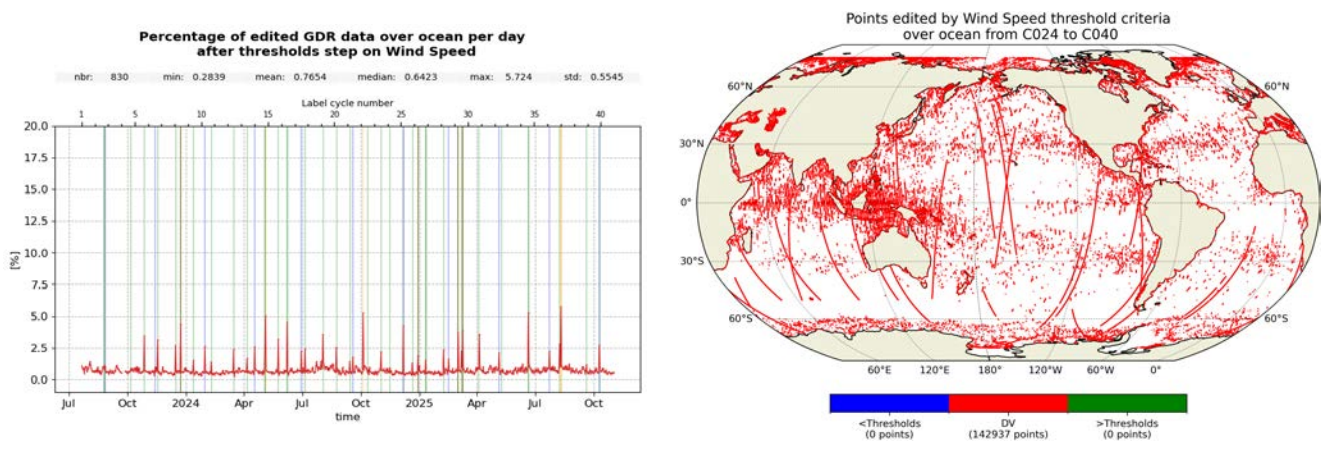


Figure 17: Edited measurements by wind speed threshold criterion.

3.2.3.8 Individual thresholds : SSB

Regarding the sea state bias criterion, the percentage of SWOT Nadir edited measurements is about 0.351%. The edited points can also be observed on the sigma0 and the SWH threshold criteria (which are both used for SSB computation).

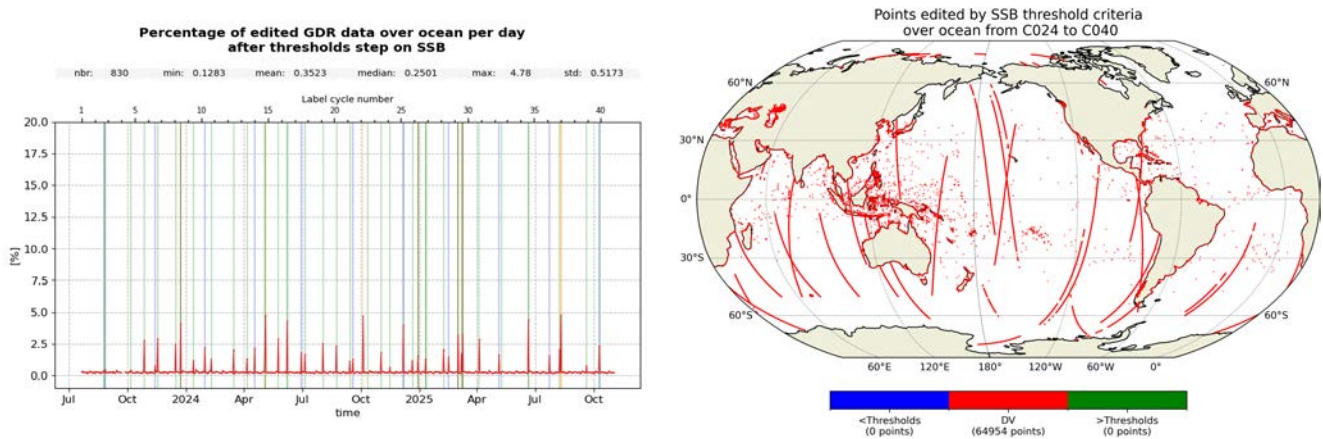


Figure 18: Edited measurements by sea state bias threshold criterion.

3.2.3.9 Individual thresholds : Ionospheric correction

The mean percentage of edited data by threshold criterion on filtered ionospheric correction is 0.763%. As ionospheric correction is computed as a combination from Range and SSB (ku and c bands), peaks and DV sections are visible. Due to filtering, small areas of rejected SSB and Range measurements are filled (this explains why we do not see these areas appear yet rejected on the other maps).

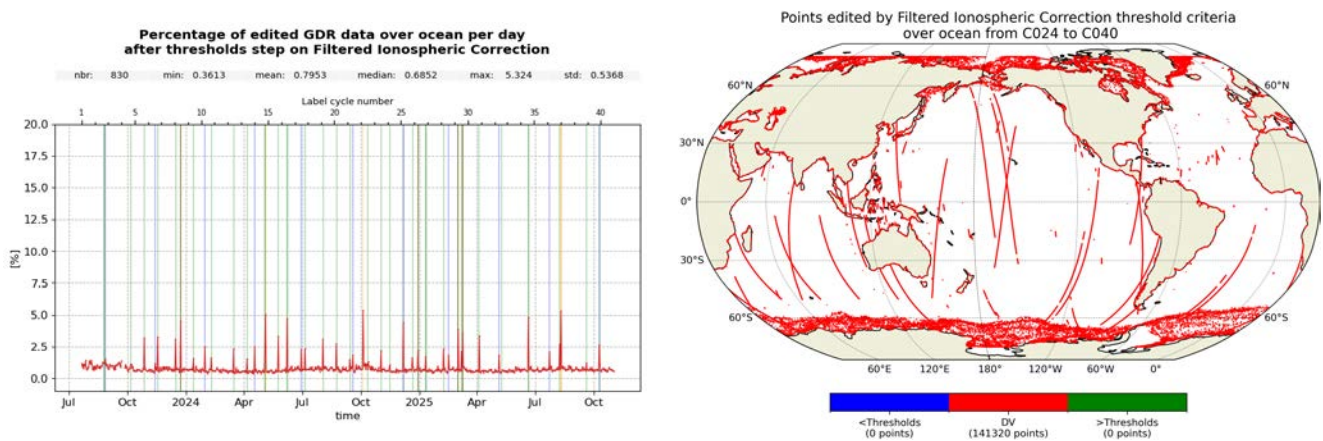


Figure 19: Edited measurements by ionospheric correction threshold criterion.

3.2.3.10 Individual thresholds: Radiometer wet tropospheric correction

The percentage of edited measurements due to radiometer wet tropospheric correction criterion is represented in figure 20. As for retracking outputs, during maneuvers geolocation problems make interpolation of the 2 radiometers impossible and therefore values are at DV.

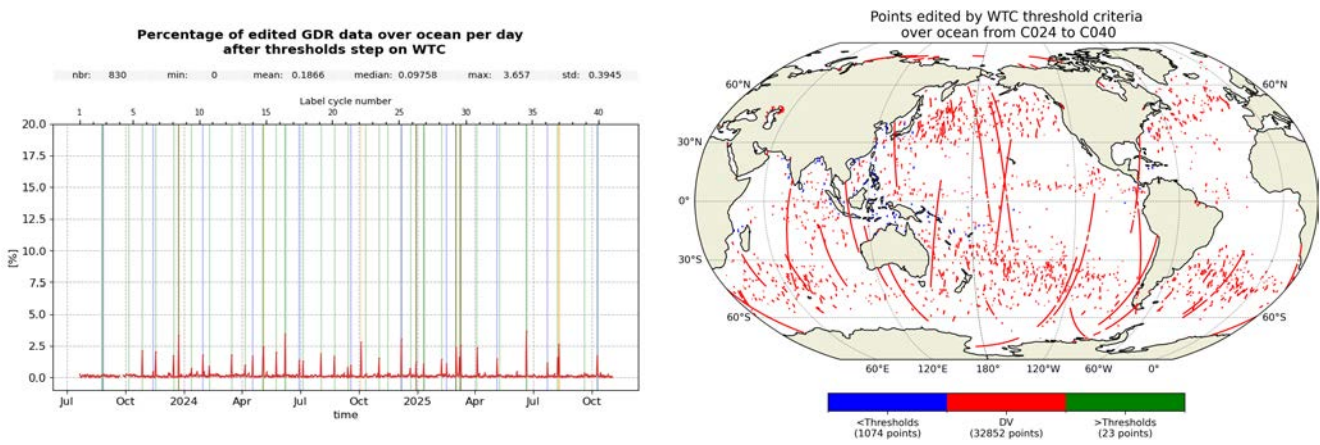


Figure 20: Edited measurements by radiometer wet tropospheric correction threshold criterion.

3.2.3.11 Individual thresholds : Ocean tide

Only a few points are edited due to ocean tide threshold criteria. The ocean tide correction is a model output, there should therefore be no edited measurement, the few edited points are linked to the coast interpolation as shown in Figure 21.

No point is edited on ocean tide equilibrium threshold criterion as shown in Figure 22. The same applies to the polar tide and the solid earth tide threshold criteria : 0 points are edited.

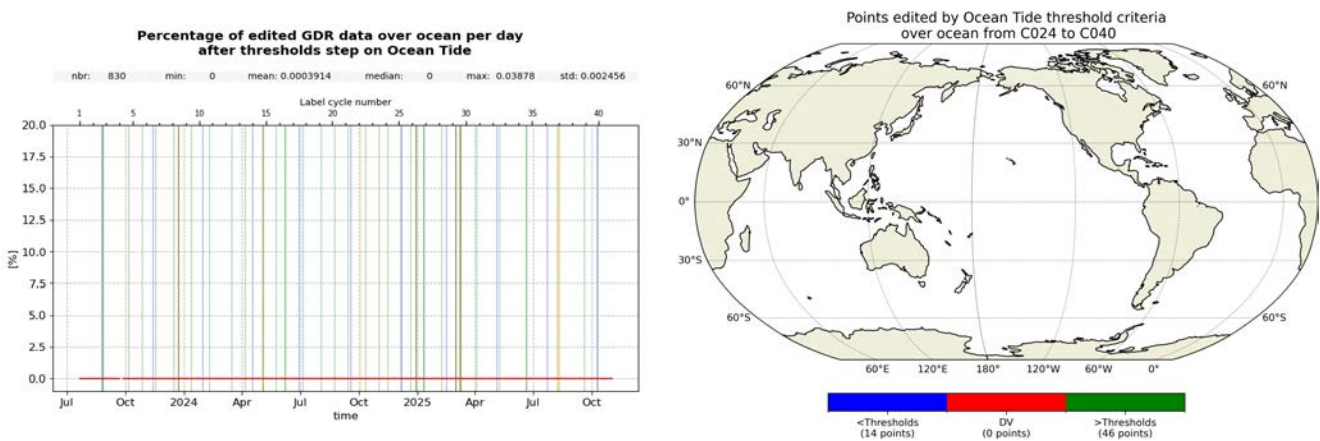


Figure 21: Edited measurements by ocean tide criterion.

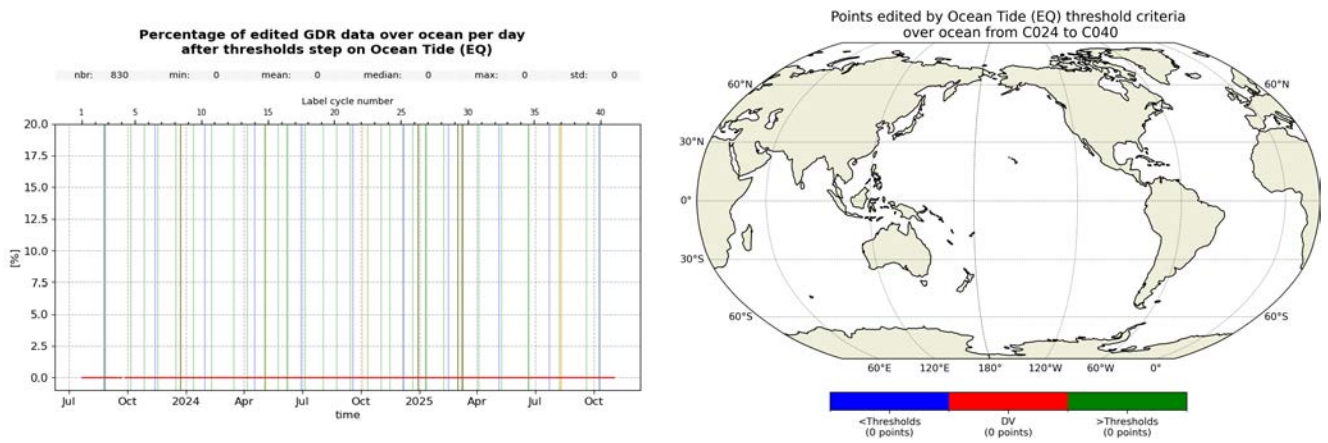


Figure 22: Edited measurements by ocean tide equilibrium threshold criterion.

3.2.3.12 Individual thresholds : Square off nadir angle

The percentage of edited measurements due to mispointing is about 0.39%. Peaks and part of passes rejected are related to maneuvers as explained in section 3.2.3.2.

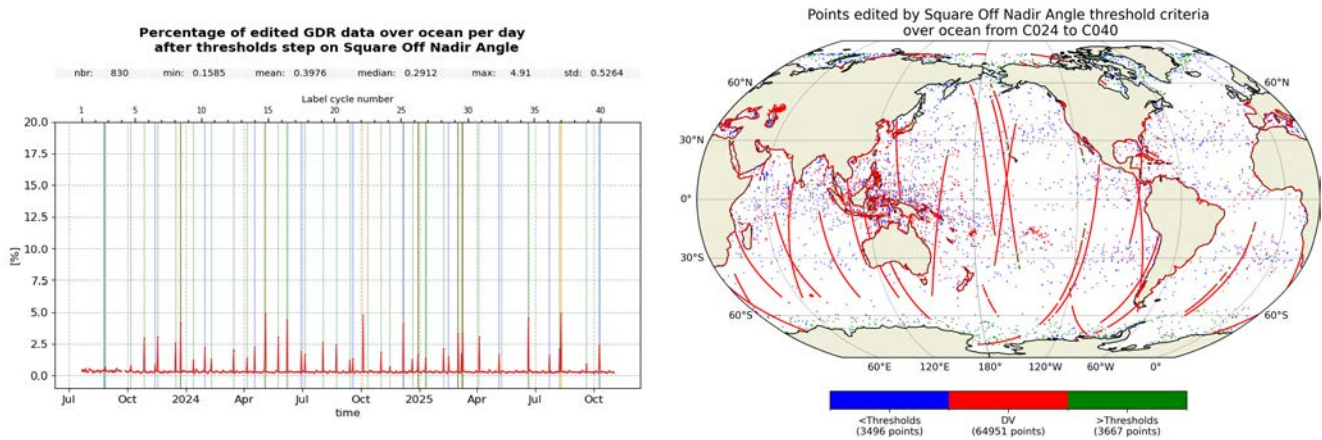


Figure 23: Edited measurements by square off nadir angle threshold criterion.

3.2.3.13 Individual thresholds : SSH

Sea surface height represents the difference between the orbit and the altimeter range.

Figure 24 summarizes the editing resulting from the sea surface height threshold criterion. It removes in average 0.455% of data for SWOT Nadir. The editing is usually due to range measurements at default values near coast in equatorial and mid-latitude regions, as well as regions with low SWHs. Moreover, peaks and part of passes rejected are related to maneuvers as explained in section 3.2.3.2.

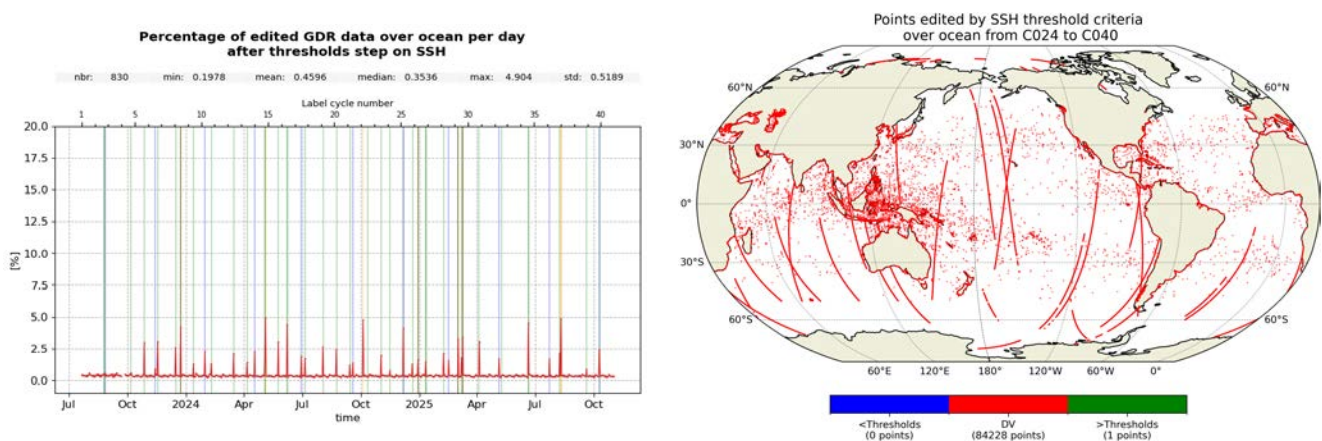


Figure 24: Edited measurements by sea surface height threshold criterion.

3.2.3.14 Individual thresholds : SLA

The percentage of edited data by threshold criterion on SLA is 1.65%. Peaks and part of passes rejected are related to maneuvers as explained in section 3.2.3.2.

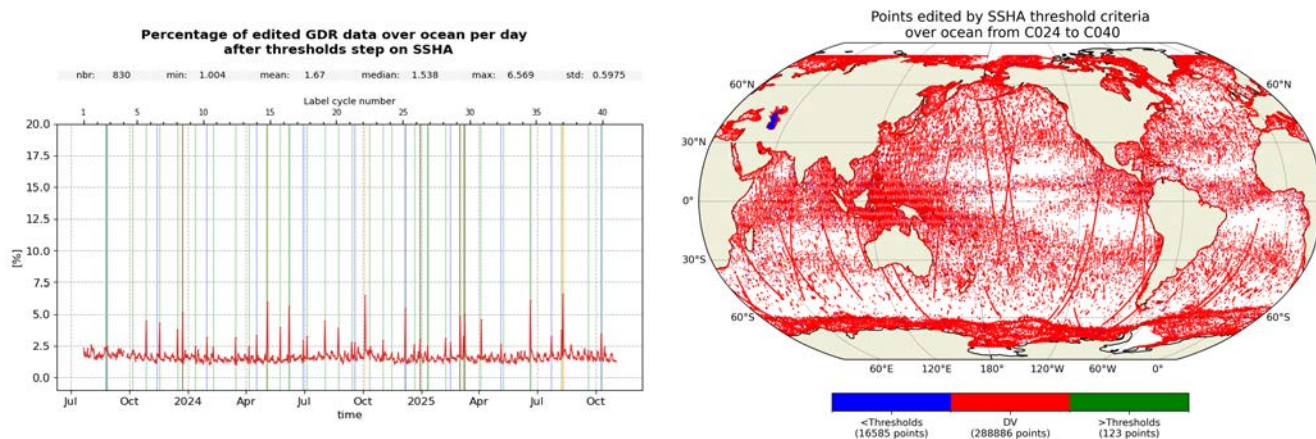


Figure 25: Edited measurements by sea level anomaly threshold criterion.

4 Monitoring of altimeter parameters

Note that from this section, we only monitor statistics on valid measurements. Mean and standard deviation of SWOT Nadir main parameters have both been monitored in this report since the beginning of the Science Phase.

4.1 20Hz measurements

The monitoring of the number and standard deviation of 20 Hz elementary range and backscatter coefficient measurements used to derive 1 Hz data is presented here. These two parameters are computed during the altimeter ground processing. As for Jason-3, Jason-2 and Sentinel-6A-MF, before performing a regression to derive the 1 Hz measurements from 20 Hz data, a MQE (mean quadratic error) criterion is used to select valid 20 Hz measurements. This first step of selection consists in verifying that the 20 Hz waveforms can be approximated by a Brown echo model (Brown, 1977 [23], Thibaut et al. 2002 [24]). Then, through an iterative regression process, elementary measurements too far from the regression line are discarded until convergence is reached. Thus, monitoring the number of 20 Hz measurements and the standard deviation computed among them is likely to reveal changes at instrumental level. The change in Altimeter characterization file visible on figures 26 and 27 left has aligned mean values of IGDR and GDR. Standard deviation of range measurements is correlated with significant wave height (SWH dedicated part: 4.3).

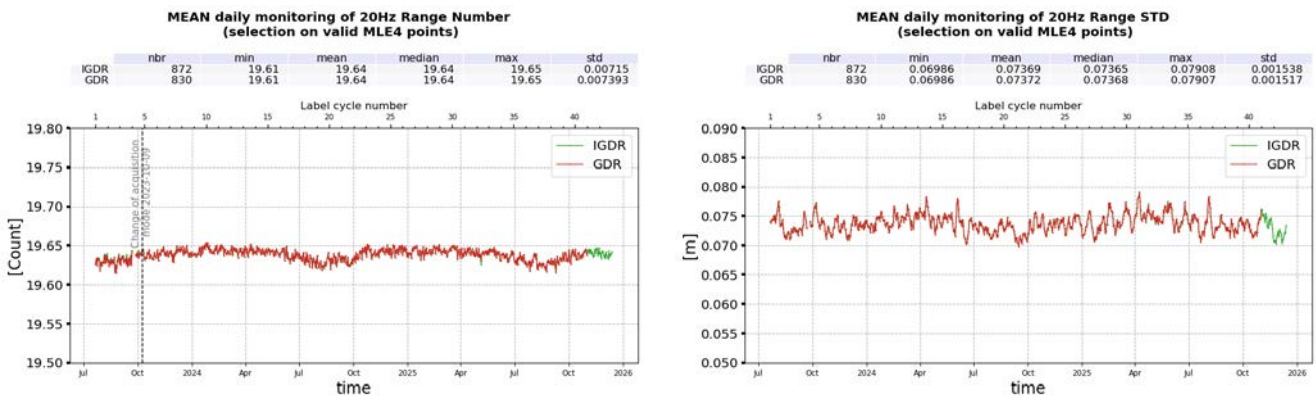


Figure 26: Daily monitoring of elementary 20 Hz range measurements

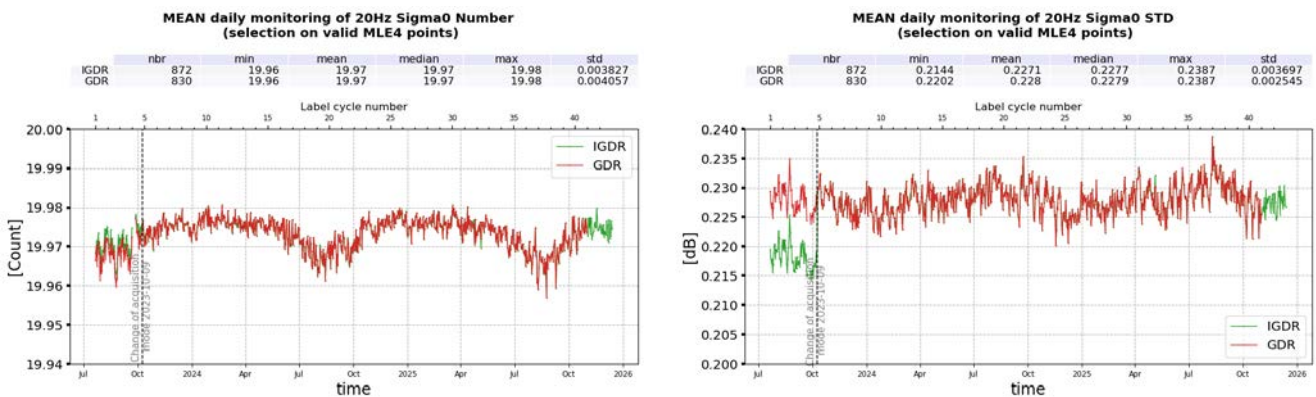


Figure 27: Daily monitoring of elementary 20 Hz sigma0 measurements

4.2 Off-nadir angle from waveform

The off-nadir angle is derived from the slope of the trailing edge of the waveform during the altimeter processing : it can either be caused by real platform mispointing or by backscattering properties of the surface. The square of the off-nadir angle, averaged on a daily basis (taking into account valid measurements only), has been plotted on figure 28.

Mispointing values for SWOT Nadir are quite stable in time. Nevertheless, over the last year, there is one period where mispointing is higher than usual but still within thresholds: on 2025-08-10 from 13:14:13 to 22:17:11, for cycle 37 pass 6 during a gyro calibration period.

Known behavior: The low amplitude periodic signal in mean value of mispointing is linked to platform mispointing coming from spacecraft attitude variation (Fig. 28, left). On the other side, the period of the signal for std seems to depict an annual variability linked to the coverage variability (Fig. 28, right).

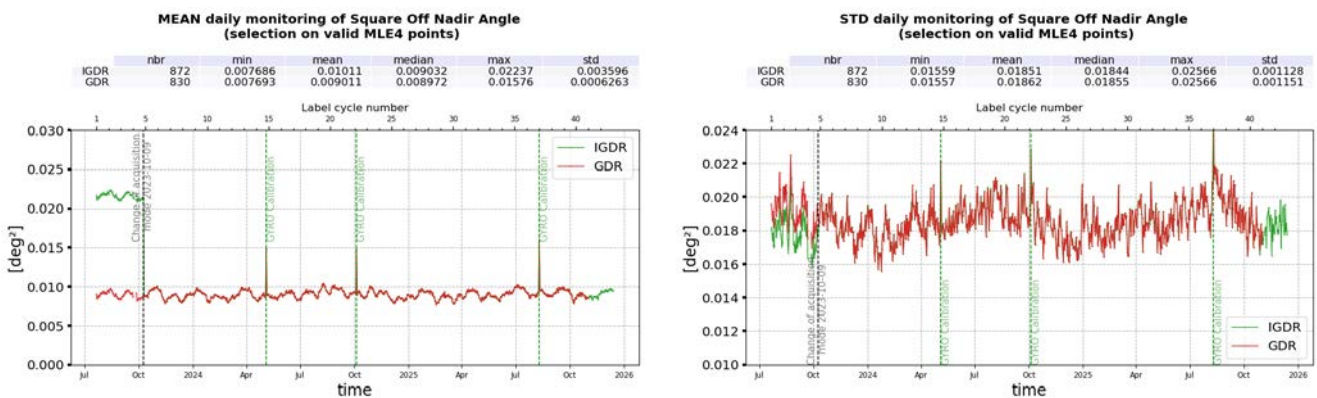


Figure 28: Daily monitoring of the square off-nadir angle.

4.3 Significant wave height

Ku-band wave estimations derived from altimeter measurements are monitored in this section. SWOT Nadir SWH is centered around 2.604 m for MLE4 (figure 29, top left) and is stable over last year. The average std over the last year is 1.359 m (figure 29, top right). The period of the signal for the std which is also slightly present for the mean, reflects the seasonal variability of wave intensity.

Over the last year, the mean and std of the differences with ERA5 model are stable and are respectively in average 12.9 cm and 30.8 cm.

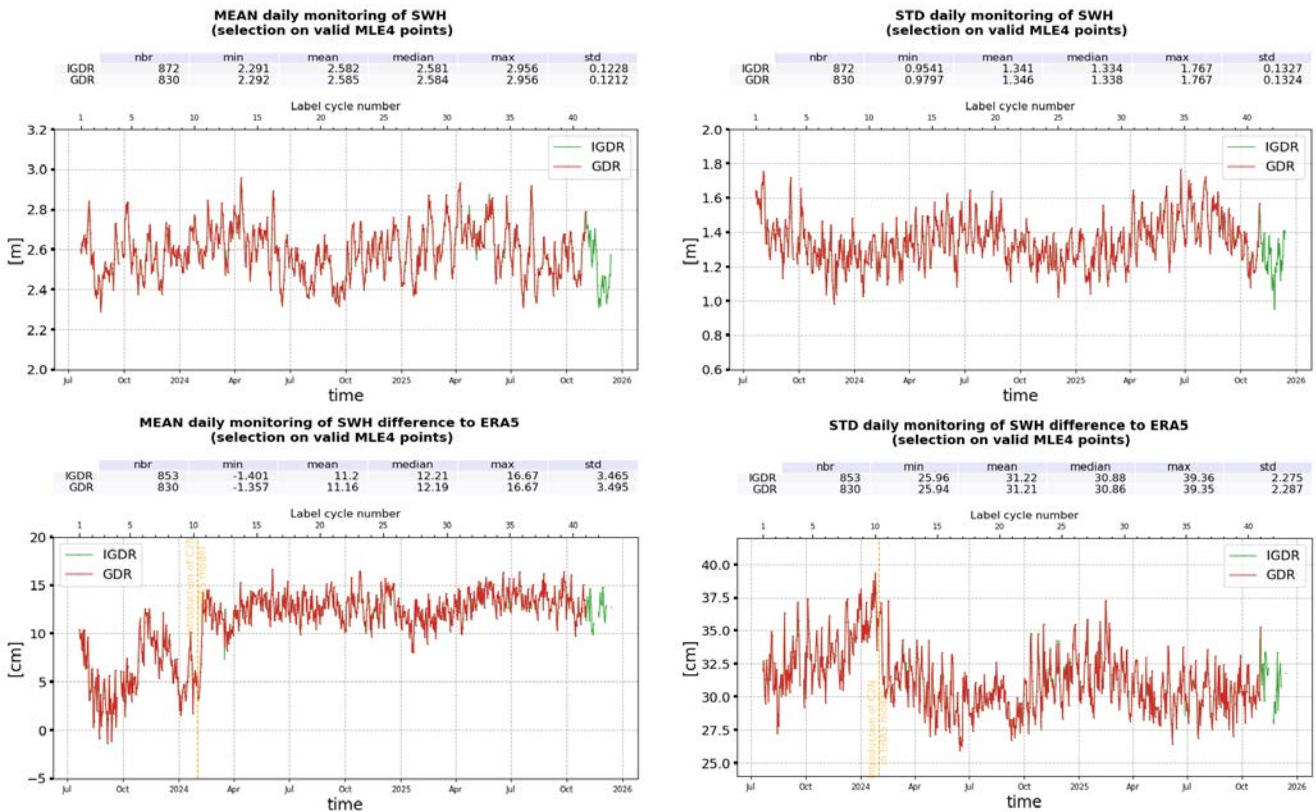


Figure 29: Monitoring of significant wave height

Figure 30 shows the maps of the mean SWH and the mean difference between altimeter and ERA5 model SWH for a winter cycle (Cycle 027, left) and a summer cycle (Cycle 036, right).

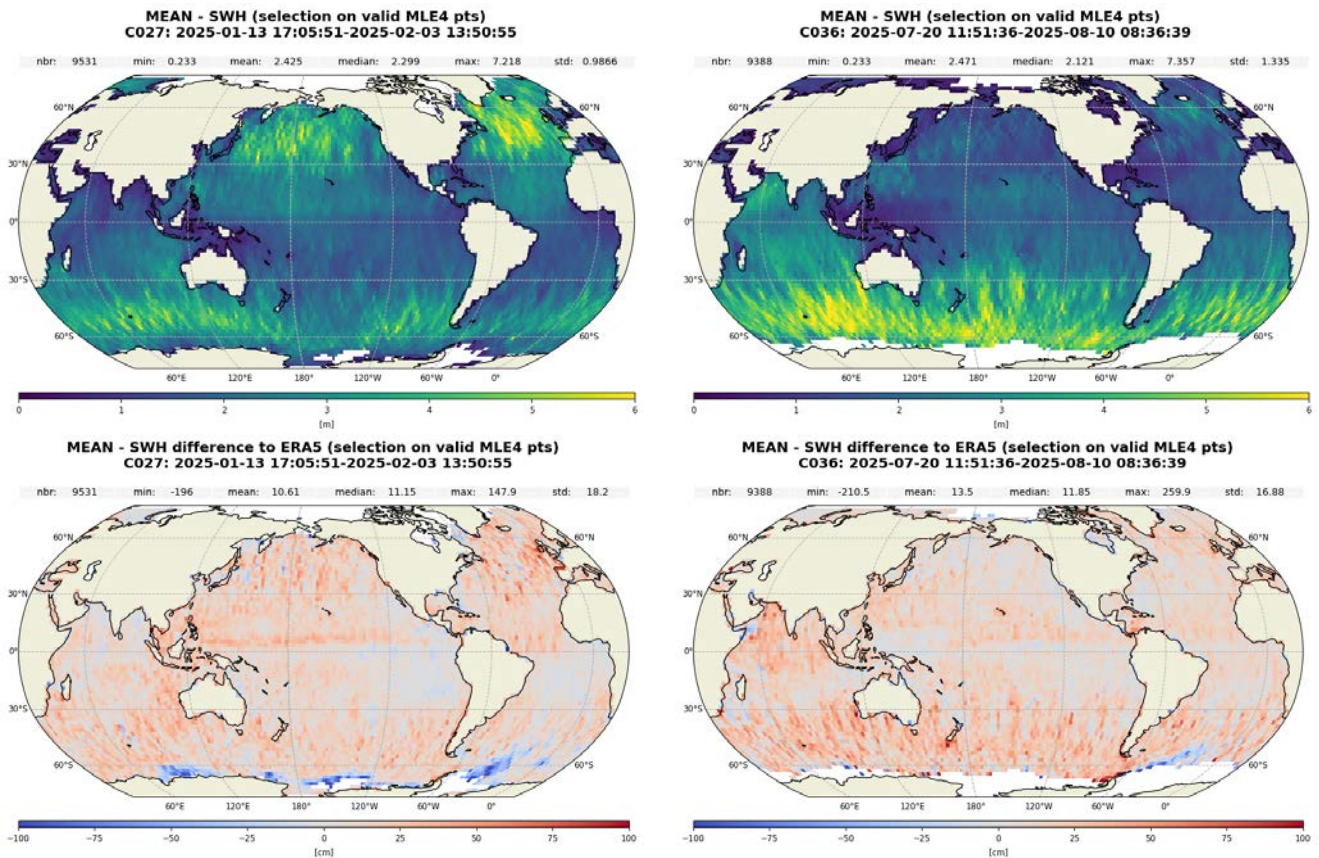


Figure 30: Cyclic Geobox mean maps of SWH (top) and of SWH difference to ERA5 model (bottom) during winter period Cycle 027(left) and during summer period Cycle 036(right)

The histogram of the SWH distribution for MLE4 and ERA5 model is presented in Figure 31. The particular behaviors of the distribution for MLE4 low SWH (<1 m) are discussed in the SWOT Nadir CalVal Phase Report [7].

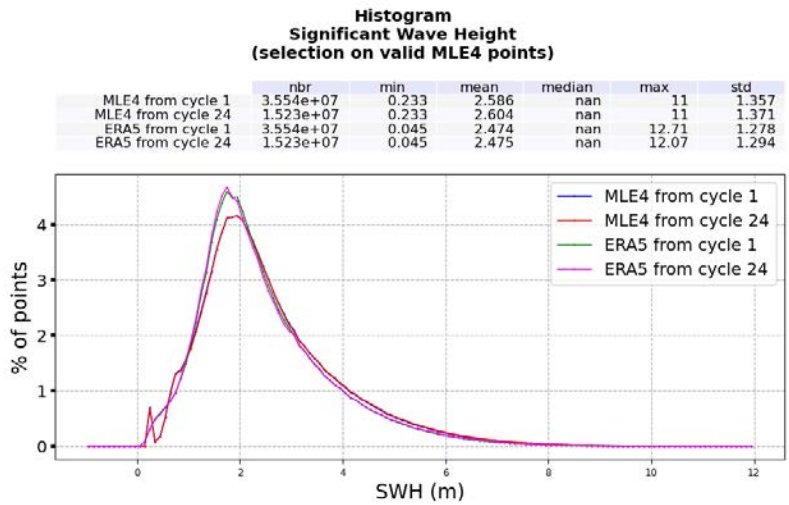


Figure 31: Histogram of SWH with MLE4 and ERA5 data

4.4 Backscatter coefficient

SWOT Nadir Ku-band backscatter coefficient is stable over the last year around 13.456 dB for the period (figure 32).

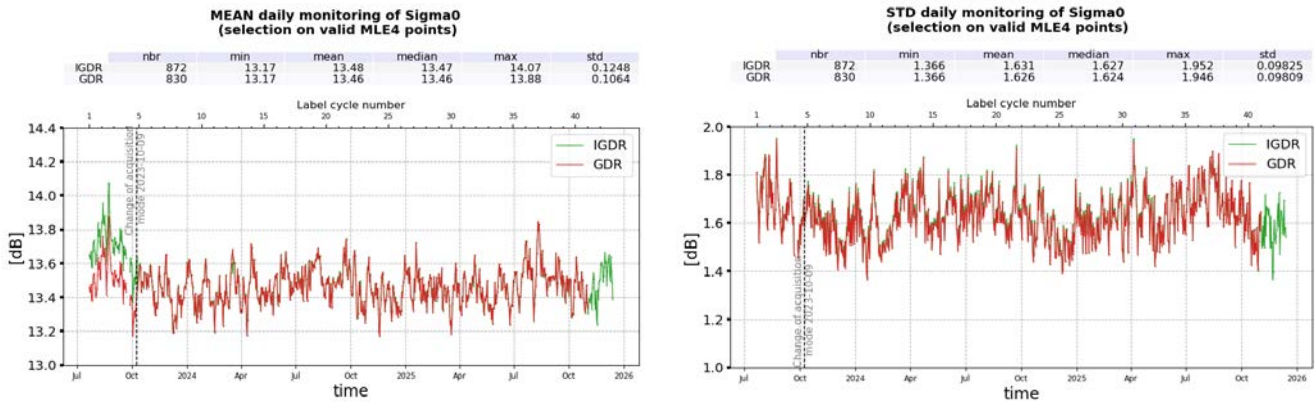


Figure 32: Daily monitoring of sigma0 measurements

4.5 Wind speed

Altimeter wind speed is derived from backscattering coefficient and significant wave height using Collard algorithm. To allow wind speed computation, a calibration bias is applied on the backscattering coefficient.

Since GDR-S 2.01, calibration bias is fitted to SWOT Nadir data. As a consequence, wind speed estimations are now aligned with ERA5 model. It was not the case in the GDR-F v1.04 version. This explains the jump in IGDR data during cycle 032 (GDR-F → GDR-S2) in Figure 34 and Figure 33.

Over the last year, the averaged wind speed value is 7.736 m/s for MLE4 (figure 33).

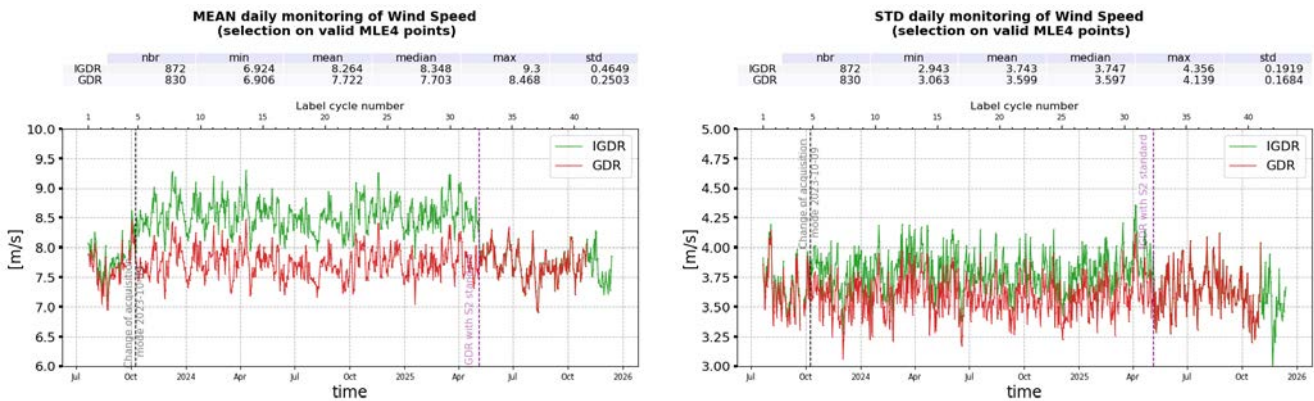


Figure 33: Monitoring of altimeter wind speed

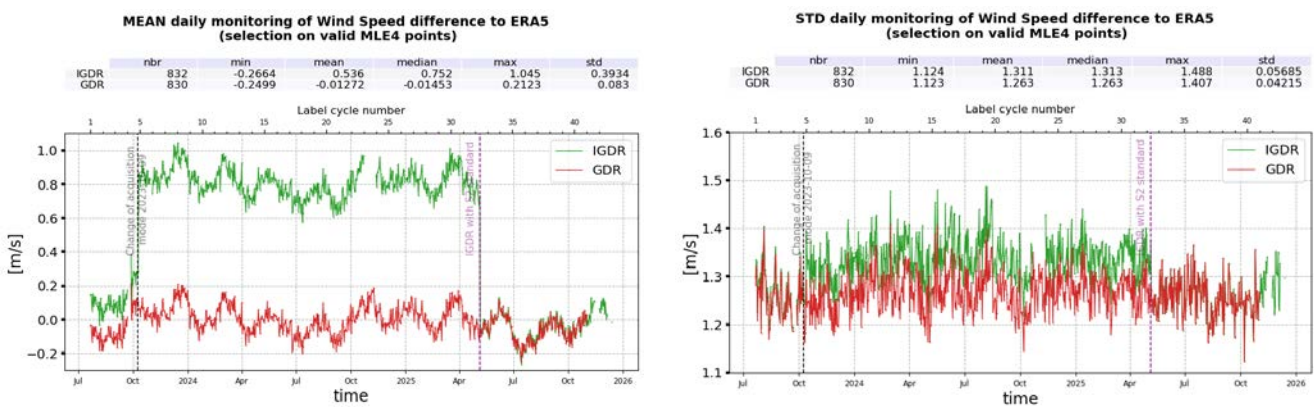


Figure 34: Monitoring of altimeter wind speed difference to ERA5 model

Figure 35 shows the maps of the mean difference between altimeter and ERA5 model Wind Speed for a winter cycle (Cycle 027, left) and a summer cycle (Cycle 036, right).

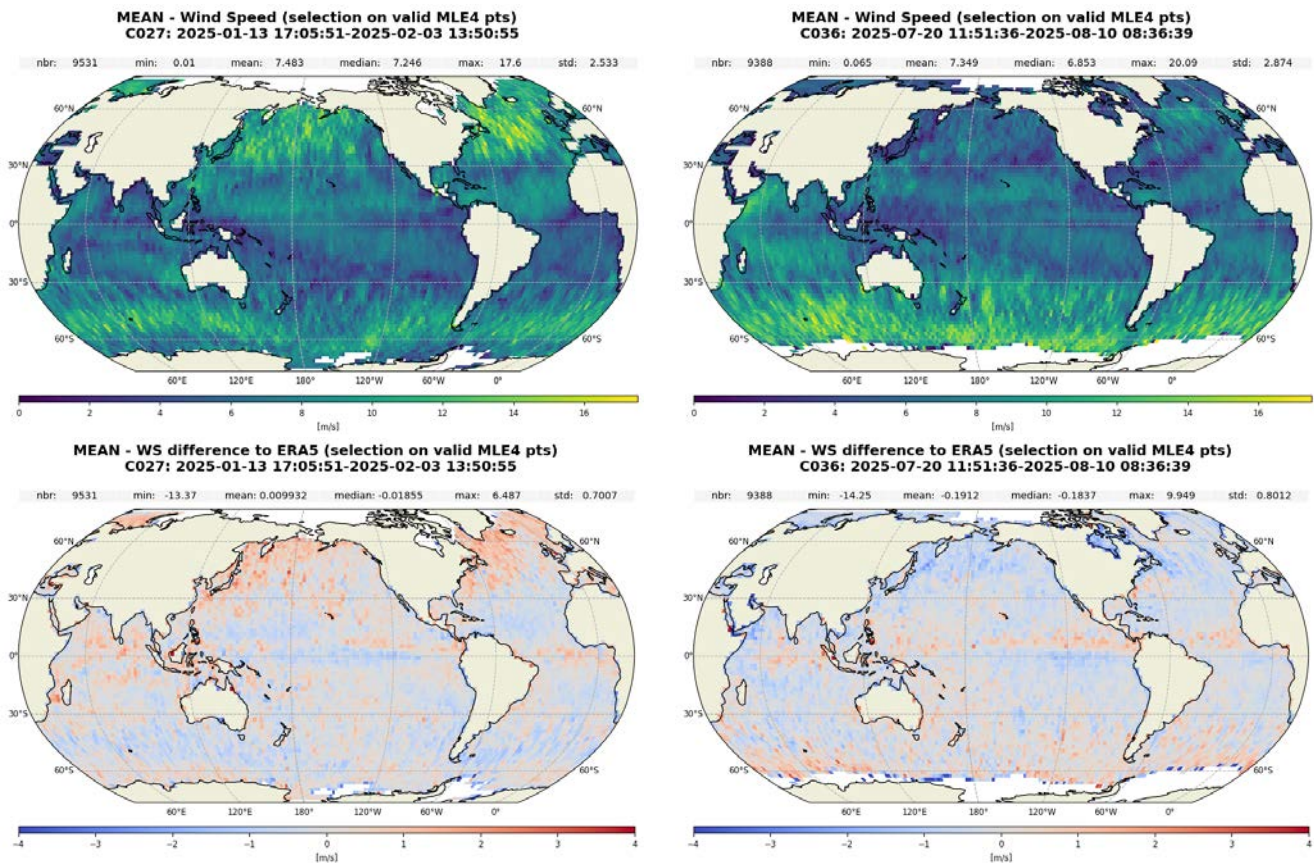


Figure 35: Cyclic Geoblox mean maps of wind speed (top) and wind speed difference to ERA5 model (bottom) during winter period Cycle 027(left) and during summer period Cycle 036(right)

4.6 Sea state bias

For the current version of GDR, SSB is not fitted to SWOT Nadir data, but the same biases as for Jason-3 GDR-F are applied. Over the last year, SWOT Nadir sea state bias is centered around -10 cm for MLE4 (figure 36).

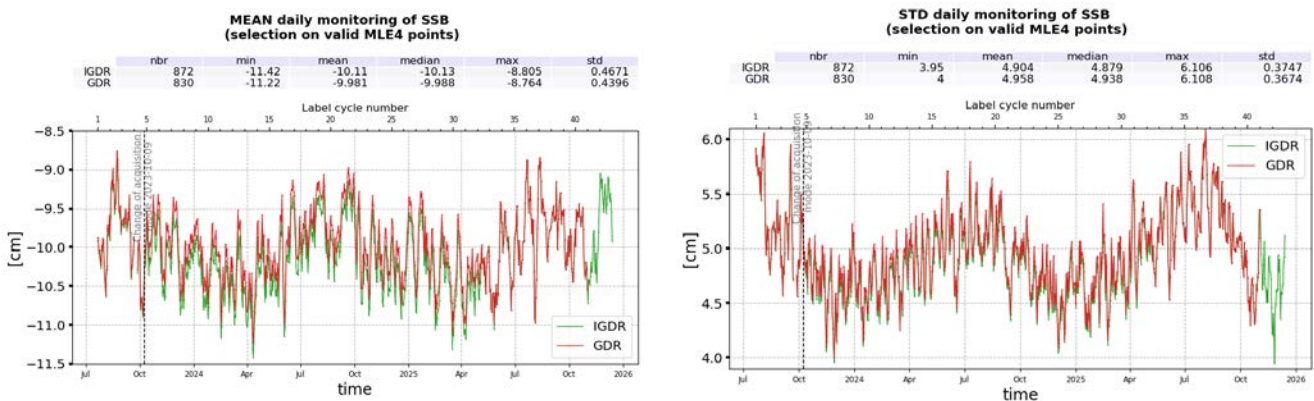


Figure 36: Monitoring of sea state bias

4.7 Ionospheric correction

Over the last year, SWOT Nadir altimeter filtered ionospheric correction is centered around -5.7 cm for MLE4 retrievals (figure 37).

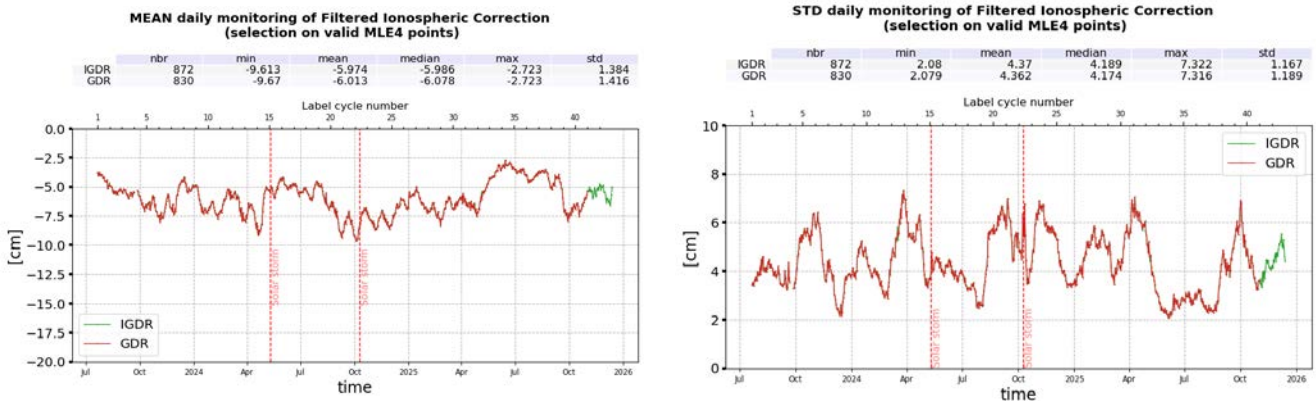


Figure 37: Monitoring of filtered ionospheric correction

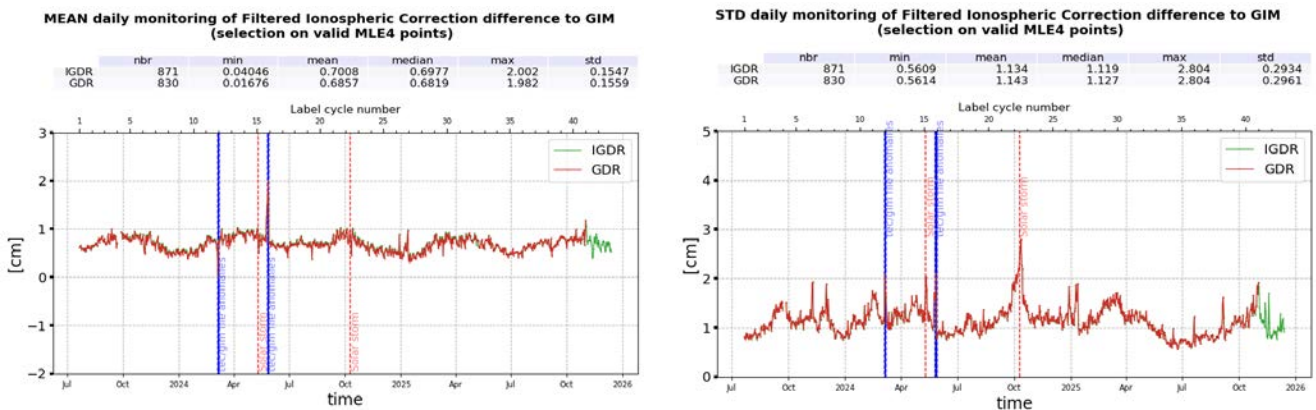


Figure 38: Monitoring of filtered ionospheric correction difference to GIM model

Note that an iterative filtering method was applied to the ionospheric correction in the production of SWOT Nadir GDR-F altimetry products. The process is applied to the non filtered solution computed from the formula:

$$Iono = \delta f [(Range_{Ku} + SSB_{Ku}) - (Range_C + SSB_C)]$$

$$\text{where } \delta f = \frac{(Frequency_{C_{band}})^2}{(Frequency_{Ku_{band}})^2 - (Frequency_{C_{band}})^2} \text{ represents the frequency factor}$$

For SWOT Nadir, frequency is 5.3GHz for C-band and 13.575GHz for Ku-band.

The iterative filtering scheme was developed to achieve two main goals:

- Base the correction on as many dual-band ionospheric observations as possible
- Improve the correction where altimetric observations are discontinuous or isolated.

This method is fully detailed from Nencioli *et al.* [21] in Jason-3 GDR-F Reprocessing Report [22].

Known issue: Some ionospheric correction measurements are lost due to a bad behaviour of the filtering process in rare cases. An ongoing study aims to explain this unexpected phenomenon. A complete presentation of the issue is made in the SWOT Nadir GDR 1-day CalVal Phase Report [7].

Link between ionospheric correction and local hour: In the previous SWOT Nadir Annual Report [14], 3 different examples of the local hour distribution are shown to illustrate the link between local hour and ionospheric correction intensity. During a day measurement the ionospheric is much more intense than during a night measurement.

5 Validation and Monitoring of Radiometer Parameters

All figures shown in this section were produced using data from the GDR-S2 reprocessing, and covers the period from the beginning of the Science Phase to the cycle 40.

5.1 Geophysical products monitoring

For the SWOT mission, the Wet Tropospheric Correction is measured by a radiometer with two independent beams, measuring tropospheric correction on each side of the nadir, with AMR Side 1 35 km away from nadir, and Side 2 40 km away. Depending of Yaw Flip, one beam measure the Wet Tropospheric Correction slightly fore of the Nadir Altimeter measurement, while the other beam measure aft of Nadir Altimeter measurement. Then, an interpolation using the two radiometer sides is performed to obtain the Wet Tropospheric Correction on each 1Hz altimeter measurement.

Figure 39 shows the daily monitoring of the Nadir Wet Tropospheric Correction for both IGDR and GDR, for every valid MLE4 points, with a mean value around -15.8 cm and a standard deviation around 9.9 cm over the last year.

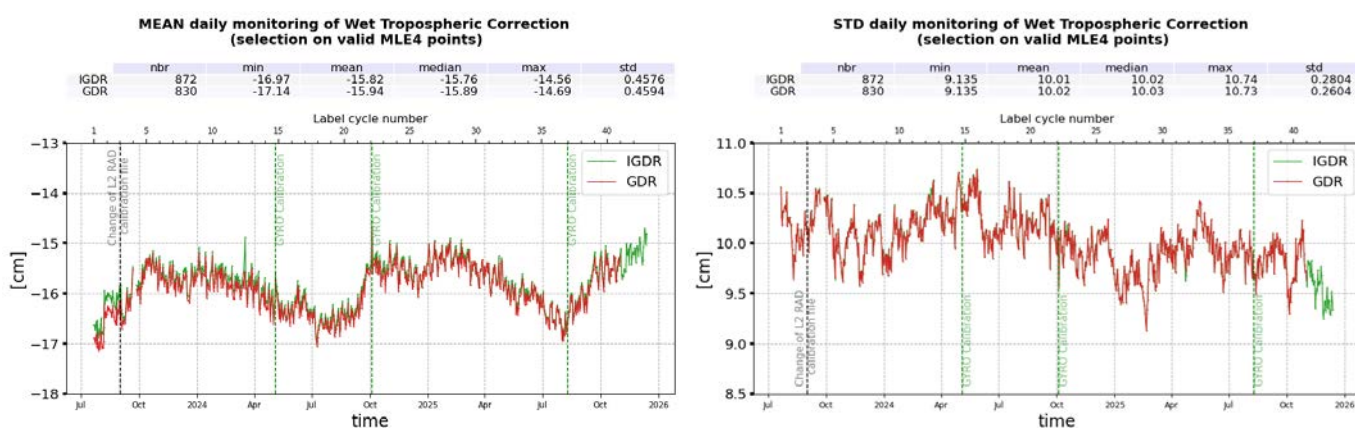


Figure 39: Daily monitoring of the Wet Tropospheric Correction for IGDR (green) and GDR (red), from Cycle 001 to Cycle 040

Figure 40 shows the evolution of the Wet Tropospheric Correction measured by both radiometer beams and interpolated on the Nadir for every Nadir points where the interpolated WTC is considered as valid, and closest S1 and S2 L2RAD points are valids too, to have the same selection for all datasets. The variations observed are mainly due to seasonal effects and geophysical events as El Niño.

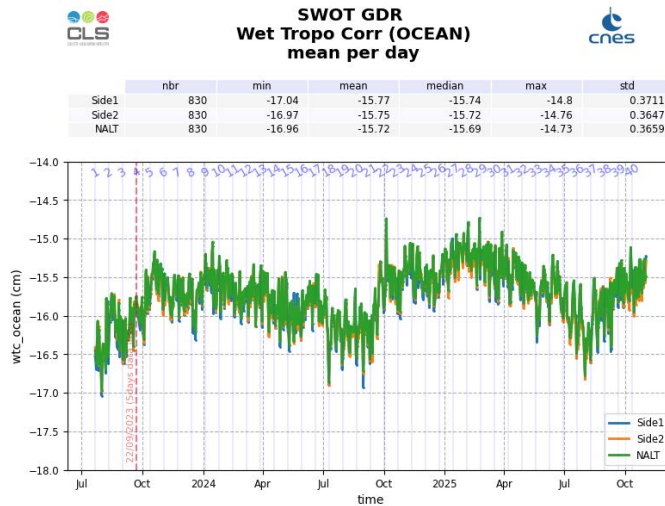


Figure 40: Daily monitoring of the mean of the Wet Tropospheric Correction for the AMR S1 (blue), AMR S2 (orange) and Nadir (green) from Cycle 1 to Cycle 40

To assert the quality of the WTC from the satellite, it is compared to a WTC computed from the ECMWF operational model, available every 6 hours. This model WTC is then linearly interpolated at both radiometer beams measurements locations and Nadir locations. Figure 41 shows the evolution of the daily mean and standard deviation of the difference between both AMR beams WTC and Nadir WTC, and model WTC, for every Nadir points where the interpolated WTC is considered as valid, and closest S1 and S2 L2RAD points are valids too, to have the same selection for all datasets. This shows the stability of SWOT’s WTC with variation of mean of no more than one mm apart from calibration changes. After 2023-10-21 change in radiometer calibration coefficients, the mean difference for both radiometer’s sides and Nadir appears is almost identical, around 0.3 cm. The daily standard deviation is stable too, around 1.1 cm for the radiometer, which is the nominal standard deviation expected (similar to Jason-3 and Sentinel-6). The daily standard deviation of the difference is only 0.9 cm for the Nadir interpolated WTC, due to the smoothing effect of the interpolation.

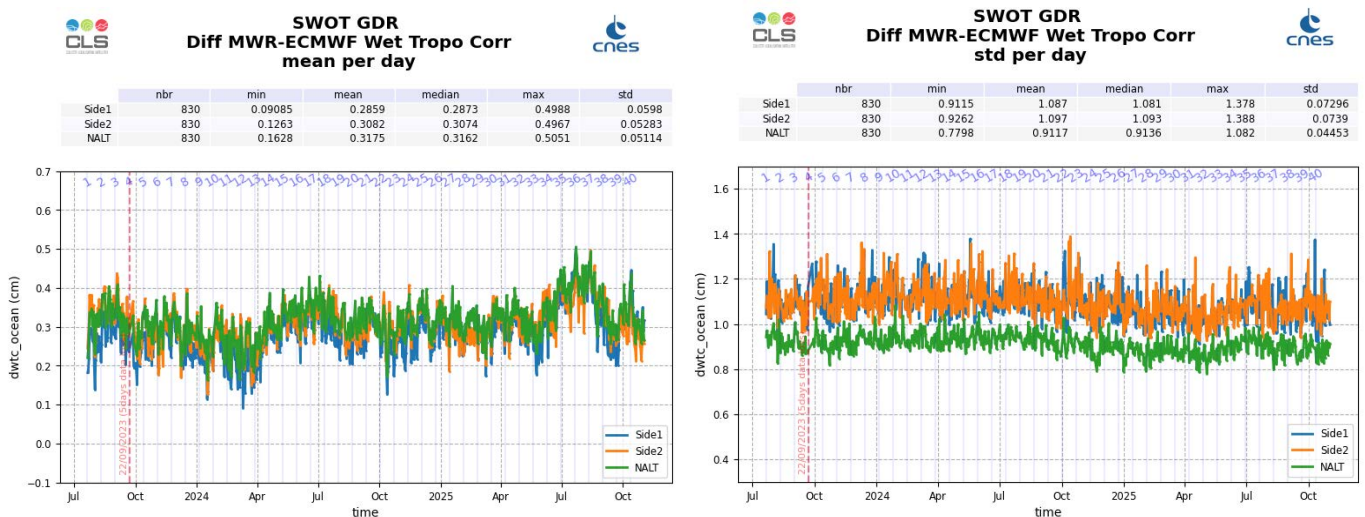


Figure 41: Daily monitoring of the mean (left) and standard deviation (right) of the difference between Wet Tropospheric Correction from MWR and from model for the AMR S1 (blue), AMR S2 (orange) and Nadir (green) from Cycle 1 to Cycle 40

Figure 42 shows the geographical variation of the difference between Nadir Wet Tropospheric Computation interpolated with MWR, and Nadir Wet Tropospheric Computation from model, in terms of mean and standard

deviation. The geographical patterns observed are as expected and similar to those observed on other altimetry missions such as Jason-3 or Sentinel-6A.

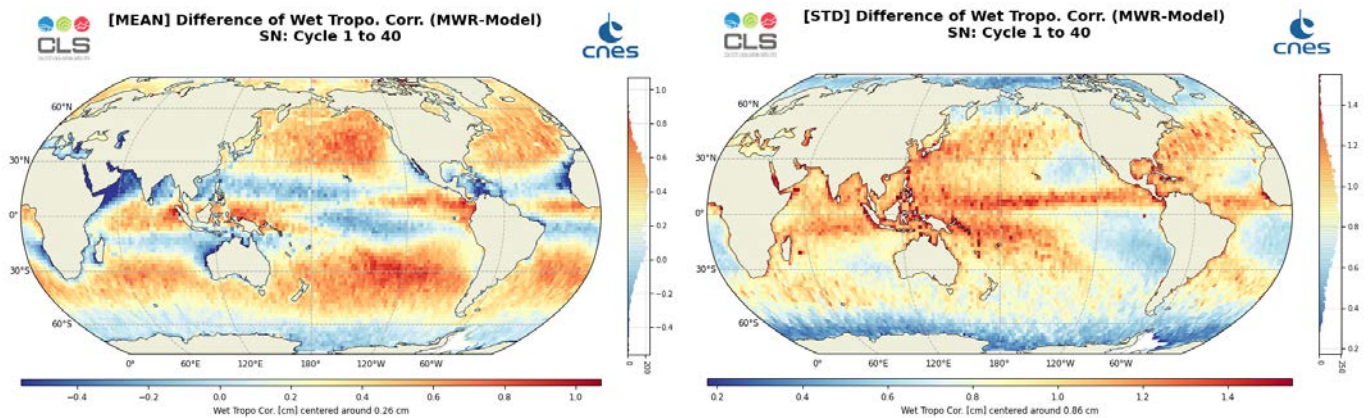


Figure 42: Geographical variation of the mean (left) and standard deviation (right) of the difference between Wet Tropospheric Correction from MWR and from model for SWOT Nadir from Cycle 1 to Cycle 40

The other radiometer products (Water Vapor Content, Cloud Liquid Water Content, Atmospheric Attenuation for the Sigma 0) are interpolated the same way as WTC and can be compared to values issued from the ECMWF model too, as shown in figure 43, assessing the good temporal stability of the Atmospheric Attenuation.

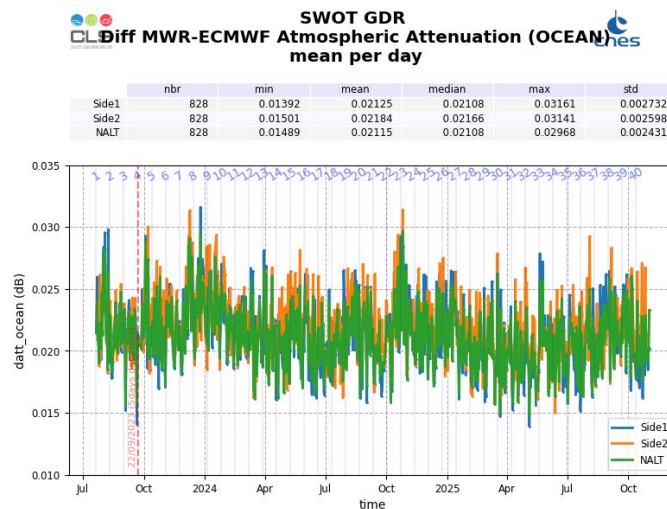


Figure 43: Daily monitoring of the mean of the difference between Atmospheric Attenuation from MWR and from model for the AMR S1 (blue), AMR S2 (orange) and Nadir (green) from Cycle 1 to Cycle 40

5.2 Intercalibration monitoring

To assess the intercalibration between the two sides of the radiometer, the gradient between each Side 1 AMR measurements and the closer Side 2 AMR measurements is calculated for the three brightness temperatures and the Wet Tropospheric Correction. This monitoring allows to detect any instrumental drift affecting one of the SWOT radiometer beams, which would increase the gradient between the two beams. In addition, excessive differences in measurements between the two beams would affect the quality of the interpolation at Nadir. Figure 44 shows the brightnesses temperatures gradients between the two radiometers.

The difference is smaller and stable for the 23.4 GHz (which is the main contributor of the Wet Tropospheric Correction) than for the other two. However, after the 22/10/2024 calibration, the S1/S2 gradient is greatly reduced for the three channels, fluctuating around 0.3 Kelvin.

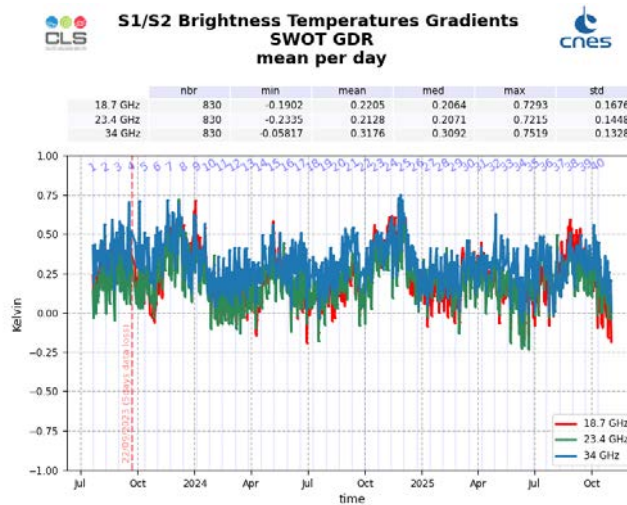


Figure 44: Daily monitoring of the mean S1/S2 gradients of brightness temperatures, for the 18.7 GHz channel (blue), the 23.4 GHz channel (green) and the 34 GHz channel (red) from Cycle 1 to Cycle 40

Figure 45 shows the Wet Tropospheric Correction gradient between the two radiometers and between the radiometers and the nadir. This difference is stable overall, at around 1 mm, and becomes near null after the change in radiometers calibration coefficients on 22/10/2024

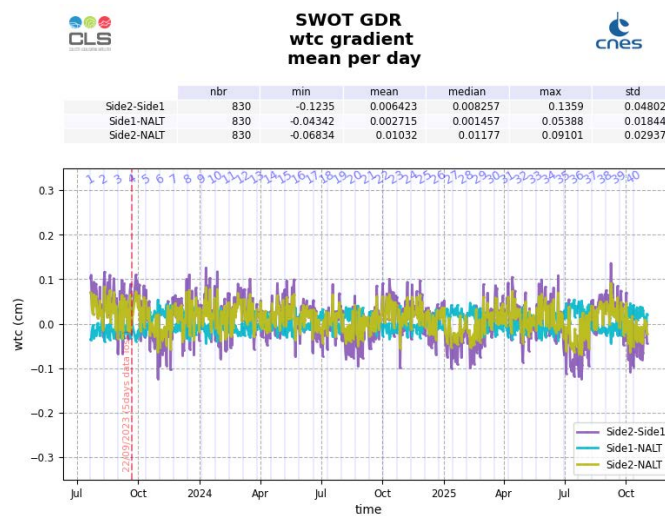


Figure 45: Daily monitoring of the wet tropospheric correction gradient between AMR Side 1 and AMR Side 2 (purple), AMR Side 1 and Nadir (cyan)

5.3 Global Performance of the Wet Tropospheric Correction

The main quality criterion for the radiometer-derived Wet Tropospheric Correction is 10-day variance difference at crossover points between a SSH (sea surface height) computed with the radiometer WTC and a SSH computed with the model WTC. Since the SSH variance at 10 days is supposed to be very low, most of the residual variance is assumed to come from the applied corrections (WTC or other). Therefore, if using

the radiometer WTC instead of model WTC reduces the SSH variance at crossovers, it indicates that the radiometer provides a better estimation of the WTC estimation than the model.

Figure 46 shows the difference of variance between the SSH with radiometer WTC (interpolated at nadir) and the SSH with model WTC for SWOT Nadir over one year and a half. The analysis excludes regions with high oceanic variability, shallow waters, and high latitudes. On average, the nadir-interpolated WTC reduces the variance by approximately 1.4 cm², which indicates a good performance of the nadir-interpolated WTC: within the selected data domain—filtered by latitude, bathymetry, and oceanic variability—the SSH variance at 10 days is expected to be close to zero.

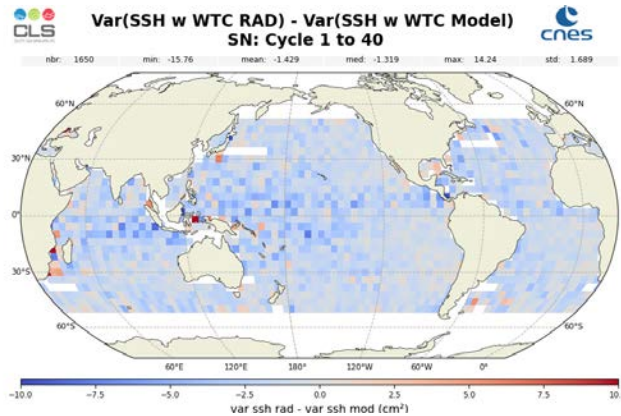


Figure 46: Difference of variance between the SSH with Nadir interpolated WTC and the SSH with model with geographical selection based on latitude (between -50 and 50 degrees), bathymetry (inferior to -1000m) and oceanic variability (inferior to 0.2m), from cycle 1 to cycle 40

Over the ocean, the interpolated Wet Tropospheric Correction is available and valid for more than 98% of the nadir measurements (see Figure 58 and Table 11 in the chapter *Synthesis of the GDRS2 reprocessing section* for more details).

6 Assessment from crossover analysis

6.1 Overview

Sea Surface Height crossover differences are the SSH differences between ascending and descending passes where they cross each other. Sea Surface Height is computed as follows:

$$SSH(\text{corrected}) = Orbit - \text{AltimeterRange} - \sum(\text{GeophysicalCorrections})$$

with for SWOT Nadir: Orbit = CNES orbit for GDR products, and

$$\begin{aligned} \sum(\text{GeophysicalCorrections}) = & \text{Non parametric sea state bias correction} \\ & + \text{Dual frequency ionospheric correction (filtered)} \\ & + \text{Radiometer wet troposphere correction} \\ & + \text{Dry troposphere correction} \\ & + \text{Dynamical atmospheric correction} \\ & + \text{Ocean tide correction (including loading tide and non equilibrium tide)} \\ & + \text{Internal tide correction} \\ & + \text{Earth tide height} \\ & + \text{Pole tide height} \end{aligned}$$

Sea Surface Height crossover differences are the SSH (corrected) differences between ascending and descending passes where they cross each other. Crossover differences are systematically analysed to estimate data quality. SSH crossover differences are computed from the valid data, with a maximum time lag of 10 days, in order to limit the effects of ocean variability which are a source of error in the performance estimation. The mean SSH crossover differences should ideally be close to zero and standard deviation should ideally be small.

Nevertheless, SSH varies also within 10 days, especially in high variability areas. Furthermore, due to lower data availability (due to seasonal sea ice coverage), models of several geophysical corrections are less precise in high latitude. Therefore, an additional geographical selection - removing shallow waters, areas of high ocean variability and high latitudes (> |50| deg) - is applied.

6.2 Monomission crossovers

The daily mean of SSH differences is plotted in Figure 47 (left). Mean of SSH differences at crossovers is almost null showing the stability of measurements for this diagnostic.

After data editing, applying additional geographical selection and SWOT Nadir standards, the crossover standard deviation over the last year is about 5 cm in MLE4.

In the map in Figure 47 (right), we detect a geographical pattern (East/West in Pacific Ocean and North/South in Atlantic Ocean). This pattern was studied and was coming from the Orbital Solution POE-F. It will be corrected in 2026 with the Orbital Solution POE-G.

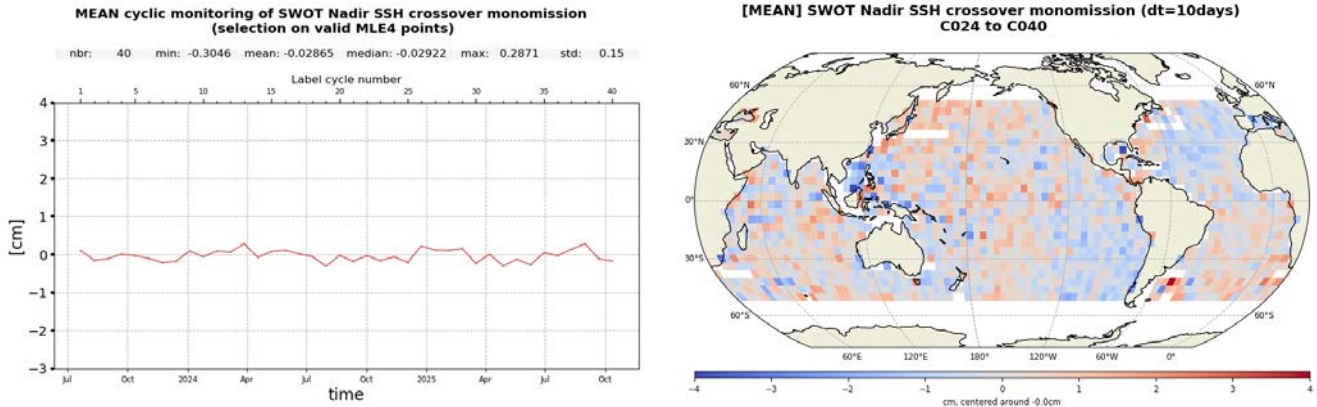


Figure 47: Mean SSH difference at crossovers mono-mission (using SL2 selection)

The daily standard deviation or variance of SSH crossovers differences are plotted in figure 48 after applying geographical criteria (bathymetry, latitude, oceanic variability).

This metric allows to estimate the system noise by dividing by $\sqrt{2}$ (which leads to 3.54 cm).

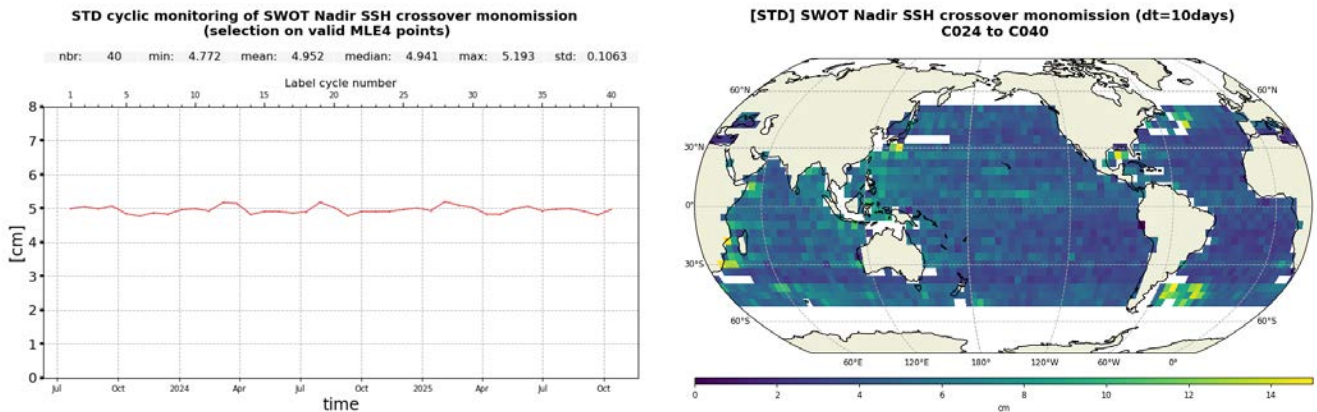


Figure 48: Std SSH difference at crossovers mono-mission (using SL2 selection)

6.3 Multimission crossovers

Dual-mission crossover performances are computed between SWOT Nadir GDR-F and Sentinel-6A-MF GDR-F and presented figure 49. There is a jump in mean SLA differences at SWOT Nadir/Sentinel-6A-MF crossovers in the Figure 50 due to S6A standard change (F09 → G01). The jump value is lower than 1 cm. It is consistent with the SLA bias value of 7.3 mm between F09 and G01 standard, described in the S6A G01 Reprocessing Calval Assessment [8]. Before and after the jump, mean SLA differences are quite stable. Figure 50 shows seasonal differences.

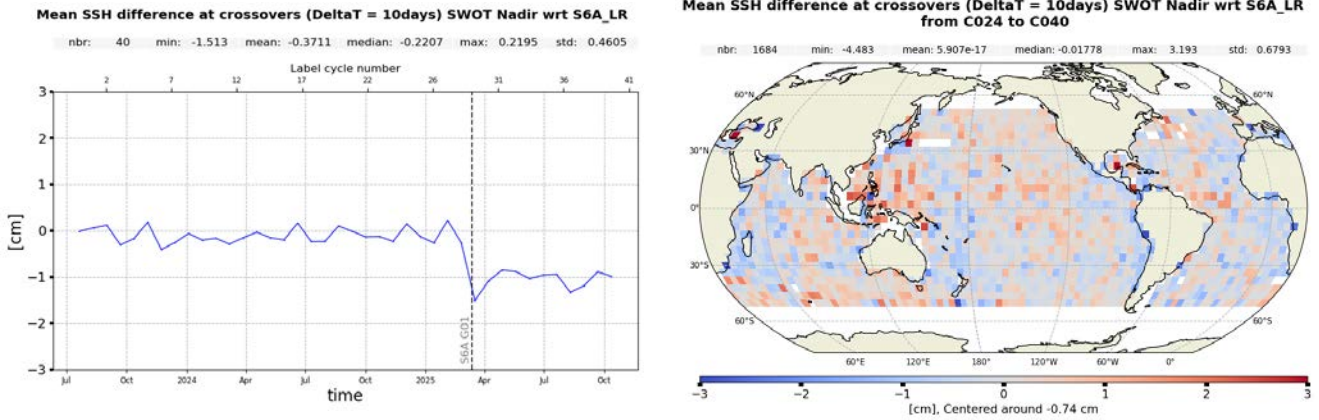


Figure 49: Mean SSH difference at crossovers between SWOT Nadir MLE4 and Sentinel-6A MF LR MLE4

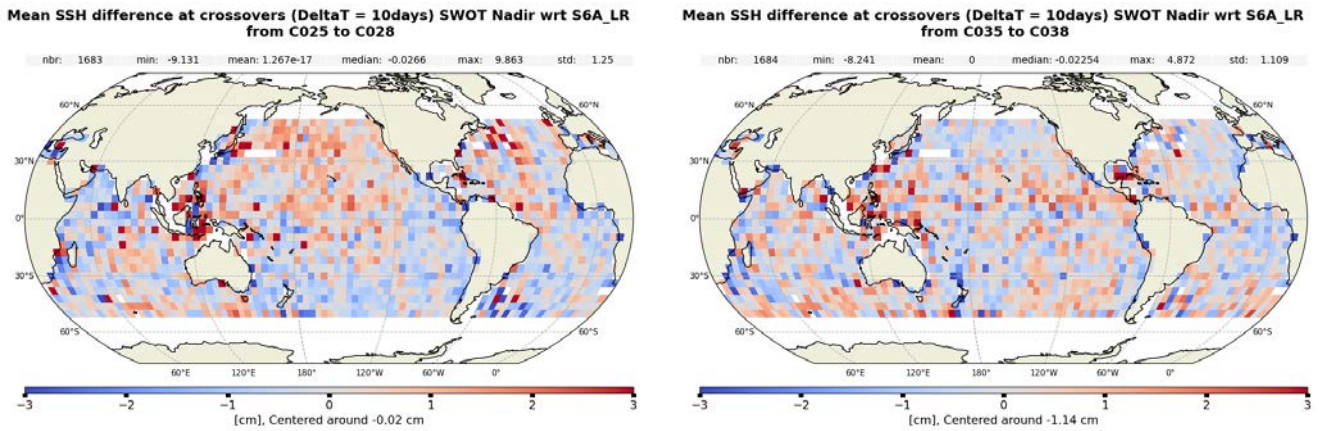


Figure 50: Mean SSH difference at crossovers between SWOT Nadir MLE4 and Sentinel-6A MF LR MLE4 for winter cycles (left) and summer cycles (right)

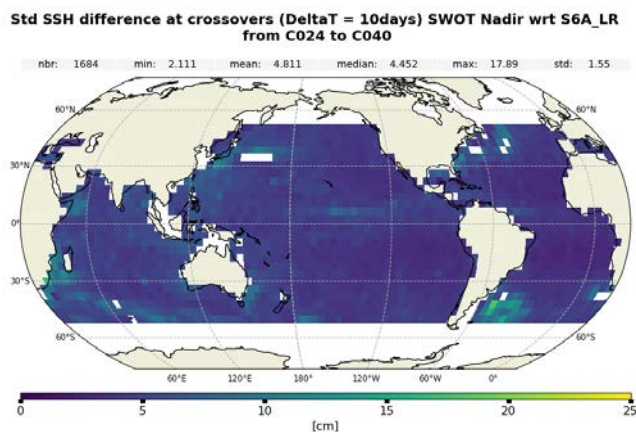
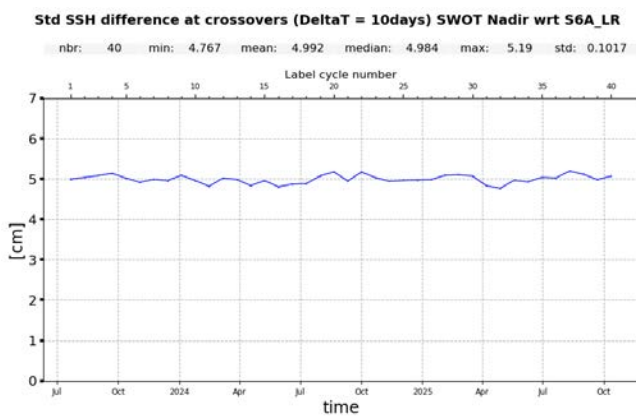


Figure 51: STD Daily monitoring of SSH difference at crossovers between SWOT Nadir MLE4 and Sentinel-6A MF LR MLE4

7 SLA along-track analysis

The Sea Surface Height Anomaly (or SLA) is the most well-known parameter estimated from altimetry. It corresponds to the elevation of sea surface, with respect to a reference called Mean Sea Surface (Mean Sea Surface (MSS)), generated by oceanic variability and climatic phenomena (such as Gulf stream current, El Nino, ...).

It is computed as follow:

$$SLA = Orbit - AltimeterRange - \sum(GeophysicalCorrections) - MSS$$

The details of the geophysical corrections for SWOT Nadir can be found in previous section 6.1.

SLA analysis is a complementary indicator to estimate the altimetry system performances. It allows to study the evolution of SLA mean (detection of jump, abnormal trend or geographical correlated biases), and also the evolution of the SLA variance highlighting the long-term stability of the altimetry system performances.

The daily monitoring of mean SLA for SWOT Nadir is computed on figure 52.

The periodic signal reflects the seasonal cycle of SLA over ocean. SWOT Nadir SLA shows a good stability over the last year with an averaged value of 6.5 cm over the last year.

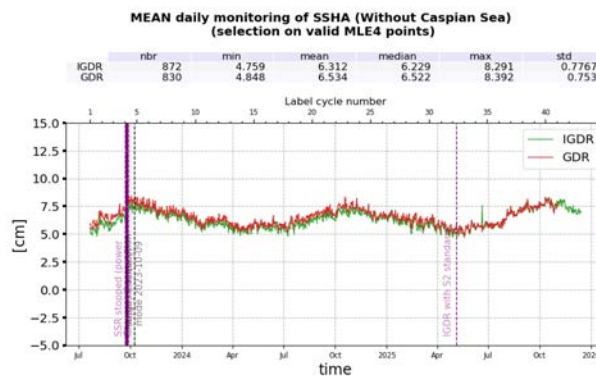


Figure 52: Daily monitoring of along-track mean SLA

The monitoring of SLA standard deviation has been computed for the SWOT Nadir mission (figure 53). Note that this metric is very dependent to the MSS reference solution used to compute SLA. SWOT Nadir shows a good stability in terms of SLA standard deviation with an averaged value of 10.2 cm over the last year. There is a peak in Figure 53 observed between October 10th and 20th is attributed solely to high latitudes (>60 °N).

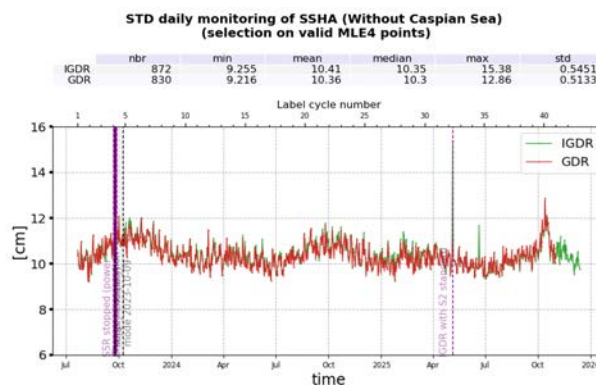


Figure 53: Daily monitoring of along-track SLA standard deviation.

8 Synthesis of the GDRS2 reprocessing

All the SWOT AMR and Nadir data were reprocessed in 2025 from GDR-F 1.04 standard to GDR-S 2.01 standard from Cycle 001 to Cycle 028. Since Cycle 029, the GDR production uses the GDR-S 2.01 standard. A dedicated release note about that change is available [here](#).

First, the section 8.1 focuses on MWR parameters modifications then the section 8.2 focuses on Nadir Altimeter parameters modifications.

8.1 Radiometer Parameters

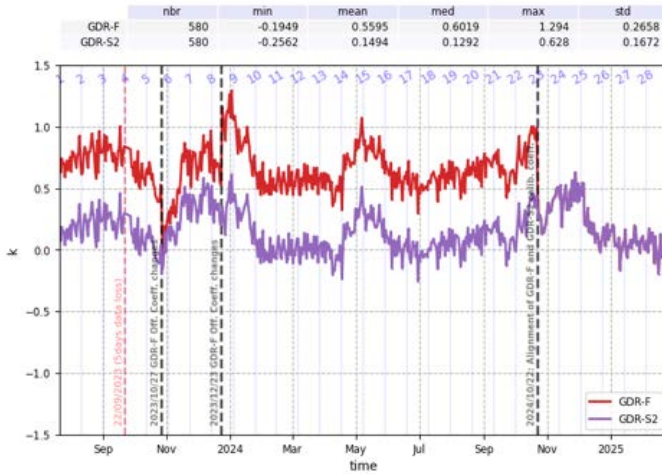
For AMR data, this reprocessing was accompanied by several modifications aimed at resolving certain issues that had been reported in the past.

8.1.1 Radiometer beams intercalibration

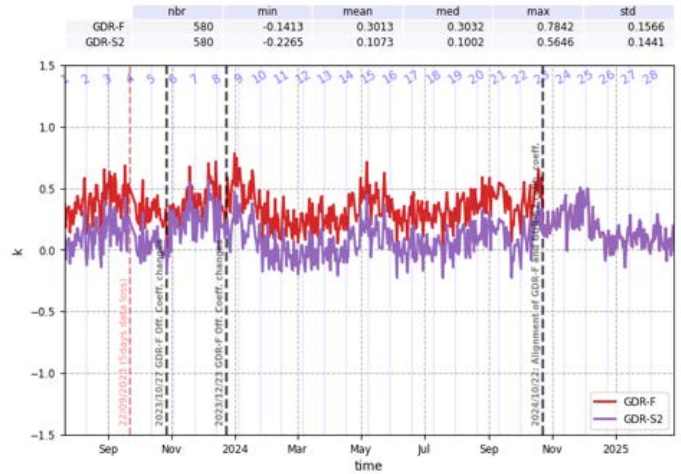
The coefficients calibration concerning the three brightness temperatures were re-adjusted, especially for the S2 beam (Side 2), in order to increase the stability of AMR data, and improve the intercalibration between the two beams.

Figure 54 shows the gradient between the two radiometer beams, for the three brightness temperatures, with GDR-F dataset and GDR-S2 dataset. It highlights the good intercalibration after the reprocessing, with a difference between the two beams close to 0 Kelvin. There are still some variations in the brightness temperatures gradient, but it never exceeds 0.5 Kelvin.

**BT 18.7 GHz (AMR S1 - AMR S2): Mean per day
SWOT: Cycle 1 to 28**



**BT 23.8 GHz (AMR S1 - AMR S2): Mean per day
SWOT: Cycle 1 to 28**



**BT 34 GHz (AMR S1 - AMR S2): Mean per day
SWOT: Cycle 1 to 28**

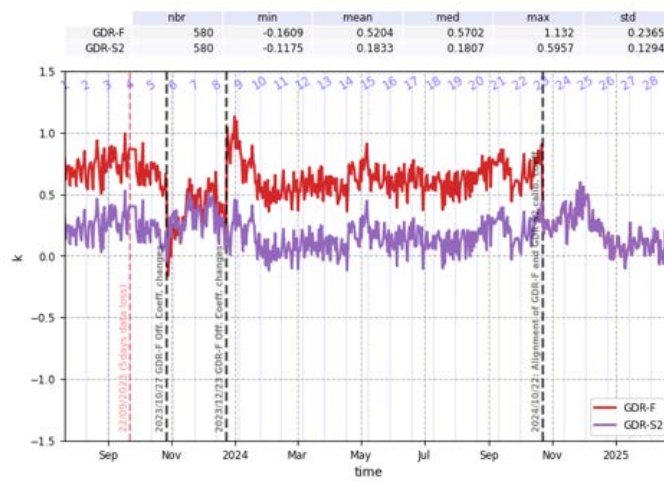


Figure 54: Gradients of brightness temperatures between the two beams, before (red) and after (purple) the reprocessing

Figure 55 shows the gradient of Wet Tropospheric Correction between the two beams. As consequences of the brightness temperatures gradients reduction, the gradient of Wet Tropospheric Correction is also reduced, with a daily mean gradient falling from 0.11 cm to 0.02 cm.

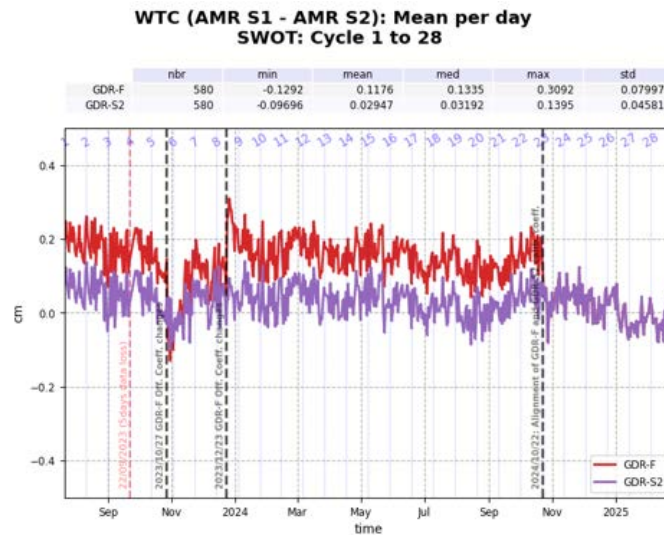


Figure 55: Gradient of Wet Tropospheric Correction between the two beams, before (red) and after (purple) the reprocessing

Figure 56 shows the daily mean of the difference between Wet Tropospheric Correction from Radiometer and Wet Tropospheric Correction from Model, for both beam and for nadir, before and after reprocessing. While reprocessing makes virtually no difference for AMR S1, the difference with the model decreases by 0.11 cm for AMR S2, and reaches values equivalent to AMR S1 (with a daily mean difference for AMR S1 and AMR S2 of respectively 0.26 cm and 0.28 cm). As a consequences, the difference with model is also slightly reduced for the WTC interpolated at the nadir, from 0.32 cm for GDR-F to 0.29 cm for GDR-S2.

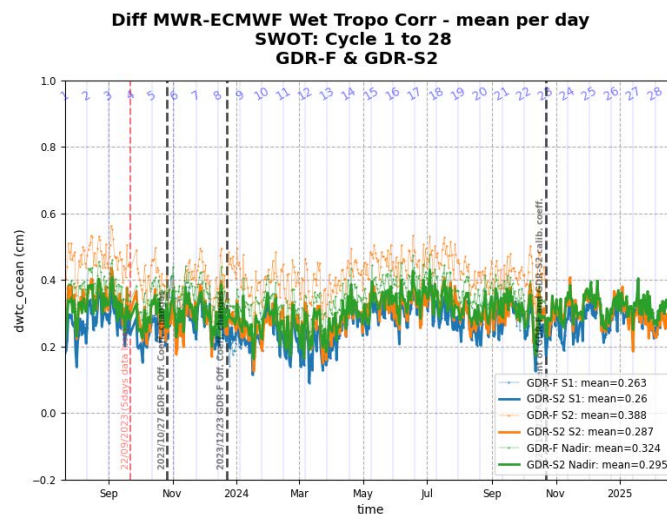


Figure 56: Daily mean of the difference between Wet Tropospheric Correction from Radiometer and Wet Tropospheric Correction from Model, for AMR S1 (blue), AMR S2 (orange) and SWOT Nadir (Green), for GDR-F (plain) and GDR-S2 (dotted)

8.1.2 Update of the interpolation quality flag

The Wet Tropospheric Correction interpolation quality flag has three different states:

- 0: The nadir interpolated WTC is considered as valid.
- 1: The nadir interpolated WTC is considered as degraded.
- 2: The nadir interpolated WTC is considered as degraded (in reality, there is no WTC interpolated on

this point).

The degraded state happens when the Wet Tropospheric Correction is extrapolated using only one AMR data, due to the absence of valid AMR data in the interpolation window. This flag was updated in the reprocessing to consider as degraded cases measurements where the correction is interpolated using only one AMR beam (due to presence of rain, ice or land on the other beam's measurements), creating a discontinuity in the Nadir Wet Tropospheric Correction and thus on the Sea Surface Height measured by SWOT Nadir.

Figure 57 shows an example on such case, over the north atlantic ocean, after reprocessing. The discontinuity visible on the nadir Wet Tropospheric Correction is now considered as degraded.

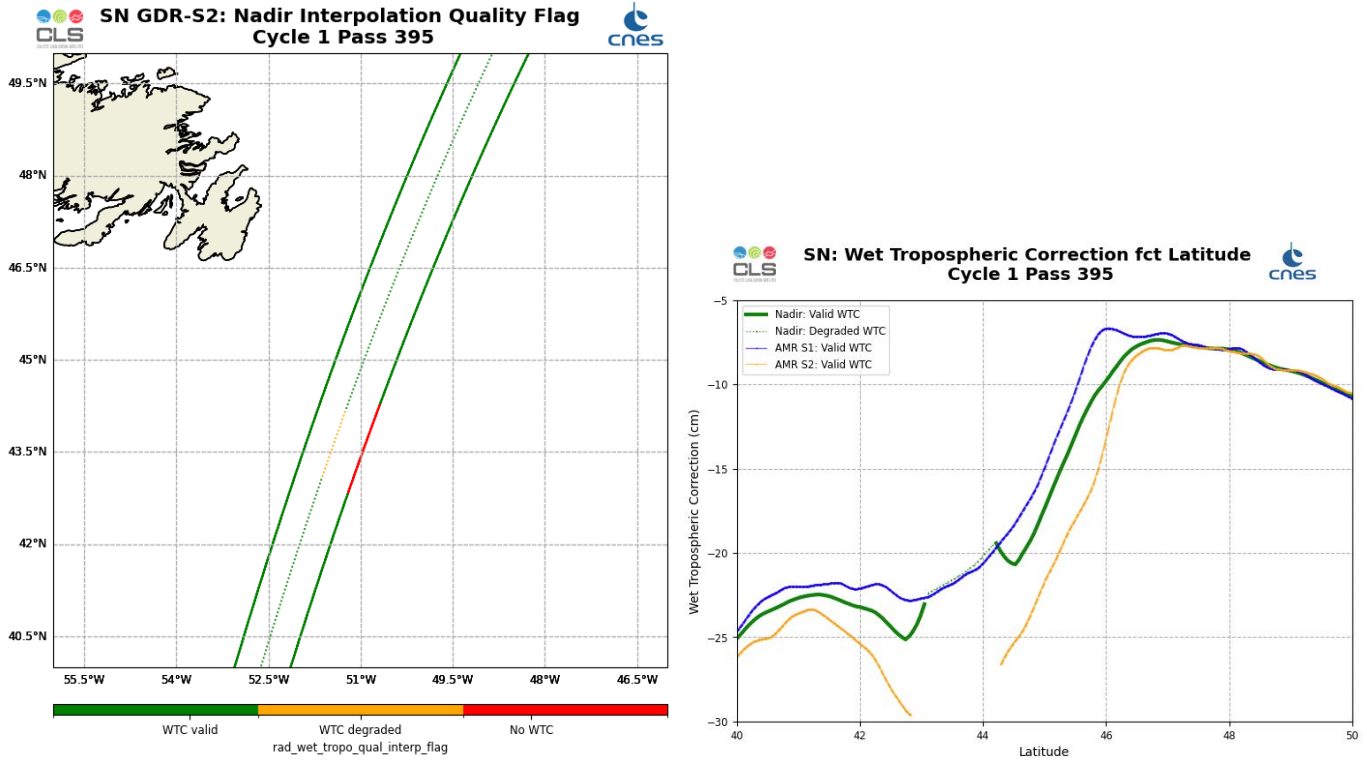


Figure 57: Example of degraded interpolation on Cycle 1 pass 395, after GDR-S2 reprocessing

These degraded cases account for approximately 1.64% of oceanic measurements, with an uneven distribution around the globe. These cases are concentrated in wet areas (intertropical convergence zones, eastern Pacific...) with some regions more than 6 to 8% of WTC degraded at nadir.

Figure 58 shows the geographical repartition of the rejected and degraded Wet Tropospheric Correction after the flag update.

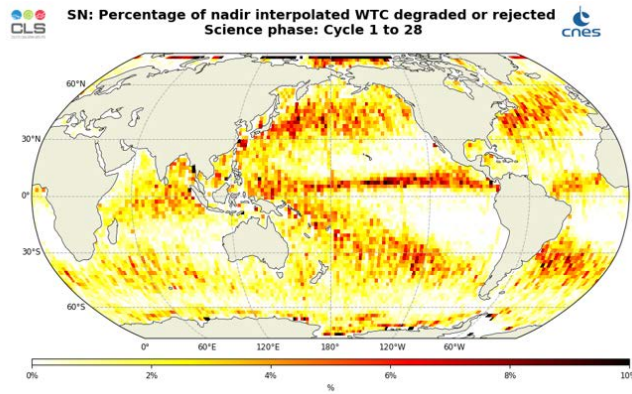


Figure 58: Proportion of degraded and rejected WTC at nadir by geographical area for GDR-S2 (Open ocean and No ice)

Table 11 shows the proportion of each state of the interpolation quality flag in the SWOT Nadir ocean measurements, after the reprocessing.

Flag Value	Percentage
0 (Valid Nadir WTC)	98.18
1 (Degraded Nadir WTC)	1.64
2 (Rejected Nadir WTC)	0.18

Table 11: Occurrences of the three interpolation quality flag state in open ocean and no ice zone for the GDR-S2 dataset

8.2 Nadir Altimeter Parameters

8.2.1 Major changes

8.2.1.1 Wind Speed

In GDR-S2, an adjustment on MLE4 Wind-Speed Sigma0 bias used in the ground segment processing has been made. This bias change from +0.06dB to +0.39dB in GDR-S2 and directly impact Wind-Speed values. This change implies a bias in Wind-Speed of around 0.8 m/s. As a consequence, Wind-Speed is now aligned with ERA5 model (see Figure 59).

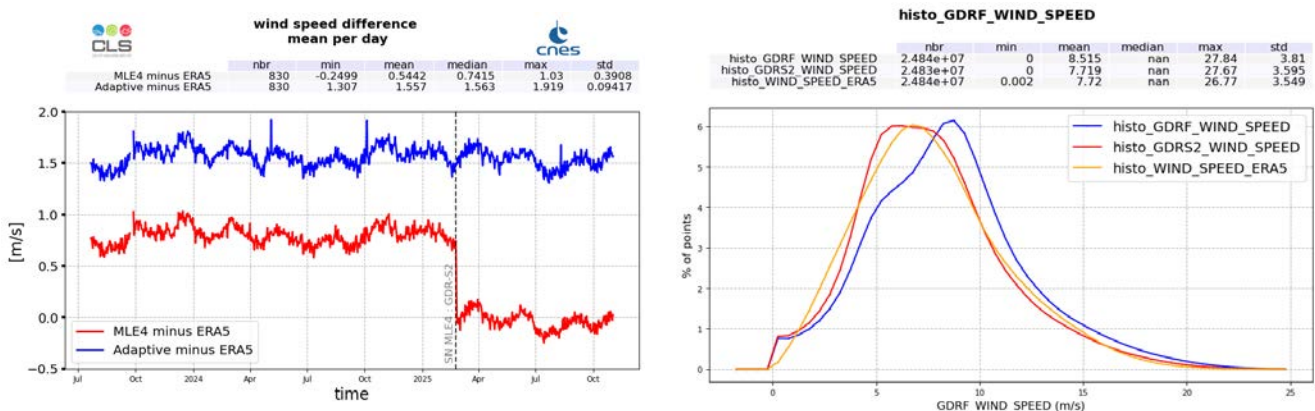


Figure 59: Wind speed change between GDR-F and GDR-S2 : LTM mean (left), Histogram (right)

8.2.1.2 Latitudinal Correction

An anomaly in Range Rate reconstruction reported by Emeline et al. [13] has been corrected in GDR-S2. In SWOT Nadir data, the impacted latitudinal bands were for ASC track: [-65.85°, -10.95°, +12.25°] and for DSC tracks: [-66.75°, -11.85°, +11.65°]. as shown in Figure 60 and in Figure 61.

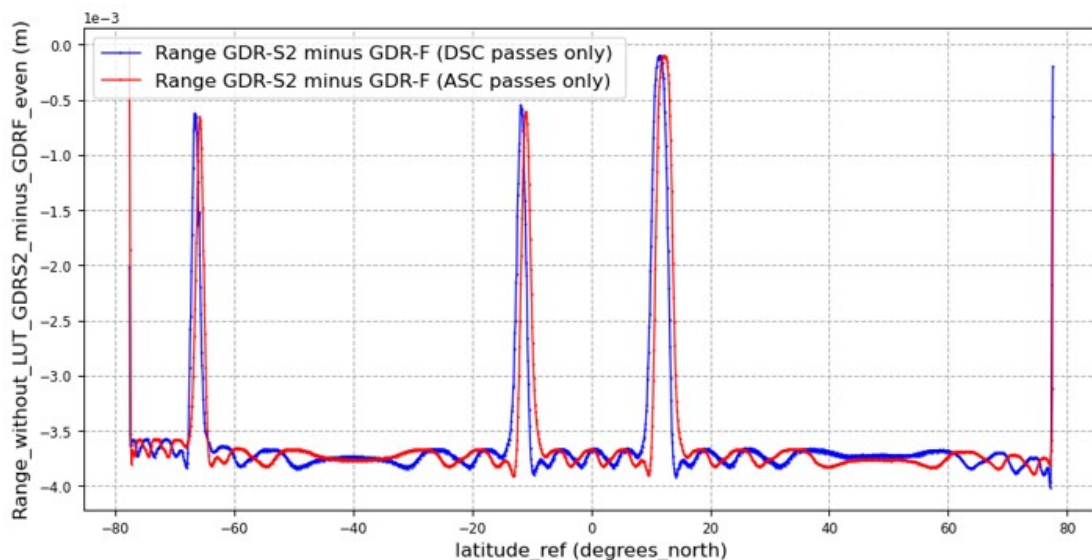


Figure 60: Distribution of differences (GDR-S2 minus GDR-F) of uncorrected Range from Look up Table with regard to latitudes

SN_GDR GDR-S2 - GDR-F : RANGE.ALT1

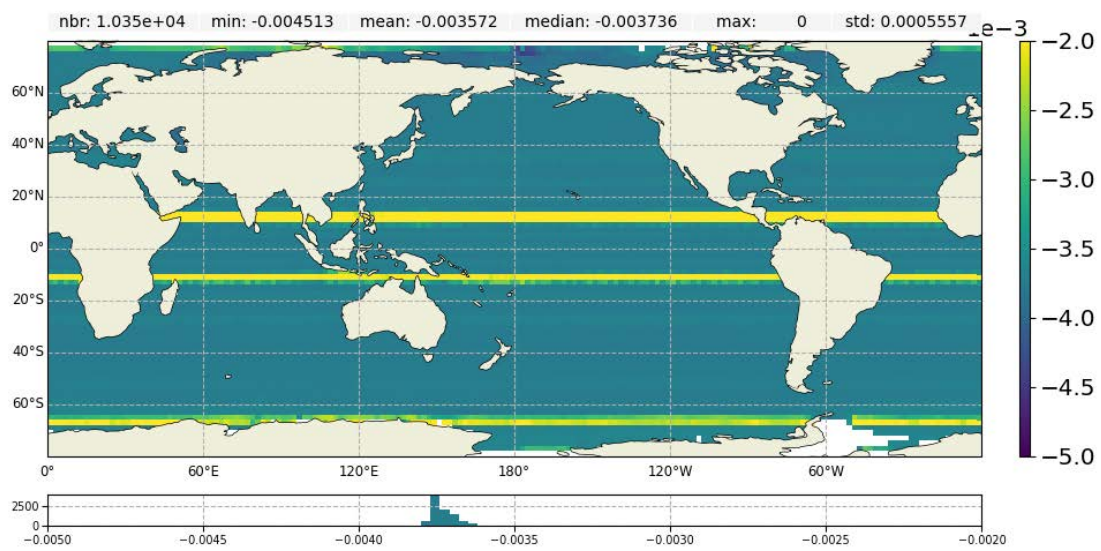


Figure 61: Map of differences (GDR-S2 minus GDR-F) of range

8.2.2 Impact on SSHA

Due to the change from GDR-F to GDR-S2, SSHA bias is around 3 mm (Science Phase). Table 62 summarizes all the source of this bias.

Field	Bias (GDR-S2 – GDR-F) : Calval Phase	Bias (GDR-S2 – GDR-F) : Science Phase
SSHA =	9,3 mm	3 mm
ORBIT.ALT I	0 mm	0 mm
RANGE.ALT I	-6,7 mm	-3.6 mm
SEA_STATE_BIAS.ALT I	+0,2 mm	+2 mm
IONOSPHERIC_CORRECTION.ALT I.FILTR	-1,3 mm	-0,2 mm
WET_TROPOSPHERIC_CORRECTION.RAD	-0,5 mm	-0.5 mm
DRY_TROPOSPHERIC_CORRECTION.MODEL	0 mm	0 mm
DYNAMICAL_ATMOSPHERIC_CORRECTION.MODEL	0 mm	0 mm
OCEAN_TIDE_HEIGHT.MODEL.FES	0 mm	+0.4 mm
OCEAN_TIDE_NEQ_LP.MODEL	-0,1 mm	0 mm
INTERNAL_TIDE.MODEL	0 mm	0 mm
POLE_TIDE_HEIGHT.MODEL	0 mm	0 mm
SOLID_EARTH_TIDE_HEIGHT.MODEL	0 mm	0 mm
MEAN_SEA_SURFACE.MODEL.CNESCLS	-0,8 mm	-1.2 mm
	= +9,2 mm	= +3,1 mm

Figure 62: Synthetic table of the SSHA bias between GDRF and GDRS2 with all different contributions

Figure 63 shows the comparison of SSHA between GDR-F and GDR-S2. Note that the bias is stable over the reprocessed period (left) and that strong changes in SSHA values occur for high latitudes (latitudes > 65°) due to the change in MSS model.

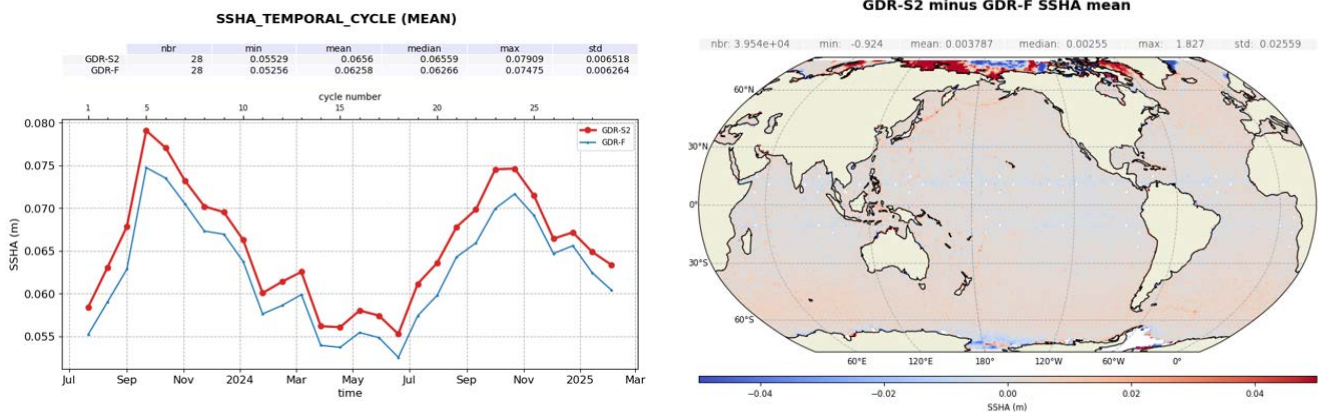


Figure 63: SSHA comparison between GDRF and GDRS2 standards : LTM Mean (left), Geobox of differences Mean (right)

The crossover analysis in Figure 64 shows the reduction in variance due to the switch from GDR-F to GDR-S2 standard. This reduction of variance is stable over the reprocessed period (left), and is global except a very few exceptions (right). It is mainly due to change in MSS and Ocean Tide Models.

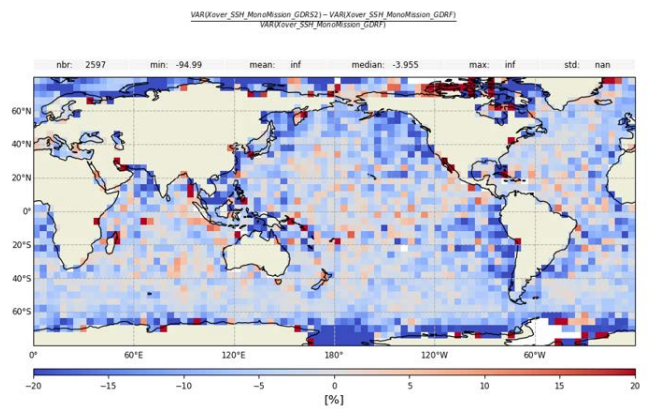
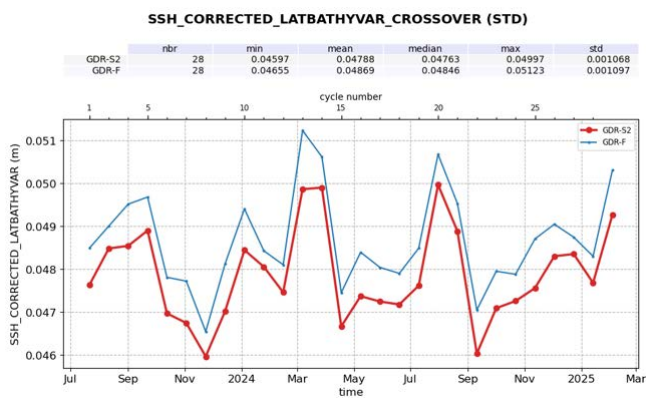


Figure 64: Mono-Mission crossover STD comparison between GDRF and GDRS2 standards : LTM Mean (left), Geobox of reduction in variance (right)

9 Conclusions

SWOT was launched on December 16th, 2022. Since July 07th, 2023, SWOT was on its operational 21-days orbit phase. In 2025 the SWOT L2 NALT data standard upgrade from GDR-F 1.04 to GDR-S 2.01. A dedicated section 8 illustrates the main impacts in this report.

The main points of the performance assessment are summarized below:

- Ocean data availability is excellent with a percentage of 99.039% available data over the last year and 98.11% since the beginning of the Science Phase.
- Data quality is also very good with 2.75% of rejected measurements over ocean (after removing sea ice data).
- The altimeter parameters analysis highlights a quite stable behavior over the period.
- At crossovers, SWOT Nadir shows good performances with a standard deviation of 5 cm and a good consistency with the Sentinel-6A-MF reference mission.

Known issues:

- The current interpolation of radiometer data on the nadir track currently requires the two AMR sides to be defined and valid. The L2_NALT flag (rad_wet_tropo_cor_interp_qual) informs users of this degraded radiometer interpolation. In a future release, we plan to revisit the radiometer interpolation algorithm to mitigate or remove interpolation artifacts altogether.
- Some ionospheric correction measurements are lost due to a bad behaviour of the filtering process in rare cases. An ongoing study aims to explain this unexpected phenomenon.
- A longitudinal centimetric pattern is visible in SSH difference at crossovers mono and multi-mission. This have been attributed to SWOT POE-F and shall be corrected in the coming SWOT POE-G orbit files.

10 References

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11 Annex

Cycle	Start	End	Details
C001	2023-07-21 05:35:38	2023-07-21 09:44:22	Impacting passes 1 to 5 with respectively 100.00%, 100.00%, 100.00%, 100.00% and 82.07% over ocean.
C001	2023-08-07 14:01:02	2023-08-07 21:40:46	Impacting passes 486 to 495 with respectively 52.13%, 100.00%, 67.45%, 100.00%, 100.00%, 100.00% and 89.93% over ocean due to connection loss with IVK.
C001	2023-08-08 14:01:46	2023-08-08 21:40:41	Impacting passes 514 to 523 with respectively 51.73%, 100.00%, 65.55%, 100.00%, 100.00%, 100.00%, 100.00%, 100.00% and 89.57% over ocean due to connection loss with IVK.
C001	2023-08-09 09:08:52	2023-08-09 22:05:39	Impacting passes 537 to 551 with respectively 90.77%, 53.95%, 71.32%, 100.00%, 44.52%, 77.09%, 100.00%, 100.00%, 100.00%, 58.28%, 100.00%, 100.00% and 100.00% over ocean due to connection loss with IVK.
C001	2023-08-10 23:56:41	2023-08-11 20:23:33	Impacting passes 554, 555 and 570 to 577 with respectively 77.94%, 62.77%, 63.48%, 100.00%, 66.86%, 100.00%, 100.00%, 100.00%, 100.00% and 100.00% over ocean due to connection loss with IVK.
C002	2023-08-25 20:53:44	2023-08-25 21:17:57	Impacting passes 414 to 415 with respectively 47.71% and 2.55% of missing data over ocean due to OCM SLOT.
C002	2023-08-27 11:06:14	2023-08-27 11:47:52	Pass 459 : 42.97% over ocean due to YAW FLIP.
C003	2023-09-07 23:10:34	2023-09-08 01:20:37	Due to KUX Pass loss (impacting pass 197 to 199 with respectively 31.04%, 100.00% and 49.87% over ocean).
C003	2023-09-12 09:04:29	2023-09-12 12:21:43	Due to Poseidon in stand-by mode (impacting pass 320 to 324 with respectively 64.63%, 100.00%, 100.00%, 100.00% and 41.48% over ocean).
C003	2023-09-18 18:36:43	2023-09-18 18:55:03	Pass 499 : 22.71% over ocean due to POS-3C calibration CNG step.
C004	2023-09-21 21:34:07	2023-09-27 14:42:40	Due to SSR stop because of power supply anomaly (impacting 59.46% of pass 003, 100% of passes 004 to 161 and 13.48% of pass 162, of missing data over ocean).
C004	2023-10-06 17:23:08	2023-10-06 17:46:03	Pass 418 : 42.02% over ocean due to OCM SLOT.
C005	2023-10-13 01:16:41	2023-10-13 03:42:55	Due to double edac on ssr (impacting passes 11 to 14 with respectively 81.59%, 100.00%, 100.00% and 22.35% of missing data over ocean).

Cycle	Start	End	Details
C005	2023-10-13 12:21:05	2023-10-13 12:21:33	Pass 24 : 1.12% over ocean (<1min).
C005	2023-10-15 10:10:50	2023-10-15 10:35:30	Due to file too small (impacting passes 77 to 78 with respectively 23.10% and 13.77% of missing data over ocean).
C005	2023-10-15 23:14:12	2023-10-15 23:14:55	Pass 092 : 2.64 % over ocean (<1min)
C005	2023-10-21 08:54:49	2023-10-21 08:55:10	Pass 243 : 1.18 % over ocean (<1min)
C005	2023-10-24 19:36:59	2023-10-24 19:39:43	Pass 340 : 10.06 % over ocean due to SWOT CREX L0A/DORIS/1178 DOPPLER.
C005	2023-10-28 19:41:39	2023-10-28 19:41:49	Pass 452 : 0.56 % over ocean (<1min)
C006	2023-11-12 17:19:02	2023-11-12 17:29:49	Impacting pass 285 with 22.23% due to Doris/-Doppler anomalies.
C006	2023-11-21 07:35:12	2023-11-21 08:35:36	Impacting passes 526 to 527 with respectively 83.78% and 57.50% due to KRX station anomalies.
C007	2023-11-28 10:53:50	2023-11-28 10:59:52	Impacting passes 141 to 142 with respectively 13.67% and 3.50% due to several missing segments.
C007	2023-11-30 22:59:36	2023-11-30 22:59:41	Impacting pass 212 with 0.20% due to missing points at high latitude.
C007	2023-12-02 00:49:49	2023-12-02 01:05:33	Pass 242: 41.24 % (several segments over ocean)
C007	2023-12-04 08:14:56	2023-12-04 08:15:09	Pass 306: 0.54 % (in Southern Pacific)
C007	2023-12-12 23:25:46	2023-12-12 23:26:07	Pass 548: 0.74 % (11 non continuous points in Carribean sea)
C008	2023-12-21 03:44:01	2023-12-21 04:17:02	Pass 193 : 21.54% over ocean (CNG calibration).
C008	2023-12-23 11:01:40	2023-12-23 11:05:39	Pass 257 : 8.81% over ocean.
C008	2024-01-01 11:05:09	2024-01-01 11:10:06	Pass 509 : 6.62% over ocean (Ground station anomaly).
C009	2024-01-07 21:48:23	2024-01-07 22:27:49	Pass 106 : 86.23% over ocean (altimeter TM loss).
C009	2024-01-07 22:27:50	2024-01-07 23:12:44	Pass 107 : 89.91% over ocean (altimeter TM loss).
C009	2024-01-08 18:43:47	2024-01-08 18:50:44	Pass 130 : 5.45% over ocean (multiple PLM gaps).
C009	2024-01-08 19:17:43	2024-01-08 19:17:50	Pass 131 : 0.62% over ocean (multiple PLM gaps).
C009	2024-01-09 15:12:17	2024-01-09 15:14:07	Pass 154 : 5.81% over ocean (multiple PLM gaps on IVK).
C009	2024-01-09 16:40:03	2024-01-09 16:43:29	Pass 156 : 7.85% over ocean (multiple PLM gaps on IVK).
C009	2024-01-09 18:16:40	2024-01-09 18:28:28	Pass 158 : 11.25% over ocean (multiple PLM gaps on IVK).
C009	2024-01-10 09:27:04	2024-01-10 09:33:52	Pass 175 : 6.56% over ocean (multiple PLM gaps, strong winds over Kiruna).

Cycle	Start	End	Details
C009	2024-01-10 15:15:39	2024-01-10 15:19:19	Pass 182 : 10.66% over ocean (multiple PLM gaps on IVK).
C009	2024-01-10 15:46:23	2024-01-10 16:50:00	Pass 184 : 8.15% over ocean (multiple PLM gaps on IVK).
C009	2024-01-10 19:27:23	2024-01-10 19:27:39	Pass 187 : 0.96% over ocean (multiple PLM gaps on IVK).
C009	2024-01-15 23:14:06	2024-01-15 23:23:25	Pass 331 : 7.16% over ocean (SSR error).
C009	2024-01-15 23:23:26	2024-01-16 04:32:05	Passes 332 to 337 : 100% over ocean (SSR error).
C009	2024-01-16 04:32:06	2024-01-16 05:06:01	Pass 338 : 7.80% over ocean (SSR error).
C009	2024-01-17 14:41:38	2024-01-17 14:42:06	Pass 377 : 1.10% over ocean (SSR error).
C009	2024-01-17 18:30:10	2024-01-17 18:38:45	Pass 382 : 27.36% over ocean (PLTM gaps between 2 successive dumps).
C009	2024-01-19 10:05:43	2024-01-19 10:06:19	Pass 428 : 2.15% over ocean (multiple PLM gaps).
C010	2024-01-25 22:11:59	2024-01-25 22:23:39	Pass 026 : 25.28% over ocean (PLTM gap).
C010	2024-01-25 22:55:03	2024-01-25 23:27:30	Pass 027 : 3.59% over ocean (PLTM gap).
C010	2024-02-06 18:22:55	2024-02-06 18:25:37	Pass 357 : 9.63% over ocean (PLTM gap).
C010	2024-02-07 12:43:49	2024-02-07 13:17:52	Pass 379 : 0.05% over ocean.
C011	2024-02-25 01:01:36	2024-02-25 03:17:13	Due to SSR anomaly (impacting passes 285 to 288 with respectively 43.19%, 100%, 100% and 15.13% of missing data over ocean).
C011	2024-03-02 14:38:27	2024-03-02 14:43:10	Pass 469 : 15.51% over ocean (SSR anomaly) over Indian ocean.
C011	2024-03-02 16:21:11	2024-03-02 16:21:39	Pass 471 : 2.77% over ocean (SSR anomaly) near eastern coast of South Africa.
C012	2024-03-07 05:02:45	2024-03-07 08:16:33	Due to SSR anomaly : impacting passes 014 to 017, with respectively 99.26%, 100.00%, 100.00% and 86.55% of missing data over ocean
C012	2024-03-10 21:48:46	2024-03-10 21:49:15	Pass 117: 1.82% of missing ocean data over ocean (<1min)
C012	2024-03-14 08:50:40	2024-03-14 08:51:35	Pass 214: 1.44% of missing ocean data over ocean (<1min)
C012	2024-03-15 22:10:57	2024-03-15 22:11:38	Impacting passes 257 to 258, with respectively 1.75% and 0.35% of missing ocean data over ocean
C012	2024-03-23 13:20:44	2024-03-23 13:37:56	Pass 471: 20.80 % of missing data over ocean
C012	2024-03-26 06:58:04	2024-03-26 07:14:00	Pass 548: 41.40% of missing data over ocean due to Antenna station issue (KUX)
C013	2024-03-27 23:45:38	2024-03-27 23:45:41	Pass 011 : 0.19 % over ocean (< 1min)
C013	2024-03-31 07:02:18	2024-03-31 08:24:52	Due to Alti PLTM not received (impacting passes 104 to 105 with respectively 78.66 % and 87.00 % of missing data over ocean)

Cycle	Start	End	Details
C013	2024-04-08 00:24:11	2024-04-08 01:49:14	Due to PLTM not received (impacting passes 320 to 322 with respectively 61.53 %, 100.00 % and 41.24 % of missing data over ocean)
C013	2024-04-16 18:43:14	2024-04-16 19:08:47	Impacting passes 565 to 566 with respectively 19.22 % and 15.69 % of missing data over ocean
C014	2024-04-18 01:16:23	2024-04-18 01:16:43	Pass 017 : 0.44% over ocean (<1min).
C014	2024-04-25 14:09:55	2024-04-25 14:31:33	Pass 228 : 5.72% over ocean.
C014	2024-04-28 05:02:05	2024-04-28 08:18:45	Due to cancelled downlink (impacting passes 301 to 305 with respectively 12.46%, 100.00%, 100.00%, 100.00% and 64.12% of missing data over ocean).
C014	2024-04-28 17:46:17	2024-04-28 17:46:17	Pass 316 : 1.68% over ocean (<1min).
C015	2024-05-10 07:06:29	2024-05-10 07:20:29	Impacting passes 055 to 056 with respectively 2.22% and 1.03% of missing data over ocean.
C015	2024-05-11 10:55:01	2024-05-11 11:56:34	Impacting passes 088 to 089 with respectively 91.20% and 23.53% of missing data over ocean due to station or network issue.
C015	2024-05-12 23:10:19	2024-05-12 23:21:56	Pass 130 : 22.29% over ocean due to SSR anomaly.
C015	2024-05-15 13:25:39	2024-05-15 13:26:20	Pass 203 : 1.84% over ocean.
C015	2024-05-17 10:55:31	2024-05-17 11:54:58	Impacting passes 256 to 257 with respectively 86.94% and 49.59% of missing data over ocean due to PLTM gap.
C015	2024-05-19 01:49:08	2024-05-19 02:24:29	Impacting passes 301 to 302 with respectively 12.39% and 18.81% of missing data over ocean due to SSR anomaly.
C015	2024-05-19 09:38:35	2024-05-19 09:46:23	Pass 310 : 15.74% over ocean.
C016	2024-05-30 11:10:29	2024-05-30 14:16:24	Impacting pass 036 to 039 with respectively 84.64%, 100.00%, 100.00% and 100.00% of missing data over ocean, due to SSR anomaly.
C016	2024-05-30 18:49:12	2024-05-30 19:24:10	Pass 045 : 13.10% over ocean.
C016	2024-05-31 07:30:39	2024-05-31 07:59:20	Pass 060 : 10.18% over ocean.
C016	2024-05-31 14:33:36	2024-05-31 14:56:36	Pass 068 : 2.08% over ocean due to SSR anomaly.
C016	2024-06-02 15:56:13	2024-06-02 16:38:26	Impacting pass 125 to 126 with respectively 7.54% and 70.46% of missing data over ocean, due to PLTM lost.
C016	2024-06-12 17:14:50	2024-06-12 18:08:53	Impacting pass 407 to 408 with respectively 15.73% and 38.43% of missing data over ocean due to SSR anomaly.
C016	2024-06-16 22:59:42	2024-06-16 22:59:52	Pass 526 : 0.41% over ocean.
C017	2024-06-19 14:44:00	2024-06-19 16:10:18	Pass 016 to 018 with respectively 67.61%, 99.32% and 1.58% over ocean, multiple gaps.
C017	2024-06-25 22:30:01	2024-06-25 23:03:02	Pass 193 : 23.10% over ocean due to POS-3C calibration CNG steps.

Cycle	Start	End	Details
C017	2024-06-27 02:37:39	2024-06-27 03:05:30	Pass 226 : 4.03% over ocean (<1min).
C017	2024-07-08 18:09:57	2024-07-08 18:13:52	Pass 552 : 0.81% over ocean.
C018	2024-07-10 11:36:36	2024-07-10 11:37:08	Pass 016 : 1.32% over ocean.
C018	2024-07-13 14:47:29	2024-07-13 16:10:16	Pass 104 to 105 with respectively 79.69% and 83.31% over ocean due to alti data not received.
C018	2024-07-22 04:06:30	2024-07-22 04:41:29	Pass 343 to 344 with respectively 13.85% and 15.17% over ocean due to IVK downlink not received.
C019	2024-08-04 06:57:10	2024-08-04 06:57:51	Pass 126 : 1.63% over ocean.
C019	2024-08-09 02:57:05	2024-08-09 02:57:08	Pass 262 : 0.28% over ocean.
C019	2024-08-14 13:07:04	2024-08-14 14:47:55	Pass 413 to 415 : 10.10%, 100.00% and 88.29% of missing data over ocean due to data distribution anomaly.
C019	2024-08-14 16:17:56	2024-08-14 18:15:57	Pass 417 to 419 : 20.15%, 100.00% and 86.21% of missing data over ocean due to data distribution anomaly.
C019	2024-08-16 11:42:49	2024-08-16 13:11:01	Pass 468 to 469 : 86.63% and 92.77% of missing data over ocean due to HBX Antenna issue.
C019	2024-08-17 11:13:41	2024-08-17 11:47:36	Pass 495 to 496 : 9.94% and 13.48% of missing data over ocean due to HBX Antenna issue.
C019	2024-08-18 11:15:34	2024-08-18 12:05:07	Pass 523 to 524 : 10.60% and 56.02% of missing data over ocean due to HBX Antenna issue.
C019	2024-08-18 21:22:42	2024-08-18 22:11:57	Pass 535 to 536 : 46.79% and 23.90% of missing data over ocean due to KRB downlink not received.
C020	2024-08-21 01:44:33	2024-08-21 02:07:09	Pass 012 : 63.80% over ocean due to IVK antenna tracking anomaly.
C020	2024-08-23 03:17:57	2024-08-23 04:38:10	Passes 070 to 071 : 73.61% and 91.43% of missing data over ocean due to IVK antenna tracking anomaly.
C020	2024-08-24 05:52:17	2024-08-24 06:25:23	Pass 101 : 1.48% over ocean due to SSR anomaly.
C020	2024-09-06 23:35:24	2024-09-06 01:11:19	Passes 457 to 459 : 4.83%, 100.00% and 91.43% of missing data over ocean due to IVK incomplete distribution - band X programming issue.
C020	2024-09-07 11:07:00	2024-09-07 11:40:02	Pass 499 : 15.02% over ocean due to SWOT/-POS Special calibrations (CAL1 CNG).
C021	2024-09-13 03:43:10	2024-09-13 05:00:01	Passes 074 to 076 : 43.42%, 100.00% and 17.08% of missing data over ocean due to data loss.
C021	2024-09-19 06:55:29	2024-09-19 08:32:25	Passes 246 to 248 : 87.93%, 100.00% and 12.64% of missing data over ocean due to alti data not received.

Cycle	Start	End	Details
C021	2024-09-20 04:43:53	2024-09-20 06:21:58	Passes 271 to 273 : 12.65%, 100.00% and 87.59% of missing data over ocean due to data loss.
C021	2024-09-20 15:19:22	2024-09-20 17:16:07	Passes 284 to 286 : 86.68 %, 100.00 and 12.72 % of missing data over ocean due to KRX data not received.
C021	2024-09-21 15:27:03	2024-09-21 17:49:07	Passes 312 to 314 : 66.74 %, 100.00 and 14.27 % of missing data over ocean due to KRX data not received.
C021	2024-09-21 18:30:24	2024-09-21 20:11:11	Passes 315 to 317 : 14.28 %, 100.00 and 92.00 % of missing data over ocean due to KRX data not received.
C021	2024-09-22 04:44:56	2024-09-22 05:06:57	Passes 327 to 328 : 13.58 % and 13.47 % of missing data over ocean due to IVK HDX issue.
C021	2024-09-22 06:35:25	2024-09-22 08:06:45	Passes 329 to 331 : 11.66 %, 100.00 and 92.78 % of missing data over ocean.
C021	2024-09-22 23:52:56	2024-09-22 2024-09-	Passes 350 to 352 : 96.32 %, 100.00 and 6.34 % of missing data over ocean due to antenna issue.
C021	2024-09-23 04:36:17	2024-09-23 05:10:59	Passes 355 to 356 : 15.08 % and 14.06 % of missing data over ocean due to COR Anomaly.
C021	2024-09-23 06:30:58	2024-09-23 08:11:23	Passes 357 to 359 : 11.39 %, 100.00 and 91.60 % of missing data over ocean due to data loss.
C021	2024-09-24 16:41:43	2024-09-24 17:17:59	Passes 397 to 398 : 15.45 % and 18.24 % of missing data over ocean to data loss (some APID)
C021	2024-09-25 05:12:31	2024-09-25 06:29:17	Passes 412 to 413 : 85.94 % and 89.79 % of missing data over ocean to data loss (some APID).
C021	2024-09-25 13:47:54	2024-09-25 14:52:56	Passes 422 to 423 : 91.13 % and 28.93 % of missing data over ocean.
C021	2024-09-30 12:06:12	2024-09-30 13:07:46	Passes 560 to 561 : 93.49 % and 32.03 % of missing data over ocean to data loss.
C022	2024-10-02 18:55:18	2024-10-02 20:23:53	Passes 040 to 041 : 80.05% and 93.86% over ocean.
C022	2024-10-03 03:00:58	2024-10-03 03:34:57	Passes 049 to 050 : 13.60% and 14.22% over ocean due to data loss.
C022	2024-10-06 15:42:07	2024-10-06 17:26:32	Passes 148 to 150 : 81.46%, 100% and 13.60% over ocean due to data loss.
C022	2024-10-07 16:59:30	2024-10-07 18:43:22	Passes 177 to 179 : 5.73%, 100.00% and 94.68% over ocean due to downlink passes conflict.
C022	2024-10-08 00:04:33	2024-10-08 00:27:21	Pass 186 : 41.98% over ocean due to data loss.
C022	2024-10-11 13:16:24	2024-10-11 14:37:27	Passes 285 to 287 : 43.28%, 100% and 8.70% over ocean due to OCM SLOT maneuver.
C022	2024-10-14 11:46:19	2024-10-14 11:46:38	Pass 367 : 1.13% over ocean (less than one minute).

Cycle	Start	End	Details
C022	2024-10-15 17:28:33	2024-10-15 19:17:19	Passes 402 to 404 : 66.21%, 100% and 25.86% over ocean due to data loss.
C022	2024-10-20 13:12:17	2024-10-20 13:24:28	Pass 537 : 31.03% over ocean due to data loss.
C023	2024-10-24 09:43:37	2024-10-24 10:33:26	Passes 061 and 062 : 78.62% and 13.76% over ocean due to corrupted data.
C023	2024-10-25 22:33:02	2024-10-25 22:33:02	Passes 104 and 105 : 79.11% and 79.06% over ocean due to downlink not received.
C023	2024-10-30 08:10:15	2024-10-30 08:35:41	Pass 227 : 17.66% over ocean due to downlink cancelled.
C023	2024-10-30 19:05:16	2024-10-30 22:21:24	Passes 240 to 243 : 94.17%, 100%, 58.70% and 87.61% over ocean due to antenna issue resulting to downlink cancelled.
C023	2024-11-01 10:44:01	2024-11-01 12:14:36	Passes 286 to 288 : 87.04 %, 100.00 % and 11.48 % over ocean to an antenna issue resulting in data loss.
C023	2024-11-01 17:37:24	2024-11-01 17:39:02	Pass 294 : 0.74% over ocean due to data gaps.
C023	2024-11-01 19:02:26	2024-11-01 19:06:57	Pass 296 : 2.55% over ocean due to data gaps.
C023	2024-11-01 20:48:12	2024-11-01 20:51:48	Pass 298 : 2.34% over ocean due to data gaps.
C024	2024-11-21 18:59:07	2024-11-21 19:27:53	Passes 271 to 272 : 12.65% and 13.03% due to IVK Scheduling anomaly COR.
C025	2024-12-04 10:57:41	2024-12-04 12:30:03	Passes 042 to 044 : 4.82%, 9.26% and 2.73% due to IVK gap before and after downlink.
C025	2024-12-10 20:30:01	2024-12-10 21:03:02	Pass 221 : 19.01% due to SWOT/POS3C Special calibrations (CAL CNG) (22.795N, 35.821E).
C025	2024-12-11 01:26:11	2024-12-11 01:47:28	Pass 227 : 0.19% due to data gap (-72.735N, -84.509E).
C025	2024-12-13 09:24:39	2024-12-13 11:06:47	Passes 292 to 294 : 57.77%, 100.00% and 34.00% due to data (APID) not received at the ASX station.
C025	2024-12-21 23:57:38	2024-12-21 00:02:25	Pass 505 : 10.09% due to data gap (-44.745N, -53.409E).
C026	2025-01-01 22:59:47	2025-01-01 22:59:52	Pass 256 : 0.34% due to data gap ((77.68N, 35.92E) to (77.671N, 36.963E)).
C026	2025-01-07 22:40:00	2025-01-08 00:02:50	Passes 423 to 425 : 38.52%, 68.24% and 19.86% due to multiple PLTM gaps at KRX station.
C026	2025-01-09 19:51:29	2025-01-09 20:18:44	Pass 476 : 14.30% due to multiple PLTM gaps at KRX station.
C027	2025-01-14 10:52:35	2025-01-14 11:18:01	Passes 021 : 1.95% and 12.67% due to data gap
C027	2025-01-17 23:27:35	2025-01-17 23:52:55	Pass 120 : 0.61% due to
C027	2025-01-24 11:05:06	2025-01-24 12:42:04	Passes 301 to 303 : 12.38%, 100% and 93.27% due to PLTM gap at IVK station
C027	2025-01-25 07:02:09	2025-01-25 07:13:10	Pass 325 : 26.16% due to multiple PLTM gaps at IVK station

Cycle	Start	End	Details
C027	2025-01-30 09:43:12	2025-01-30 10:59:37	Passes 468 : 86.55% and 92.71% due to PLTM gaps at IVK station
C027	2025-01-30 21:14:27	2025-01-30 21:24:05	Pass 481 : 6.63% due to PLTM gaps at IVK station
C027	2025-01-31 11:11:44	2025-01-31 11:20:45	Passes 497 : 6.45% and 10.68% due to PLTM gaps at KRX station
C027	2025-02-02 04:00:02	2025-02-02 04:00:17	Pass 545 : 0.55% due to data gap
C027	2025-02-03 04:29:24	2025-02-03 04:41:02	Pass 574 : 25.19% due to a SSR reconfiguration resulting in an absence of data
C028	2025-02-05 21:52:12	2025-02-05 23:11:29	Passes 066 to 067 : 84.13% and 95.56% due to PLTM gaps.
C028	2025-02-06 19:37:21	2025-02-06 21:31:02	Passes 091 to 093 : 12.86%, 14.87% and 2.61% due to multiple PLTM gaps.
C028	2025-02-09 19:40:45	2025-02-09 19:48:28	Pass 175 : 4.94% due to multiple PLTM gaps.
C028	2025-02-13 21:56:33	2025-02-13 22:25:56	Pass 290 : 70.12% due to multiple PLTM gaps.
C028	2025-02-18 09:20:45	2025-02-18 11:05:26	Passes 415 to 417 : 11.56%, 100.00% and 74.10% due to
C028	2025-02-21 20:00:23	2025-02-21 20:08:55	Pass 512 : 15.92% due to data gaps.
C028	2025-02-22 06:29:53	2025-02-22 08:07:08	Passes 524 to 526 : 87.23%, 100.00% and 11.29% due to a power outage at HBX station.
C028	2025-02-22 18:26:54	2025-02-22 19:49:44	Passes 538 to 539 : 82.14% and 94.10% due to
C029	2025-03-02 06:29:44	2025-03-02 07:52:55	Passes 164 : 15.10% and 50.76% due to a burst in the beginning of an avoidance maneuver.
C029	2025-03-02 10:47:03	2025-03-02 11:30:03	Pass 169 : 39.23% due to a burst in the end of an avoidance maneuver.
C029	2025-03-07 20:12:22	2025-03-07 20:54:00	Pass 320 : 62.83% due to an OCM SLOT maneuver.
C029	2025-03-09 12:28:22	2025-03-09 13:16:17	Pass 367 : 20.39% due to a burst in the beginning of an avoidance maneuver.
C029	2025-03-09 15:52:07	2025-03-09 16:23:21	Pass 371 : 63.55% due to a burst in the end of an avoidance maneuver.
C030	2025-03-18 11:50:27	2025-03-18 15:13:38	Passes 034 to 038 : 6.60%, 8.01%, 84.62%, 100.00% and 14.92% due to multiple PLTM gaps at Kiruna [KRX] station.
C030	2025-03-21 18:38:14	2025-03-21 19:16:31	Pass 126 : 82.02% due to gaps in the received pass at Inuvik [IVB] station.
C030	2025-03-22 06:40:16	2025-03-22 06:50:00	Pass 140 : 21.96% due to multiple PLTM gaps at Kiruna [KRX] station.
C030	2025-03-24 04:15:01	2025-03-24 04:48:02	Pass 193 : 19.31% due to the CNG calibration.
C030	2025-03-25 06:42:55	2025-03-25 07:33:23	Passes 224 : 1.63% and 1.36% due to multiple PLTM gaps at Kiruna [KRX] station.
C030	2025-03-29 08:04:56	2025-03-29 08:05:22	Pass 337 : 0.98% due to a SSR anomaly.

Cycle	Start	End	Details
C030	2025-04-03 06:43:38	2025-04-03 08:07:07	Passes 476 : 12.11% and 8.26% due to multiple PLTM gaps at Kiruna [KRX] station.
C030	2025-04-03 11:02:50	2025-04-03 11:25:55	Pass 481 : 0.40% due to multiple PLTM gaps at Kiruna [KRX] station.
C030	2025-04-04 11:34:08	2025-04-04 13:41:04	Passes 509 to 512 : 12.67%, 100.00%, 100.00% and 16.86% due to a SSR anomaly.
C031	2025-04-16 20:14:39	2025-04-16 21:53:41	Passes 271 to 273 : 12.64%, 100% and 87.53% due to data lost.
C031	2025-04-23 03:09:02	2025-04-23 03:11:40	Pass 447 : 3.50% due to downlink not received.
C031	2025-04-26 15:29:43	2025-04-26 19:17:54	Passes 546 to 550 : 91.90%, 100%, 100%, 100%, 100% and 37.41% due to downlink not received.
C031	2025-04-27 15:30:36	2025-04-27 18:39:15	Passes 574 to 577 : 93.94%, 100%, 100% and 86.37% due to downlink not received.
C032	2025-04-28 04:35:45	2025-04-28 05:34:25	Passes 005 : 69.08% and 32.36% due to downlink not received.
C032	2025-05-10 17:31:06	2025-05-10 20:42:15	Passes 356 to 360 : 85.90%, 100.00%, 100.00%, 100.00% and 3.21% due to data lost.
C033	2025-05-26 19:00:47	2025-05-26 19:17:28	Passes 221 : 21.91% and 3.90% due to SSR anomaly.
C033	2025-05-26 21:59:36	2025-05-26 23:43:27	Passes 225 to 227 : 65.53%, 100.00% and 34.24% due to SSR anomaly.
C033	2025-05-30 14:53:08	2025-05-30 15:48:39	Passes 329 : 100.00% and 9.90% due to
C033	2025-06-01 12:31:34	2025-06-01 12:43:22	Pass 382 : 27.41% due to
C033	2025-06-03 05:44:57	2025-06-03 08:48:31	Passes 430 to 433 : 57.02%, 100.00%, 100.00% and 90.88% due to
C033	2025-06-06 15:34:32	2025-06-06 17:28:49	Passes 525 to 527 : 5.98%, 100.00% and 99.40% due to data lost.
C034	2025-06-15 15:16:01	2025-06-15 15:49:02	Pass 193 : 21.16% due to CNG Calibration.
C034	2025-06-19 08:21:10	2025-06-19 08:28:08	Pass 297 : 1.70% due to data gap.
C034	2025-06-27 15:57:06	2025-06-27 15:57:11	Pass 530 : 0.21% due to data gap.
C034	2025-06-28 05:33:00	2025-06-28 09:10:51	Passes 545 to 550 : 14.30%, 100.00%, 100.00%, 60.34%, 100.00% and 13.24% due to downlink not received.
C035	2025-07-04 09:28:43	2025-07-04 12:05:07	Passes 134 to 137 : 86.02%, 100.00%, 100.00% and 82.10% due to passes lost at HBX station.
C035	2025-07-12 00:58:23	2025-07-12 01:18:16	Pass 348 : 50.33% due to antenna issue at HBX station.
C035	2025-07-15 05:58:34	2025-07-15 07:23:31	Passes 438 : 84.82% and 89.60% due to passes lost at IVK station.
C035	2025-07-17 16:01:07	2025-07-17 16:40:30	Passes 505 : 14.63% due to passes lost at IVK station.
C036	2025-07-27 02:40:14	2025-07-27 03:58:12	Passes 186 : 84.44% and 87.04% due to only a few seconds received at IVB station.

Cycle	Start	End	Details
C036	2025-07-27 14:34:05	2025-07-27 15:46:51	Passes 200 : 89.03% and 52.35% due to downlink not received at KRB.
C036	2025-08-01 14:44:25	2025-08-01 19:40:48	Passes 340 to 345 : 85.80% and 100.00% and 100.00% and 100.00% and 100.00% due to a SSR anomaly.
C036	2025-08-03 13:52:00	2025-08-03 13:56:50	Pass 395 : 0.40% due to downlink lost.
C036	2025-08-05 05:05:57	2025-08-05 07:35:37	Passes 440 to 443 : 4.11%, 100.00%, 100.00% and 77.92% due to downlink lost at HBX station.
C037	2025-08-15 07:27:05	2025-08-15 09:41:37	Passes 139 to 142 : 9.34%, 100.00%, 100.00% and 7.87% due to downlink lost.
C037	2025-08-15 12:41:49	2025-08-15 12:49:59	Pass 145 : 25.21% due to bad frames received (weak x-band signal).
C037	2025-08-17 11:19:10	2025-08-17 11:55:07	Pass 200 : 36.38% due to SSR onboard anomaly.
C037	2025-08-23 21:38:18	2025-08-23 21:38:34	Pass 380 : 0.21% due to data gap.
C037	2025-08-31 04:41:24	2025-08-31 04:42:01	Pass 584 : 1.42% due to data gap.
C038	2025-08-31 11:10:13	2025-08-31 12:44:11	Passes 007 to 009 : 13.73%, 100.00% and 86.47% due to pass lost
C038	2025-09-09 23:38:05	2025-09-09 02:40:13	Passes 246 to 249 : 87.94%, 100.00%, 100.00% and 76.21% due to antenna anomaly
C038	2025-09-09 06:52:13	2025-09-09 07:02:58	Pass 254 : 10.21% due to PLTM gaps
C038	2025-09-11 16:39:30	2025-09-11 18:48:19	Passes 322 to 324 : 94.46%, 100.00% and 56.97% due to station anomaly
C038	2025-09-12 04:23:45	2025-09-12 06:53:17	Passes 335 to 338 : 15.71%, 100.00%, 100.00% and 7.80% due to station anomaly
C038	2025-09-17 00:39:00	2025-09-17 01:12:02	Pass 471 : 20.55% due to CNG calibration
C039	2025-09-23 06:24:31	2025-09-23 06:25:06	Passes 061 : 1.08% and 0.38% due to data gap.
C039	2025-10-01 11:48:00	2025-10-01 11:53:37	Pass 292 : 12.53% due to context integrity anomaly.
C039	2025-10-01 13:23:48	2025-10-01 13:38:45	Pass 294 : 30.59% due to HDR recording issue.
C040	2025-10-15 18:44:36	2025-10-16 06:12:02	Passes 108 to 121 : 90.53%, 100.00%, 5.41%, 95.51%, 100.00%, 8.42%, 73.75%, 100.00% and 75.65% due to downlink degraded.
C040	2025-10-23 00:02:07	2025-10-23 00:54:50	Passes 310 : 92.24% and 30.69% due to pass lost.
C040	2025-10-26 22:03:53	2025-10-26 22:08:12	Pass 419 : 11.99% due to pass lost.
C040	2025-10-27 07:18:42	2025-10-27 07:39:38	Passes 430 : 3.13% and 0.30% due to multiple data gaps.
C040	2025-11-01 01:14:11	2025-11-01 01:15:06	Pass 563 : 2.75% due to pass lost.

Table 12: List of all missing GDR SWOT Nadir data over ocean from C001 to C040