EUMETSAT OSI SAF
OCEAN AND SEA ICE

Half-Yearly Operations Report

2nd half 2021

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0.1	January 2022	CH	Template
1.0	25/03/2022	CH	First version (LR sea ice drift results missing)

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1. Introduction

1.1. Scope of the document

The present report covers from 1st of July to 31 December 2021.

The objective of this document is to provide EUMETSAT and users, in complement with the web site http://osi-saf.eumetsat.int, an overview on OSI SAF products availability and quality, main anomalies and events, product usage, users' feedback, and updated available documentation.

- Low and Mid latitude (LML) Centre (Sub-System 1, SS1), under Météo-France responsibility, processes and distributes the SST and Radiative Fluxes products covering LML, North Atlantic Regional (NAR) and Global areas. Ifremer contributes to the products distribution and archiving,
- High Latitude (HL) Centre (Sub-System 2, SS2), under MET Norway responsibility with the co-operation of DMI, processes and distributes the Global Sea Ice products, the High Latitude SST and the High Latitude Radiative Fluxes,
- Wind Centre (Sub-System 3, SS3), under KNMI responsibility, processes and distributes the Wind products.

1.2. Products characteristics

The characteristics of the current products are specified in the Service Specification (SeSp) Document [AD.1] available on http://osi-saf.eumetsat.int, the OSI SAF web site.

Three values are usually available for accuracy requirements, for each product:

- The threshold accuracy is the minimum acceptable
- The target (or breakthrough) accuracy is the desired performance level
- The optimal accuracy

In this report, the product performance is compared to the target accuracy. If the values do not meet the target accuracy but are compliant to the threshold accuracy, it is considered useful to distribute the product anyway.

According to OSI-SS-GEN-101 in SeSp [AD.1], operational OSI SAF products accuracy should be better than the value specified as threshold accuracy in the products tables when input satellite data are available with the nominal level of quality (on monthly basis).

1.3. Applicable documents

[AD.1] OSI SAF
Service Specification (SeSp)
SAF/OSI/CDOP3/MF/MGT/PL/003, version 1.12, 31 December 2021

1.4. Reference documents

[RD.1] ASCAT Wind Product User Manual
OSI-102 (discontinued), OSI-102-b, OSI-102-c, OSI-103 (discontinued), OSI-104 (discontinued), 0SI-104-b, 0SI-104-c
SAF/OSI/CDOP/KNMI/TEC/MA/126

[RD.2] RapidScat Wind Product User Manual
OSI-109 (discontinued)
SAF/OSI/CDOP2/KNMI/TEC/MA/227

[RD.3] ScatSat-1 wind Product User Manual
OSI-112-a (discontinued), OSI-112-b (discontinued)
SAF/OSI/CDOP2/KNMI/TEC/MA/287

[RD.4] EUMETSAT OSI SAF
Product User Manual (PUM) for the HY-2 winds
OSI-114-a, OSI-114-b, OSI-115-a, OSI-115-b
SAF/OSI/CDOP3/KNMI/TEC/MA/392

[RD.5] ASCAT L2 winds Data Record Product User Manual
OSI-150-a, OSI-150-b
SAF/OSI/CDOP2/KNMI/TEC/MA/238

[RD.6] Reprocessed SeaWinds L2 winds Product User Manual
OSI-151-a, OSI-151-b
SAF/OSI/CDOP2/KNMI/TEC/MA/220

[RD.7] ERS L2 winds Data Record Product User Manual
OSI-152
SAF/OSI/CDOP2/KNMI/TEC/MA/279

[RD.8] Oceansat-2 L2 winds Data Record Product User Manual
OSI-153-a, OSI-153-b
SAF/OSI/CDOP3/KNMI/TEC/MA/297

[RD.9] Low Earth Orbiter Sea Surface Temperature Product User Manual
OSI-201-b, OSI-202-b, OSI-204-b, OSI-204-c, OSI-208-b
SAF/OSI/CDOP3/MF/TEC/MA/127

[RD.10]Northern High Latitude L3 Sea and Sea Ice Surface Temperature Product User Manual
OSI-203-a, OSI-203-b
SAF/OSI/CDOP3/met.no/TEC/MA/115

[RD.11]High Latitudes L2 Sea and Sea Ice Surface Temperature Product User Manual
OSI-205-a, OSI-205-b
SAF/OSI/CDOP3/DMI/TEC/MA/246

[RD.12]Geostationary Sea Surface Temperature Product User Manual
OSI-206-a, OSI-207-b, OSI-IO-SST
SAF/OSI/CDOP3/MF/TEC/MA/181

[RD.13]Product User Manual for Atlantic High Latitudes level 3 Radiative Flux products
OSI-301-b, OSI-302-b
SAF/OSI/CDOP3/MET-Norway/TEC/MA/373

[RD.14]MSG/SEVIRI Sea Surface Temperature data record Product User Manual
OSI-250
SAF/OSI/CDOP3/MF/TEC/MA/309

[RD.15]Geostationary Radiative Flux Product User Manual
OSI-303-a, OSI-304-a, OSI-305-b, OSI-306-b, OSI-IO-DLI, OSI-IO-SSI
SAF/OSI/CDOP3/MF/TEC/MA/182

[RD.16]Product User Manual for OSI SAF Global Sea Ice Concentration
OSI-401-b
SAF/OSI/CDOP3/DMI_MET/TEC/MA/204

[RD.17]Global Sea Ice Edge and Type Product User's Manual
OSI-402-d, OSI-403-d
SAF/OSI/CDOP2/MET-Norway/TEC/MA/205

[RD.18]50 Ghz Sea Ice Emissivity Product User Manual
OSI-404-a
SAF/OSI/CDOP3/DMI/TEC/MA/191

[RD.19]Low Resolution Sea Ice Drift Product User’s Manual
OSI-405-c
SAF/OSI/CDOP/met.no/TEC/MA/128

[RD.20]Medium Resolution Sea Ice Drift Product User Manual
OSI-407-a
SAF/OSI/CDOP/DMI/TEC/MA/137

[RD.21]Product User Manual for the OSI SAF AMSR-2 Global Sea Ice Concentration
OSI-408
SAF/OSI/CDOP2/DMI/TEC/265

[RD.22]EUMETSAT OSI SAF
Product User Manual for the Global Sea Ice Concentration Level 2
OSI-410
SAF/OSI/CDOP3/DMI/TEC/377

[RD.23]Global Sea Ice Concentration Reprocessing Product User Manual
OSI-409, OSI-409-a, OSI-430
SAF/OSI/CDOP3/MET-Norway/TEC/MA/138

[RD.24]Global Sea Ice Concentration Climate Data Record Product User Manual
OSI-450, OSI-430-b
SAF/OSI/CDOP2/MET/TEC/MA/288

1.5. Definitions, acronyms and abbreviations

AHL	Atlantic High Latitude
ASCAT	Advanced SCATterometer
AVHRR	Advanced Very High Resolution Radiometer
BUFR	Binary Universal Format Representation
CDOP	Continuous Development and Operations Phase
CMEMS	Copernicus Marine Environment Monitoring Service
CMS	Centre de Météorologie Spatiale (Météo-France)
DLI	Downward Long wave Irradiance
DMI	Danish Meteorological Institute
DMSP	Defense Meteorological Satellite Program
ECMWF	European Centre for Medium range Weather Forecasts
EDC	EUMETSAT Data Centre
EPS	European Polar System
FTP	File Transfer Protocol
GBL	Global oceans
GOES	Geostationary Operational Environmental Satellite
GOES-E	GOES-East, nominal GOES at 75°W
GRIB	GRIdded Binary format
GTS	Global Transmission System
HIRLAM	High Resolution Limited Area Model
HL	High Latitude
HRIT	High Rate Information Transmission
Ifremer	Institut Français de Recherche pour l'Exploitation de la MER
KNMI	Koninklijk Nederlands Meteorologisch Instituut
LEO	Low Earth Orbiter
LML	Low and Mid Latitude
MAP	Merged Atlantic Product
MET	Nominal Meteosat at 0° longitude
MET Norway or MET	Norwegian Meteorological Institute
Metop	METeorological OPerational Satellite
MF	Météo-France
MGR	Meta-GRanule
MSG	Meteosat Second Generation
NAR	Northern Atlantic and Regional
NESDIS	National Environmental Satellite, Data and Information Service
NetCDF	Network Common Data Form
NMS	National Meteorological Service
NOAA	National Oceanic and Atmospheric Administration
NPP	NPOESS Preparatory Project
NPOESS	National Polar-orbiting Operational Environmental Satellite System

NRT	Near Real-Time
NWP	Numerical Weather Prediction
NIC	National Ice Center (USA)
OSI SAF	Ocean and Sea Ice SAF
R&D	Research and Development
RMDCN	Regional Meteorological Data Communication Network
RMS	Root-Mean-Squared
RSD	Robust Standard Deviation
SAF	Satellite Application Facility
SD	Standard Deviation
SEVIRI	Spinning Enhanced Visible and Infra-Red Imager
SSI	Surface Short wave Irradiance
SSMI	Special Sensor Microwave Imager
SSMIS	Special Sensor Microwave Imager and Sounder
SST/IST	Sea Surface Temperature/ sea Ice Surface Temperature
SST	Sea Surface Temperature
TBC	To Be Confirmed
TBD	To Be Defined
WMO	World Meteorological Organisation

2. OSI SAF products availability and timeliness

As indicated in the Service Specification Document [AD-1], operational OSI SAF products are expected to be available for distribution within the specified time in more than **95%** of the cases where input satellite data are available with the nominal level of quality, on monthly basis.
Section 2.1 shows the measured availability on the OSI SAF FTP servers.
Section 2.2 shows the measured availability via EUMETCast.
The dissemination of the OSI SAF products via EUMETCast implies an additional step, not under the strict OSI SAF responsibility, but general EUMETSAT's one.

Note: The timeliness of the wind products on the KNMI FTP server is not measured separately and therefore the figures in table 2 are copied from table 3 for the wind products. Since the EUMETCast transmission is known to add only a very small delay to the timeliness, the availabilities on the KNMI FTP server are very close to or slightly better than the figures measured via EUMETCast.

The measured availability of the Global **Sea Ice concentration (resp. edge, type)** products corresponds to the situation when a product file is provided within 5 hours, whatever if there are input data or not. The sea ice type is the last product being produced, therefore the most likely to be outside this 5 hour spec.

Please find in section 3 comments on the tables included in section 2.1 and 2.2.

2.1. Availability on FTP servers

Ref.	Product	JUL. 2021	AUG. 2021	SEP. 2021	OCT. 2021	NOV. 2021	DEC. 2021
OSI-102	ASCAT-A 25 km wind	99.9	100	99.9	97.1	100	N/A
OSI-102-b	ASCAT-B 25 km wind	99.9	100	99.9	99.9	100	100
OSI-102-c	ASCAT-C 25 km wind	100	99.9	99.9	99.9	100	99.9
OSI-104	ASCAT-A Coastal wind	99.3	99.1	99.1	96.3	99.2	100
OSI-104-b	ASCAT-B Coastal wind	99.9	99.9	99.8	100	100	100
OSI-104-c	ASCAT-C Coastal wind	99.9	99.9	99.9	99.9	100	99.8
OSI-114-a	HY-2B 25 km wind vectors	N/A	N/A	N/A	93.8	95.0	95.4
OSI-114-b	HY-2B 50 km wind vectors	N/A	N/A	N/A	93.8	95.0	95.4
OSI-115-a	HY-2C 25 km wind vectors	N/A	N/A	N/A	99.1	91.3	97.5
OSI-115-b	HY-2C 50 km wind vectors	N/A	N/A	N/A	99.3	91.5	97.5
OSI-201-b	GBL SST	100	100	100	100	88.3	87.1
OSI-202-b	NAR SST	100	100	100	100	95.0	87.1
OSI-203-a	NHL SST/IST (L3)	100	100	100	96.8	100	100
OSI-203-b	NHL SST/IST (L3)	100	98.4	100	96.8	100	100
OSI-204-b	MGR SST (Metop-B)	99.9	89.3	93.8	99.8	89.5	73.1
OSI-204-c	MGR SST (Metop-C)	99.9	99.8	99.7	100	99.8	87.9
OSI-205-a	SST/IST (L2)	99.9	99.8	99.8	99.8	100.0	100.0
OSI-205-b	SST/IST (L2)	99.1	99.8	99.8	100	99.3	98.4
OSI-206-a	Meteosat SST	100	92.3	99.4	99.9	98.5	73.1
OSI-207-b	GOES-East SST	99.9	92.9	99.9	100	98.8	69.2
OSI-208-b	IASI SST	99.8	92.6	99.8	99.9	98.8	71.9
OSI-301-b OSI-302-b	AHL DLI + SSI	100	100	100	100	100	100
OSI-303-a	Meteosat DLI - hourly	99.9	100	100	100	98.9	72.9
	Meteosat DLI - daily	100	100	100	100	100	70
OSI-304-a	Meteosat SSI - hourly	99.9	100	100	100	98,9	72.9
	Meteosat SSI - daily	100	100	100	100	100	70.0
OSI-305-b	GOES-East DLI - hourly	99.9	100	100	100	100	68.7
	GOES-East DLI - daily	100	100	100	100	100	67.7
OSI-306-b	GOES-East SSI - hourly	99.9	100	100	100	100	68.7
	GOES-East SSI - daily	100.0	100	100	100	100	67.7
OSI-401-b	Global Sea Ice Concentration (SSMIS)	100	100	100	100	100	100
OSI-402-d	Global Sea Ice Edge	100	96.8	100	100	100	100
OSI-403-d	Global Sea Ice Type	100	96.8	100	100	100	100
OSI-404/-a	Global Sea Ice Emissivity	100	100	100	98.3	100	100
OSI-405-c	Low Res. Sea Ice Drift	100	96.8	100	100	100	100
OSI-407-a	Medium Res. Sea Ice Drift	100	100	100	91.2	100	100
OSI-408	Global Sea Ice Concentration (AMSR-2)	100	100	100	100	100	100
OSI-410	Level 2 PMW sea ice concentration	81.0	84.8	86.8	90.8	86.4	79.1
OSI-430-a	Global Reproc Sea Ice Conc Updates	100	100	100	100	100	100

Table 1: Percentage of OSI SAF products available on the OSI SAF FTP servers within the specified time over 2nd half 2021.

2.2. Availability via EUMETCast

Ref.	Product	JUL. 2021	AUG. 2021	SEP. 2021	OCT. 2021	NOV. 2021	DEC. 2021
OSI-102	ASCAT-A 25 km wind	99.9	100	99.9	97.1	100	N/A
OSI-102-b	ASCAT-B 25 km wind	99.9	100	99.9	99.9	100	100
OSI-102-c	ASCAT-C 25 km wind	100	99.9	99.9	99.9	100	99.9
OSI-104	ASCAT-A Coastal wind	99.3	99.1	99.1	96.3	99.2	100
OSI-104-b	ASCAT-B Coastal wind	99.9	99.9	99.8	100	100	100
OSI-104-c	ASCAT-C Coastal wind	99.9	99.9	99.9	99.9	100	99.8
OSI-114-a	HY-2B 25 km wind vectors	N/A	N/A	N/A	93.8	95.0	95.4
OSI-114-b	HY-2B 50 km wind vectors	N/A	N/A	N/A	93.8	95.0	95.4
OSI-115-a	HY-2C 25 km wind vectors	N/A	N/A	N/A	99.1	91.3	97.5
OSI-115-b	HY-2C 50 km wind vectors	N/A	N/A	N/A	99.3	91.5	97.5
OSI-201-b	GBL SST	100	100	100	100	90.0	100
OSI-202-b	NAR SST	100	100	100	100	95.0	100
OSI-203-a	NHL SST/IST (L3)	100	100	98.3	96.8	100	100
OSI-203-b	NHL SST/IST (L3)	100	100	98.3	96.8	100	100
OSI-204-b	MGR SST (Metop-B)	99.8	98.4	99.9	99.8	90.3	100
OSI-204-c	MGR SST (Metop-C)	100	99.9	99.9	99.9	100	100
OSI-205-a	SST/IST (L2)	98.1	98.1	99.5	98.4	99.3	97.7
OSI-205-b	SST/IST (L2)	100	100	100	100	100	100
OSI-206-a	Meteosat SST	99.9	100	100	100	100	100
OSI-207-b	GOES-East SST	100	98.5	100	100	100	99.4
OSI-208-b	IASI SST						
OSI-301-b OSI-302-b	AHL DLI + SSI	100	100	100	100	100	100
OSI-303-a	Meteosat DLI - hourly	99.6	100	100	100	100	100
	Meteosat DLI - daily	100	100	100	100	100	100
OSI-304-a	Meteosat SSI - hourly	99.6	100	100	100	100	100
	Meteosat SSI - daily	100	100	100	100	100	100
OSI-305-b	GOES-East DLI - hourly	99.7	100	100	100	100	100
	GOES-East DLI - daily	100	100	100	100	100	100
OSI-306-b	GOES-East SSI - hourly	99.7	100	100	100	100	100
	GOES-East SSI - daily	100	100	100	100	100	100
OSI-401-b	Global Sea Ice Concentration (SSMIS)	100	100	100	100	100	100
OSI-402-d	Global Sea Ice Edge	100	96.8	100	100	100	100
OSI-403-d	Global Sea Ice Type	100	96.8	100	100	100	100
OSI-404/-a	Global Sea Ice Emissivity	100	100	100	100	100	100
OSI-405-c	Low Res. Sea Ice Drift	100	96.8	100	100	100	100
OSI-407-a	Medium Res. Sea Ice Drift	100	100	100	99.2	100	100
OSI-408	Global Sea Ice Concentration (AMSR-2)	100	100	100	100	100	100
OSI-410	Level 2 PMW sea ice concentration	81.1	84.9	86.8	90.9	86.7	79.3

Table 2: Percentage of OSI SAF products delivered via EUMETCast within the specified time over 2nd half 2021.

Comment: See section 3 for explanations about the lower availabilities.

3. Main anomalies, corrective and preventive measures

In case of anomaly (outage, degraded products…), service messages are made available in near-real time to the registered users through the Web site http://osi-saf.eumetsat.int.

3.1. At Low and Mid-Latitudes subsystem (Météo-France and Ifremer)

Date	Impacted products or services	Anomaly	Corrective and preventive measures
August	MGR SST Meteosat SST GOES-East SST IASI SST	LML ftp server punctual anomalies	
31 October 03 nov.	All data	LML ftp server Ifremer down	Full space
12 Nov. 15 Nov.	GLB SST MGR SST NAR SST	Processing issue	Delete corrupted input data
23 Dec. 02 January	All data	LML ftp server Ifremer down	Server down

3.2. At High Latitudes subsystem (MET Norway and DMI)

Date	Impacted products or services	Anomaly	Corrective and preventive measures
31.08.2021	HL FTP server	Outage of FTP server in main data room, FTP server unavailable for 1.5 hours.	Activated FTP server in backup data room
2021 H2	OSI-410	The AMSR2 input data for OSI-410 L2 SICO is often delayed causing the L2 product to not be within timeliness.	We will consider how to calculate the timeliness, if the issue with delayed data continues

3.3. At Wind subsystem (KNMI)

Date	Impacted products or services	Anomaly	Corrective and preventive measures
22 Jul	OSI-102, OSI-104	The ASCAT-A winds have been unavailable on 22 July between 1:12 and 7:54 UTC sensing time due to an instrument anomaly.	

Date	Impacted products or services	Anomaly	Corrective and preventive measures
12 Oct	OSI-102, OSI-104	The ASCAT-A winds have been unavailable between 11 October 9:00 and 12 October 18:00 UTC sensing time due to a spacecraft anomaly (end of life technology test). Since the dissemination was temporarily stopped, this caused lower availabilities in October.	
3 Dec	OSI-102-b, OSI-104-b	The ASCAT-B winds have been unavailable on 3 December between 12:30 and 16:39 UTC sensing time due to an instrument anomaly.	
11-Oct	OSI-114-a, OSI-114-b	The HY-2B winds have been unavailable between 2 October 9:00 and 8 October 11:00 UTC sensing time due to an instrument anomaly.	
2021 H2	OSI-114-a, OSI-114-b, OSI-115-a, OSI-115-b	HY-2B and HY-2C input data are sometimes delivered late for unknown reasons, this causes lower availabilities from time to time. Although the end-to-end availability is not always met for the wind products, the OSI SAF availability is met.	

4. Main events and modifications, maintenance activities

In case of event or modification, corresponding service messages are made available in near-real time to the registered users through the Web site http://osi-saf.eumetsat.int.

4.1. At Low and Mid-Latitudes subsystem (Météo-France and Ifremer)

Date	Impacted products or services	Events and modifications, maintenance activities
25 nov.	All data	LML ftp serveur upgrade

4.2. At High Latitudes subsystem (MET Norway and DMI)

Date	Impacted products or services	Events and modifications, maintenance activities
8 July 2021	OSI-410	New OSI SAF Level 2 Sea Ice Concentration Product operational
26-10-2021	OSI-402-d and OSI-403-d	There was a bug in the time and time_bnds variables in the OSI SAF sea ice edge and type products. The bug was introduced with the change in the sea ice edge and type product that was done on 1st June 2021. Users were informed, and a bugfix was introduced on Monday 1st November, including updating the FTP archive.

4.3. At Wind subsystem (KNMI)

Date	Impacted products or services	Events and modifications, maintenance activities
October, November	OSI-114-a, OSI-114-b, OSI-115-a, OSI-115-b	The HY-2B and HY-2C winds are publicly available on the KNMI FTP server with operational status since 21 October. The products are available on EUMETCast since 4 November.
30-Nov	OSI-102-c	The ASCAT-C 25 km global wind products are available on the GTS as of 30 November.

4.4. Release of software and new data records & ICDR

The CFOSAT scatterometer wind data processor (CWDP) v1.0 has been released. The software is distributed through the NWP SAF website.

5. OSI SAF products quality

5.1. SST quality

The comparison between SST products and Match up data bases (MDB) gathering in situ (buoy) measurements is performed on a routine basis for each satellite.

SST values are required to have the following target accuracy when compared to night time and daytime buoy measurements (see Service Specification Document [AD-1]):

	Monthly mean difference (mean difference req. in following tables) in the following ranges	Monthly standard deviation (SD req. in following tables) less than
Global low earth orbit products (GBL, NAR, MGR and IASI SST)	± 0.5 K	0.8 K
High latitudes low earth orbit products (SST in HL SST/IST products)	± 0.7 K	1.0 K
Geostationary products (Meteosat and GOES-East SST)	± 0.5 K	1.0 K

According to GHRSST-PP project, for IR derived products, the normalized Proximity Confidence Value scale shows 6 values: 0: unprocessed, 1: cloudy, 2: bad, 3: suspect, 4: acceptable, 5: excellent. A quality level is provided at pixel level. Those values are good predictors of the errors. It is recommended not to use the confidence value 2 for quantitative use. Usable data are those with confidence values 3, 4 and 5.

The list of blacklisted buoys over the concerned period is available here:
ftp://ftp.ifremer.fr/ifremer/cersat/projects/myocean/sst-tac/insitu/blacklist/

In the following maps, there are at least 5 matchups (satellite and in situ measurements) per box. Monthly maps of number of matchups in each box are available on the web site.

The number of cases might not be consistent in monthly and half-yearly statistics. There are two reasons responsible for this:

- the monthly statistics are run using the drifting buoy blacklist available for that month, whereas the map is produced at the end of the 6 month period using a more up to date black list.
- The blacklist is periodically update and therefore small differences are expected in the number of points - to produce a map we set up a threshold to the minimum number of records necessary for each 5x5° box.

Robust statistics
In the following, for the LML SST products (OSI-206-a, OSI-207-b, OSI-IO-SST, OSI-202-b, OSI-201-b, OSI-204-b, OSI-204-c), robust statistics (median and Robust Standard Deviation) are computed. The RSD is defined by Merchant and Harris (1999):

$$RSD = \frac{75^{th}\ percentile\ of\ \Delta SST - 25^{th}\ percentile\ of\ \Delta SST}{1{,}348} \quad \text{with} \quad \Delta SST = SST_{sat} - SST_{insitu}$$

Median and RSD are a little more stable than the mean and SD, and the RSD is lower than the SD.

Please note that the following figures show the map of median SST and the following tables show mean, SD, median and RSD.

5.1.1. Meteosat SST (OSI-206-a) quality

The following maps indicate the median night-time and day-time SST median difference with respect to buoys measurements for quality level 3,4,5 over the reporting period. Monthly maps are available on http://osi-saf.eumetsat.int/lml/#qua_SST%Metop%20GBL%20SST_monthly%20map_monthly_Night%20time.

The operational SST retrieval from Meteosat and GOES-East updated chain validation report v1.1 (http://osi-saf.eumetsat.int/lml/#doc_SST) gives further details about the regional bias observed.

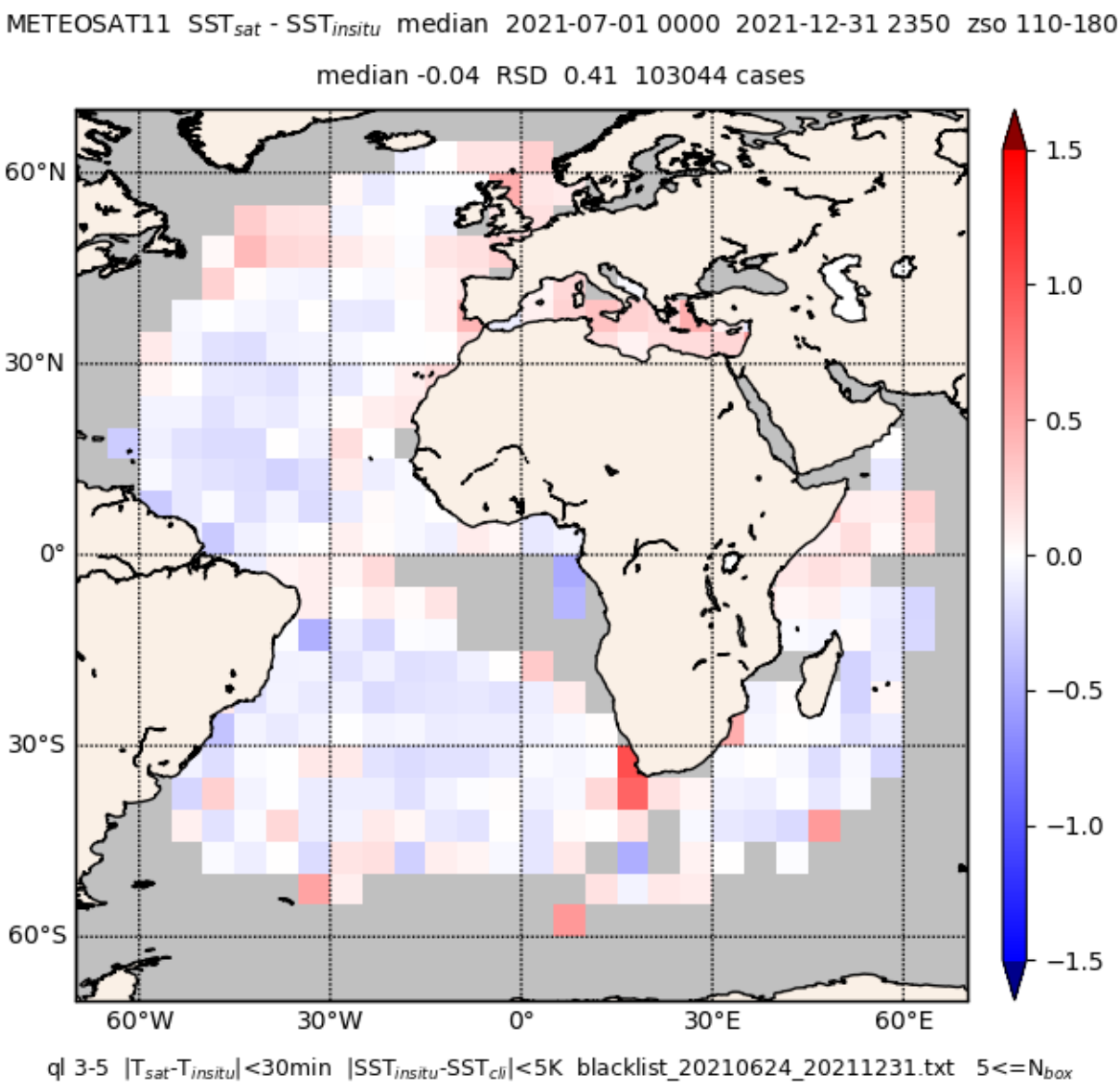


Figure 1: Meteosat night-time SST median difference with respect to buoys measurements for quality level 3,4,5

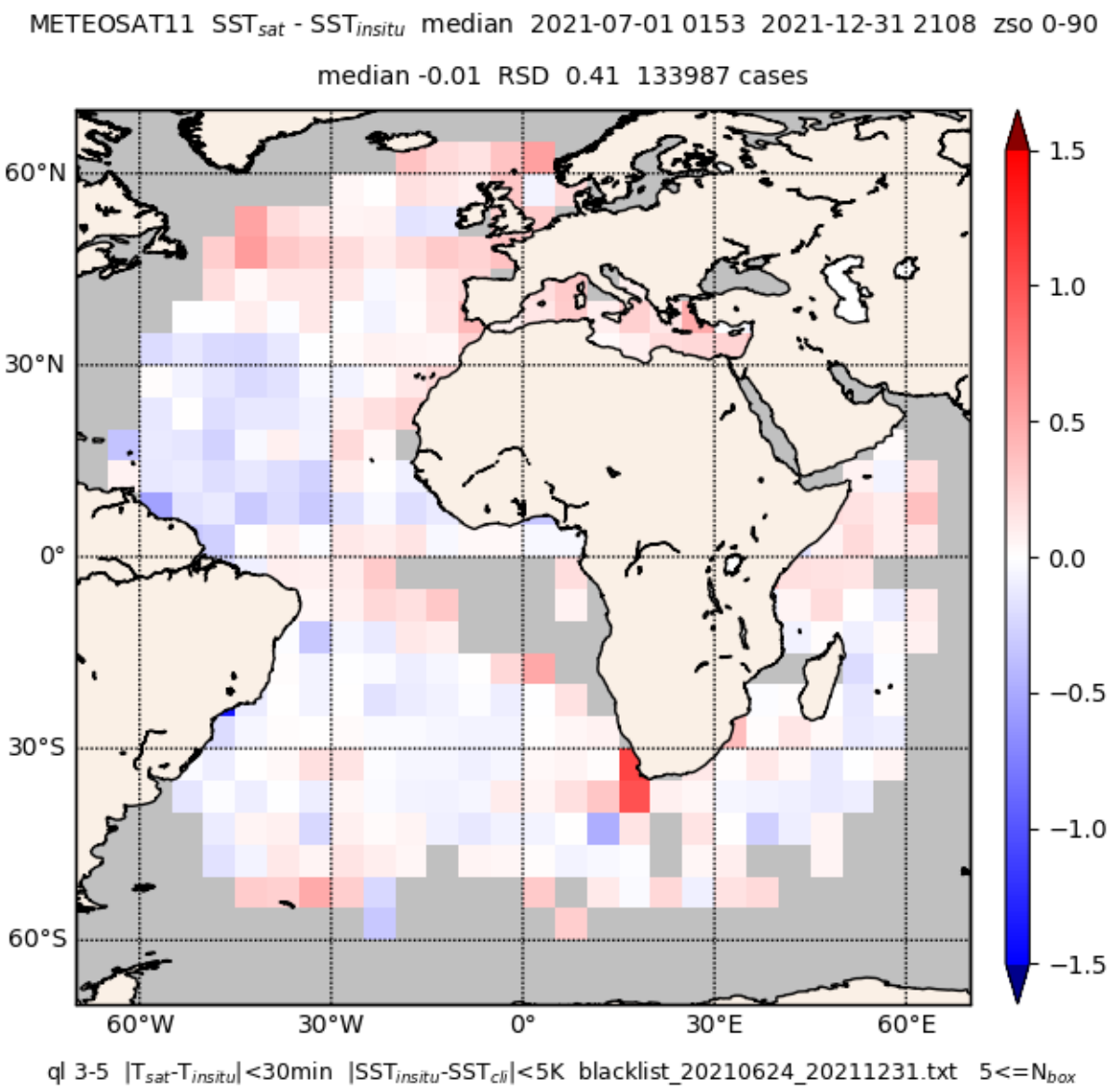


Figure 2: Meteosat day-time SST median difference with respect to buoys measurements for quality level 3,4,5

The following table provides the Meteosat-derived SST quality results over the reporting period.

Meteosat night-time SST quality results over 2nd half 2021					
Month	Number of cases	Mean diff. in K (req.: ± 0.5 K)	SD in K (req.: ± 1 K)	Median in K	RSD in K
JUL. 2021	17021	-0.07	0.46	-0.05	0.40
AUG. 2021	19078	-0.05	0.44	-0.04	0.39
SEP. 2021	17825	-0.10	0.46	-0.08	0.42
OCT. 2021	17695	-0.07	0.44	-0.06	0.40
NOV. 2021	15479	-0.04	0.44	-0.02	0.41
DEC. 2021	15946	-0.04	0.45	-0.01	0.42
Meteosat day-time SST quality results over 2nd half 2021					
JUL. 2021	26718	-0.07	0.52	-0.02	0.45
AUG. 2021	27670	-0.04	0.52	0.00	0.42
SEP. 2021	22486	-0.09	0.50	-0.05	0.42
OCT. 2021	19948	-0.02	0.45	0.00	0.38
NOV. 2021	17428	-0.01	0.43	0.02	0.37
DEC. 2021	19737	-0.00	0.44	0.02	0.39

Table 3: Meteosat SST quality results over 2nd half 2021 , for 3, 4, 5 quality indexes.

Comments:
Overall statistics are within the requirement.

5.1.2. GOES-East SST (OSI-207-b) quality

The following maps indicate the median night-time and day-time SST median difference with respect to buoys measurements for quality level 3,4,5 over the reporting period. Monthly maps are available on http://osi-saf.eumetsat.int/lml/#qua_SST%GOES-E%20SST_monthly%20map_monthly_Night%20time.

The operational SST retrieval from MSG/SEVIRI and GOES-East updated chain validation report v1.1 (http://osi-saf.eumetsat.int/lml/#doc_SST) gives further details about the regional bias observed.

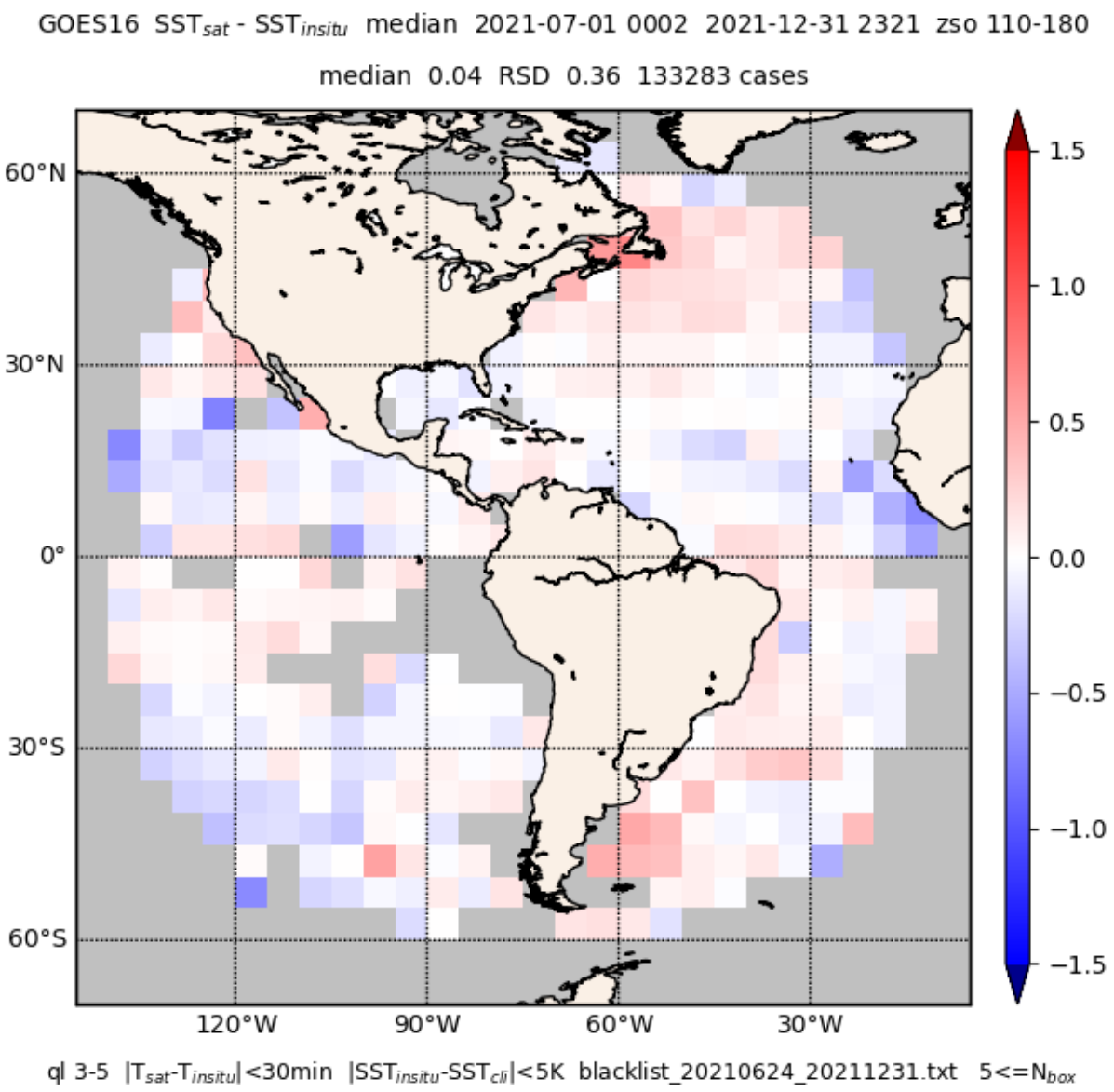


Figure 3: GOES-East night-time SST median difference with respect to buoys measurements for quality level 3,4,5

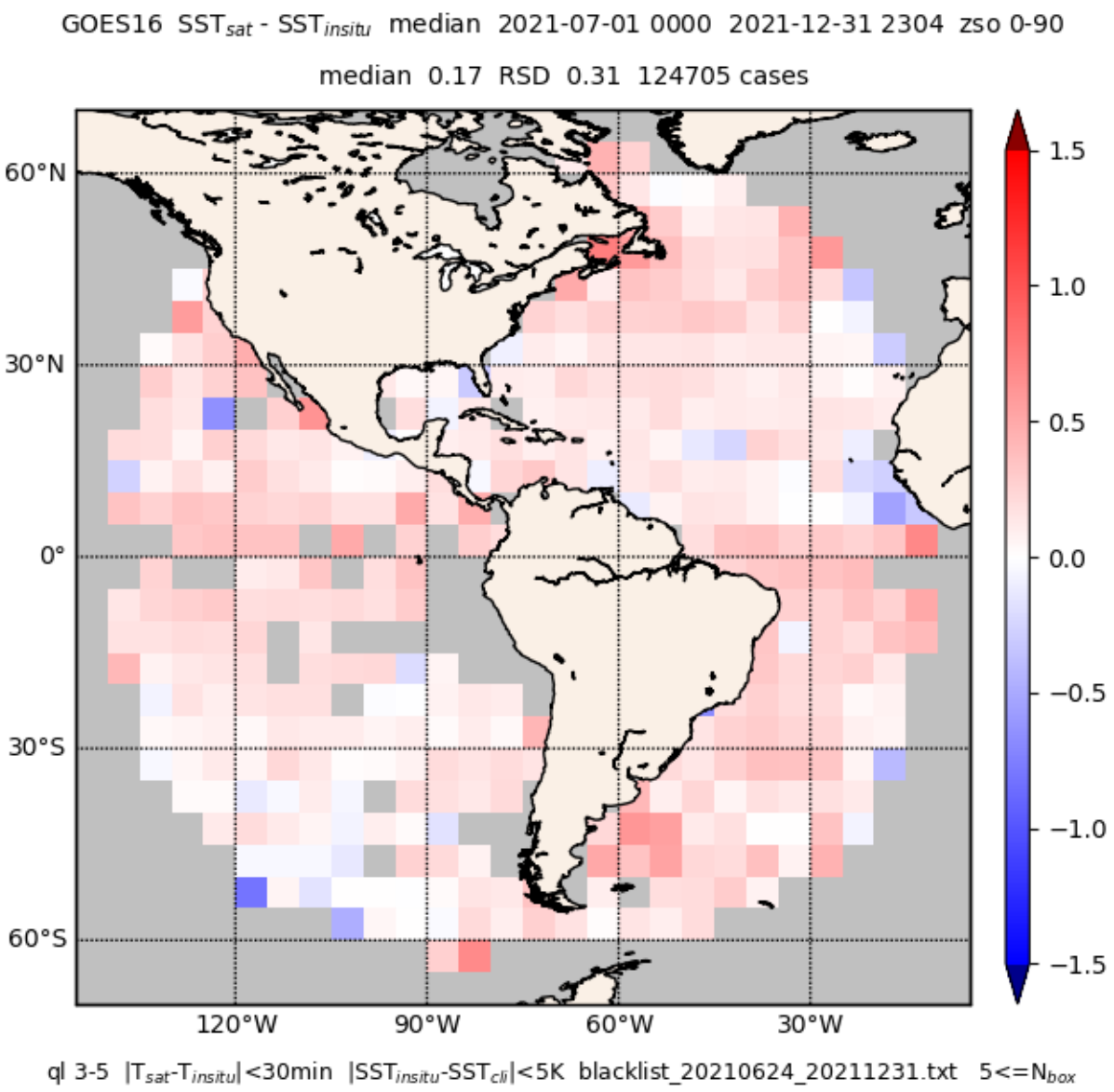


Figure 4: GOES-East day-time SST median difference with respect to buoys measurements for quality level 3,4,5

The following table provides the GOES-E-derived SST quality results over the reporting period.

GOES-East night-time SST quality results 2nd half 2021					
Month	Number of cases	Mean diff. in K (req.: ± 0.5 K)	SD in K (req.: ± 1 K)	Median in K	RSD in K
JUL. 2021	18971	-0.08	0.41	-0.03	0.36
AUG. 2021	22456	-0.04	0.42	0.00	0.36
SEP. 2021	22711	0.00	0.44	0.03	0.36
OCT. 2021	22257	0.03	0.45	0.05	0.39
NOV. 2021	23003	0.05	0.43	0.08	0.35
DEC. 2021	23885	0.04	0.38	0.08	0.32
GOES-East day-time SST quality results 2nd half 2021					
JUL. 2021	20999	0.03	0.42	0.08	0.35
AUG. 2021	22820	0.09	0.43	0.12	0.32
SEP. 2021	20466	0.16	0.41	0.18	0.32
OCT. 2021	19176	0.22	0.42	0.21	0.34
NOV. 2021	19849	0.20	0.36	0.21	0.29
DEC. 2021	21395	0.19	0.35	0.21	0.27

Table 4: GOES-East SST quality results over 2nd half 2021 , for 3, 4, 5 quality indexes

Comments:
Overall statistics are within the requirement.

5.1.3. Meteosat Indian Ocean SST (OSI-IO-SST) quality

Since 2016, Meteosat-8 is in position 41.5 east for the Indian Ocean Data Coverage (IODC). Sea Surface Temperature is processed as a demonstration product.

The following maps indicate the median night-time and day-time SST median difference with respect to buoys measurements for quality level 3,4,5 over the reporting period.

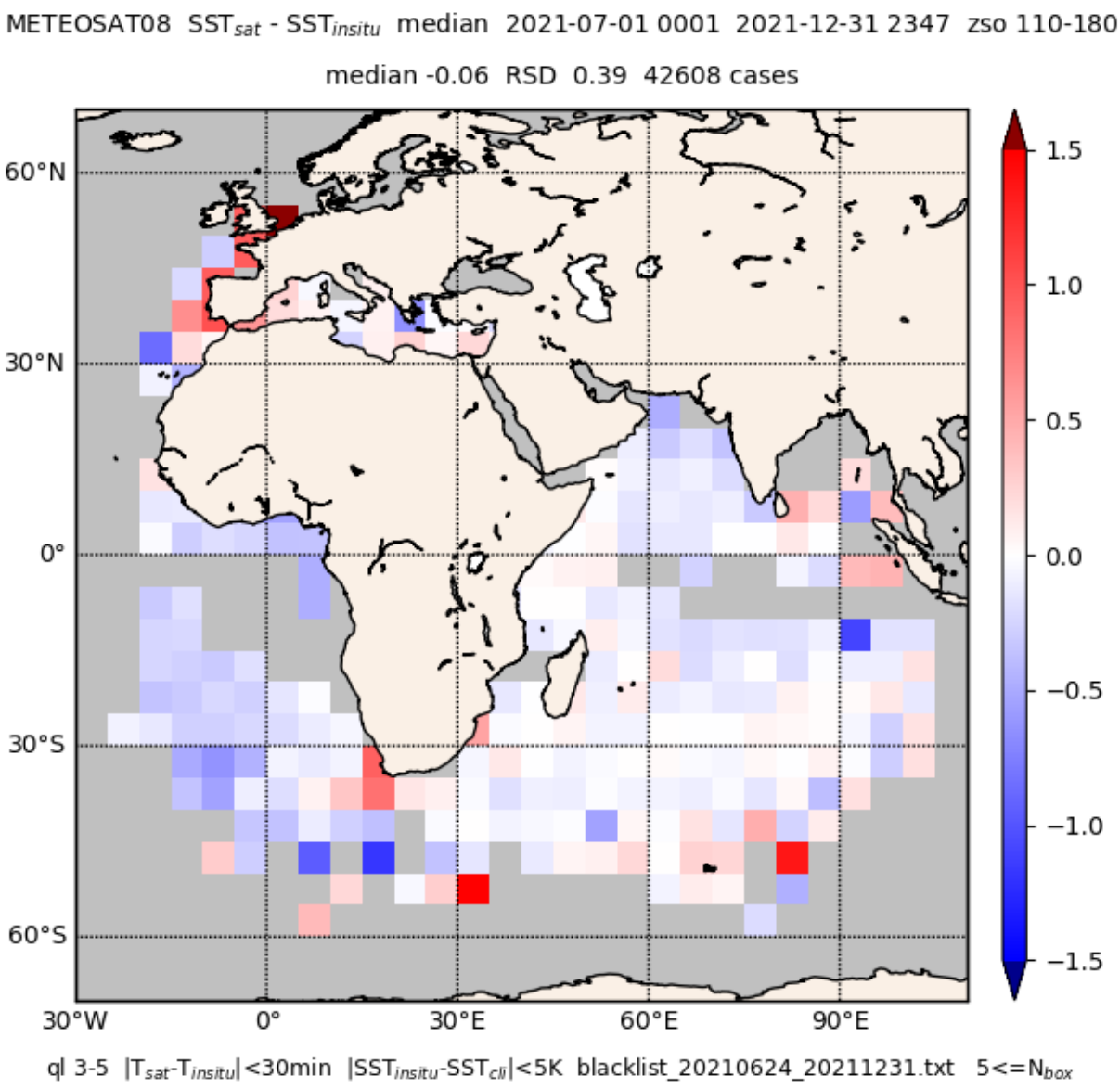


Figure 5: Meteosat Indian Ocean night-time SST median difference with respect to buoys measurements for quality level 3,4,5

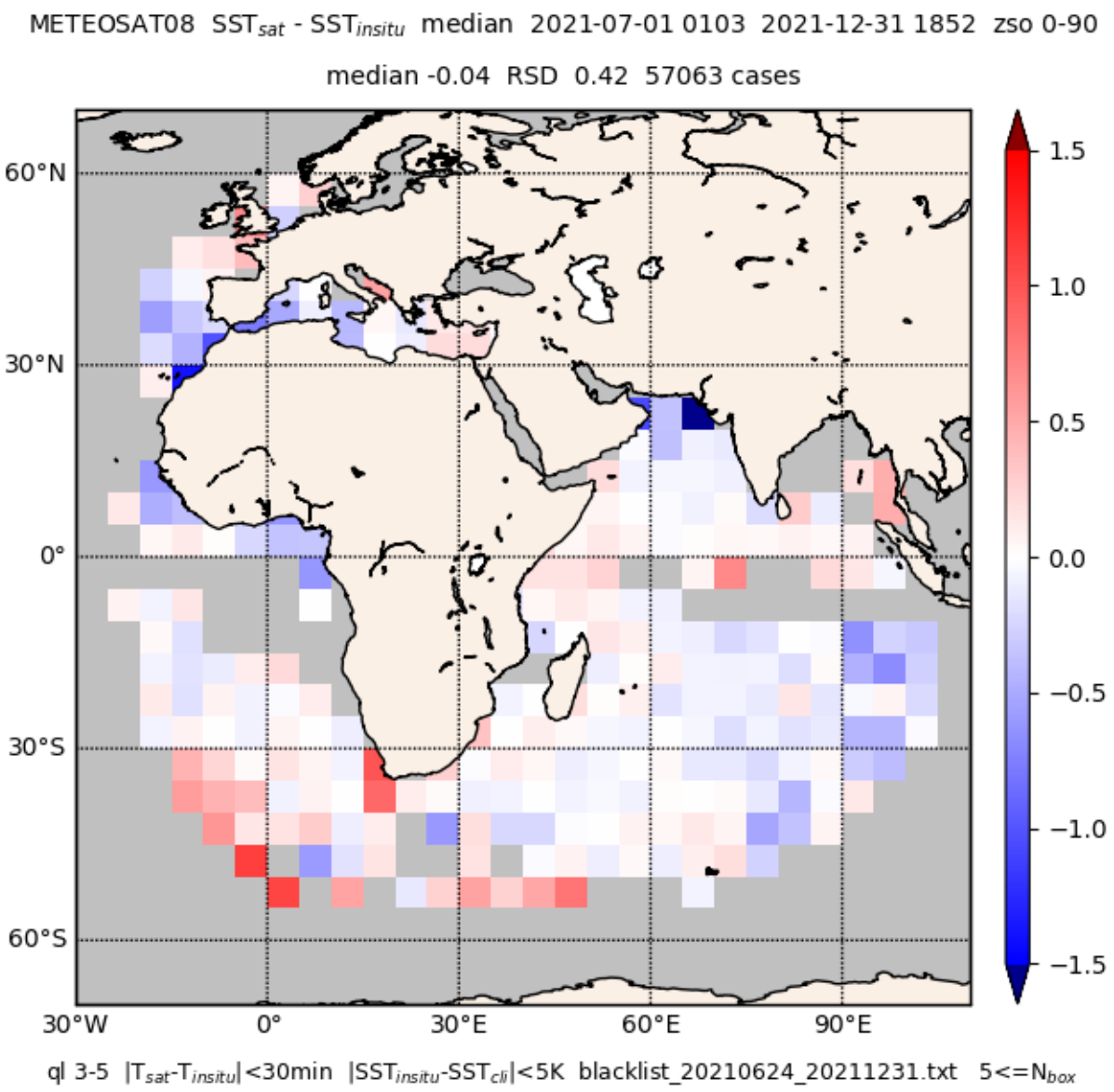


Figure 6: Meteosat Indian Ocean day-time SST median difference with respect to buoys measurements for quality level 3,4,5

The following table provides the Meteosat Indian Ocean-derived SST quality results over the reporting period.

Meteosat Indian Ocean night-time SST quality results over 2nd half 2021					
Month	Number of cases	Mean diff. in K (req.: ± 0.5 K)	SD in K (req.: ± 1 K)	Median in K	RSD in K
JUL. 2021	8956	-0.03	0.43	-0.02	0.36
AUG. 2021	7684	-0.08	0.42	-0.06	0.36
SEP. 2021	6778	-0.12	0.45	-0.11	0.38
OCT. 2021	7020	-0.05	0.49	-0.06	0.40
NOV. 2021	6672	-0.02	0.51	-0.02	0.45
DEC. 2021	5498	-0.10	0.53	-0.09	0.45
Meteosat Indian Ocean day-time SST quality results over 2nd half 2021					
JUL. 2021	10252	-0.04	0.51	0.02	0.36
AUG. 2021	10617	-0.04	0.52	0.01	0.39
SEP. 2021	8105	-0.12	0.50	-0.09	0.39
OCT. 2021	8991	-0.15	0.51	-0.13	0.42
NOV. 2021	9343	-0.15	0.50	-0.12	0.45
DEC. 2021	9755	0.02	0.55	0.04	0.47

Table 5: Meteosat Indian Ocean SST quality results over 2nd half 2021 , for 3, 4, 5 quality indexes.

Comments:
Overall statistics are within the requirement.

5.1.4. NAR SST (OSI-202-c) quality

The operational NAR SST is processed with AVHRR and VIIRS data, separately. Currently Metop-B and NOAA-20 are used.

The comparison between NAR SST products and Match up data bases (MDB) gathering in situ (buoy) measurements is performed on a routine basis for each operational Metop and NOAA-20 satellite. It is considered that if the accuracy requirements are met for both AVHRR and VIIRS separately, the accuracy requirements for OSI-202-b are fully met.

5.1.4.1. NOAA-20 NAR SST quality

The following maps indicate the median night-time and day-time SST median difference with respect to buoys measurements for quality level 3,4,5 over the reporting period. Monthly maps are available on https://osi-saf.eumetsat.int/low-and-mid-latitudes-processing-center/charts-display?product=SST&area=NAR%20NOAA-20&chart=Monthly%20statistics%2C%20night%20time

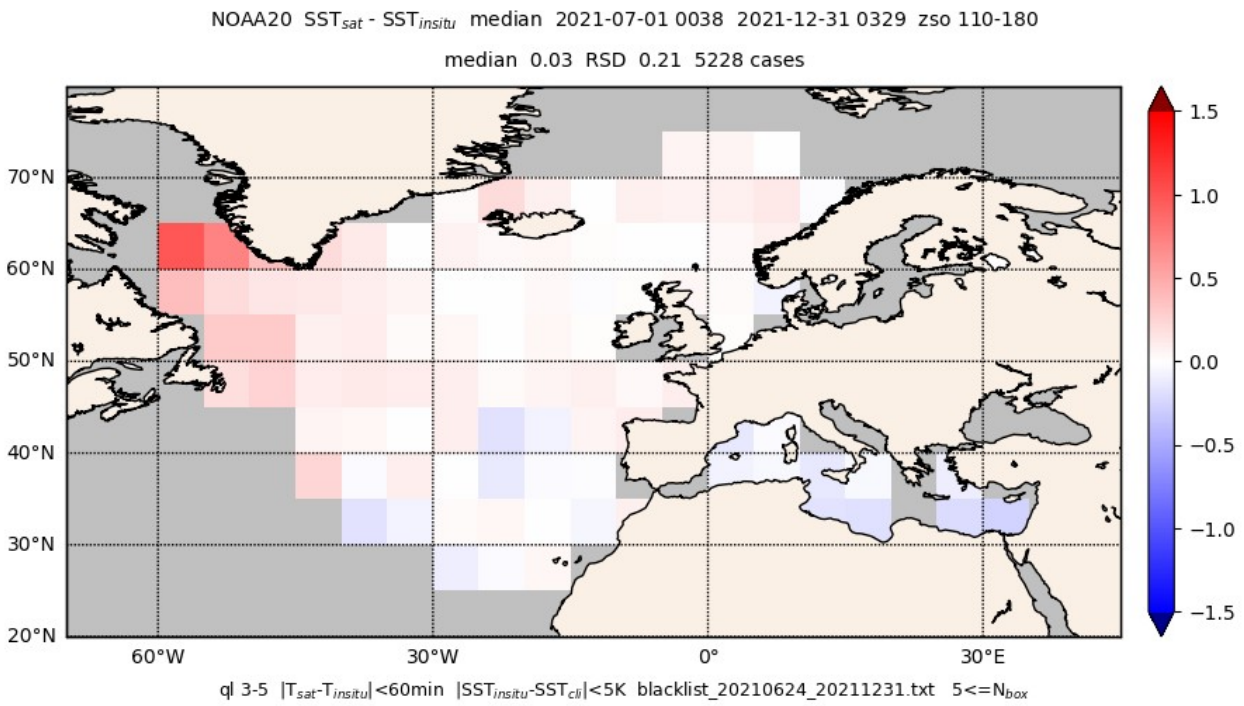


Figure 7: NOAA-20 NAR night-time SST median difference with respect to buoys measurements for quality level 3,4,5

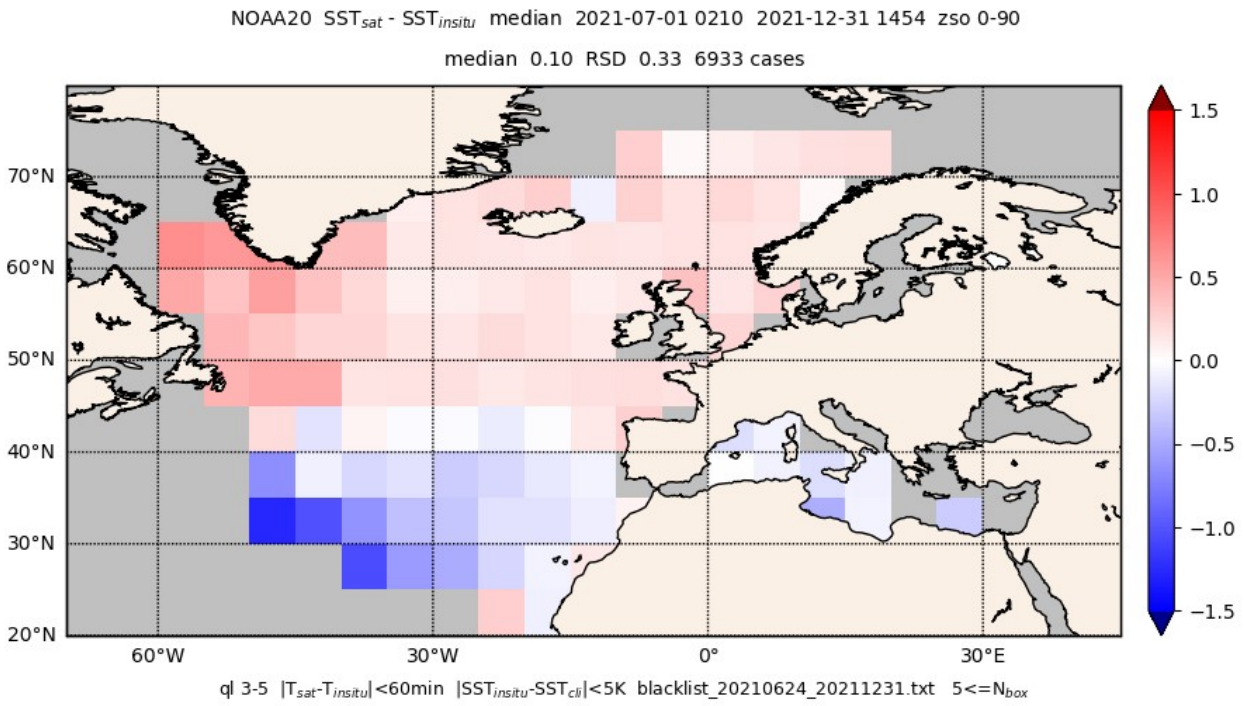


Figure 8: NOAA-20 NAR day-time SST median difference with respect to buoys measurements for quality level 3,4,5

The following table provides the NOAA-20-derived SST quality results over the reporting period.

NOAA-20 NAR night-time SST quality results over 2nd half 2021					
Month	Number of cases	Mean diff. in K (req.: ± 0.5 K)	SD in K (req.: ± 0.8 K)	Median in K	RSD in K
JUL. 2021	324	-0.05	0.45	-0.03	0.25
AUG. 2021	679	-0.05	0.32	0.00	0.29
SEP. 2021	915	0.00	0.35	0.06	0.23
OCT. 2021	1387	0.03	0.27	0.04	0.19
NOV. 2021	921	0.03	0.26	0.04	0.17
DEC. 2021	1002	0.02	0.26	0.03	0.19
NOAA-20 NAR day-time SST quality results over 2nd half 2021					
JUL. 2021	1170	0.03	0.55	0.13	0.39
AUG. 2021	1260	-0.03	0.52	0.05	0.40
SEP. 2021	1312	-0.01	0.49	0.07	0.37
OCT. 2021	1424	0.03	0.43	0.10	0.30
NOV. 2021	851	0.06	0.39	0.12	0.28
DEC. 2021	916	0.07	0.34	0.11	0.22

Table 6: Quality results for NOAA-20 NAR SST over 2nd half 2021 , for 3, 4, 5 quality indexes

Comments:
Overall statistics are within the requirement.

5.1.4.2. Metop NAR SST quality

The following maps indicate the median night-time and day-time SST median difference with respect to buoys measurements for quality level 3,4,5 over the reporting period. Monthly maps are available on http://osi-saf.eumetsat.int/lml/#qua_SST%Metop%20NAR%20SST_monthly%20map_monthly_Night%20time.

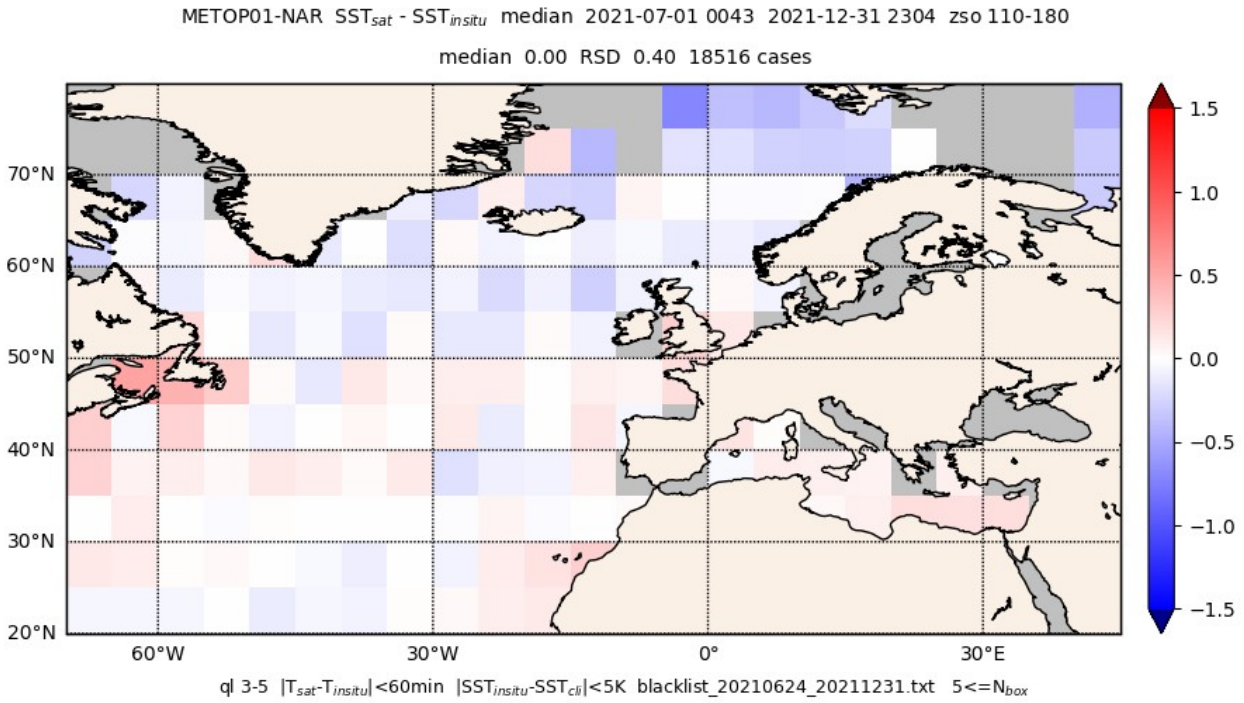


Figure 9: Metop-B NAR night-time SST median difference with respect to buoys measurements for quality level 3,4,5

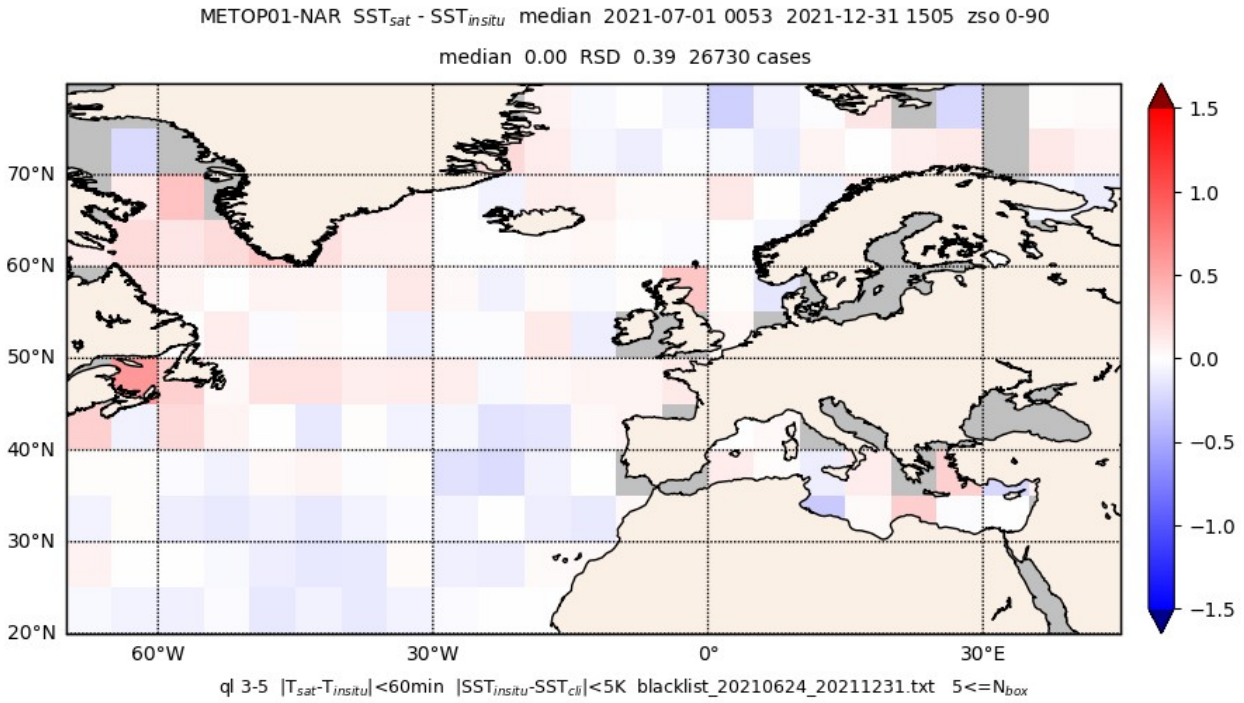


Figure 10: Metop-B NAR day-time SST median difference with respect to buoys measurements for quality level 3,4,5

The following table provides Metop-B-derived SST quality results over the reporting period.

Metop-B NAR night-time SST quality results over 2nd half 2021					
Month	Number of cases	Mean diff. in K (req.: ± 0.5 K)	SD in K (req.: ± 0.8 K)	Median in K	RSD in K
JUL. 2021	1295	-0.18	0.39	-0.12	0.29
AUG. 2021	2250	-0.06	0.47	-0.01	0.36
SEP. 2021	3296	-0.08	0.56	0.00	0.42
OCT. 2021	4471	-0.09	0.53	0.00	0.43
NOV. 2021	3409	-0.05	0.63	0.04	0.43
DEC. 2021	3795	-0.07	0.48	0.02	0.39
Metop-B NAR day-time SST quality results over 2nd half 2021					
JUL. 2021	5045	-0.23	0.71	-0.13	0.43
AUG. 2021	4935	-0.12	0.61	-0.04	0.40
SEP. 2021	5319	-0.01	0.51	0.06	0.39
OCT. 2021	5161	-0.02	0.44	0.05	0.38
NOV. 2021	3022	0.00	0.47	0.07	0.36
DEC. 2021	3248	-0.01	0.38	0.04	0.31

Table 7: Quality results for Metop-B NAR SST over 2nd half 2021 , for 3, 4, 5 quality indexes

Comments:
Overall statistics are within the requirement.

5.1.5. GBL SST (OSI-201) and MGR SST (OSI-204) quality

The OSI SAF SST products on global coverage (GBL SST and MGR SST) are based on Metop/AVHRR data, currently Metop-B.
The following maps indicate the median night-time and day-time SST median difference with respect to buoys measurements for quality level 3,4,5 over the reporting period. Monthly maps are available on http://osi-saf.eumetsat.int/lml/#qua_SST%Metop%20GBL%20SST_monthly%20map_monthly_Night%20time.

The Metop/AVHRR SST validation report, available on http://osi-saf.eumetsat.int, gives further details about the regional bias observed and their origin.

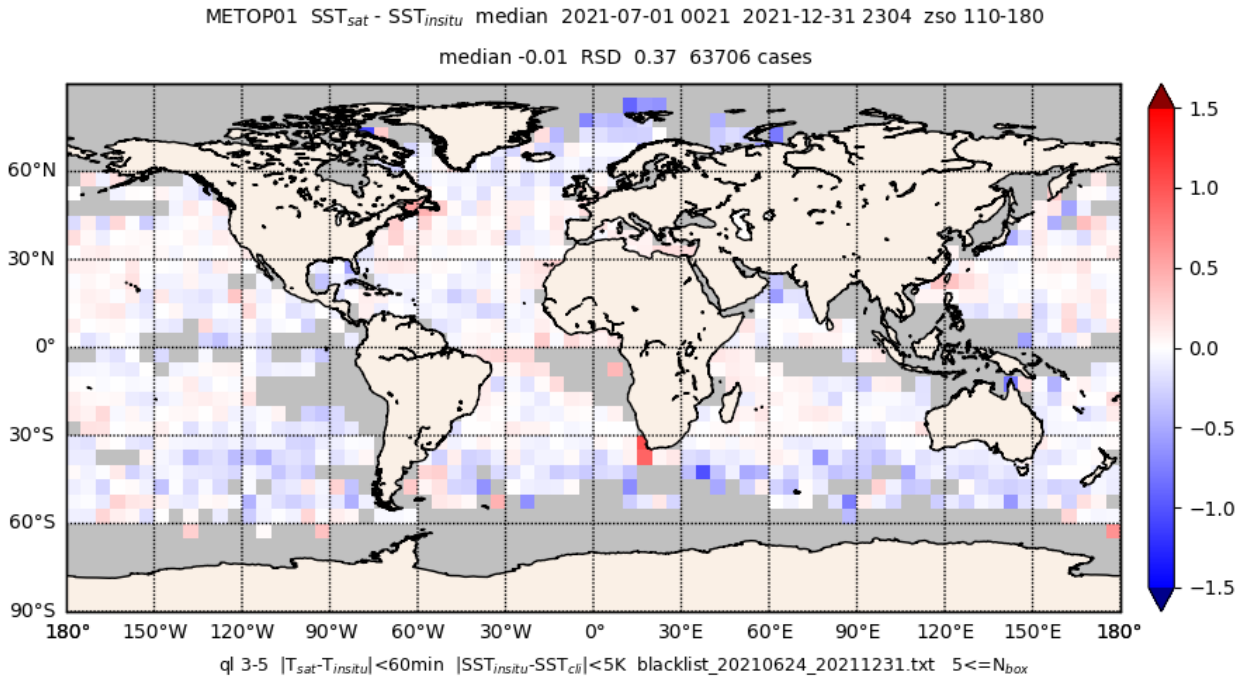


Figure 11: Metop-B night-time SST median difference with respect to buoys measurements for quality level 3,4,5

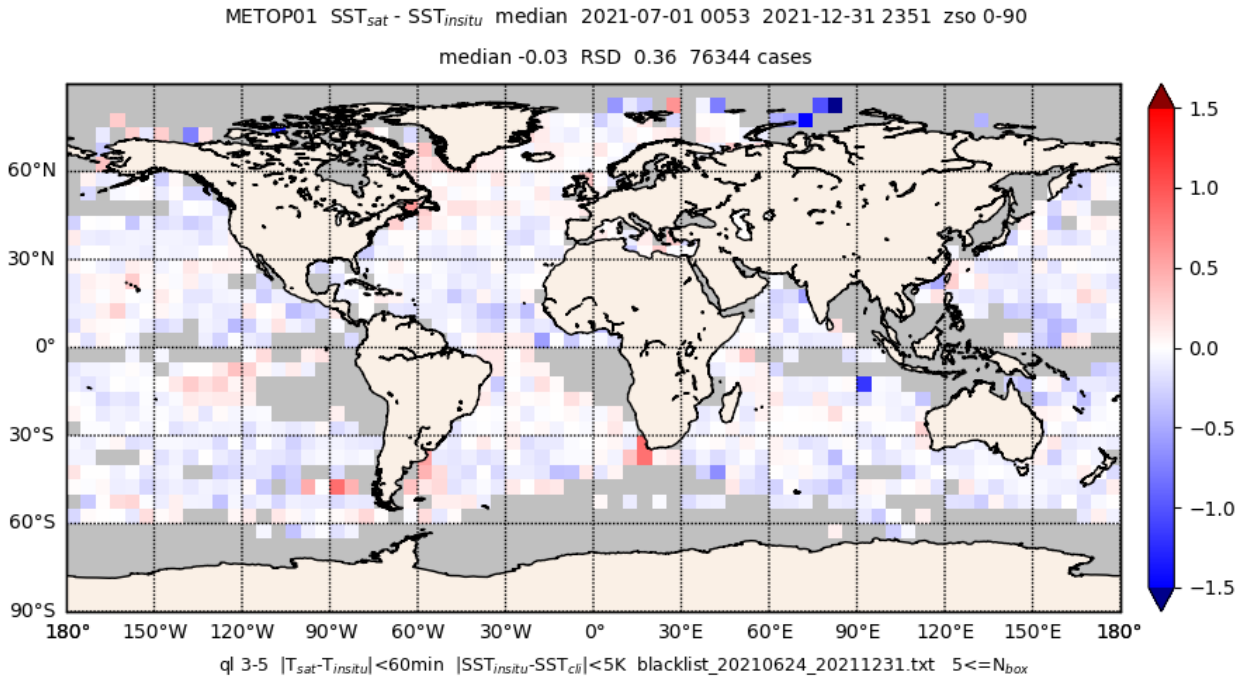


Figure 12: Metop-B day-time SST median difference with respect to buoys measurements for quality level 3,4,5

The following table provides the Metop-derived SST quality results over the reporting period.

Global Metop-B night-time SST quality results over 2nd half 2021					
Month	Number of cases	Mean diff. in K (req.: ± 0.5 K)	SD in K (req.: ± 0.8 K)	Median in K	RSD in K
JUL. 2021	8460	-0.11	0.46	-0.03	0.34
AUG. 2021	10237	-0.09	0.47	-0.02	0.33
SEP. 2021	11756	-0.10	0.52	-0.01	0.37
OCT. 2021	12437	-0.11	0.55	-0.01	0.38
NOV. 2021	10033	-0.10	0.55	-0.01	0.38
DEC. 2021	10783	-0.11	0.54	-0.01	0.39
Global Metop-B day-time SST quality results over 2nd half 2021					
JUL. 2021	13385	-0.17	0.60	-0.09	0.39
AUG. 2021	13855	-0.11	0.51	-0.05	0.36
SEP. 2021	14303	-0.07	0.48	-0.02	0.36
OCT. 2021	13474	-0.06	0.44	-0.01	0.37
NOV. 2021	10248	-0.06	0.44	-0.01	0.36
DEC. 2021	11079	-0.06	0.44	-0.02	0.35

Table 8: Quality results for global METOP SST over 2nd half 2021, for 3,4,5 quality indexes

Comments:
Overall statistics are within the requirement.

5.1.6. MGR SST (OSI-204-c) quality

Following the request of the UK MET Office (for OSTIA in CMEMS) to have the SST from 2 Metops, the Full resolution Metop Sea Surface Temperature metagranules are also processed with Metop-C/AVHRR.
The following maps indicate the median night-time and day-time SST median difference with respect to buoys measurements for quality level 3,4,5 over the reporting period. Monthly maps are available on http://osi-saf.eumetsat.int/lml/#qua_SST%Metop%20GBL%20SST_monthly%20map_monthly_Night%20time.

The Metop/AVHRR SST validation report, available on http://osi-saf.eumetsat.int, gives further details about the regional bias observed and their origin.

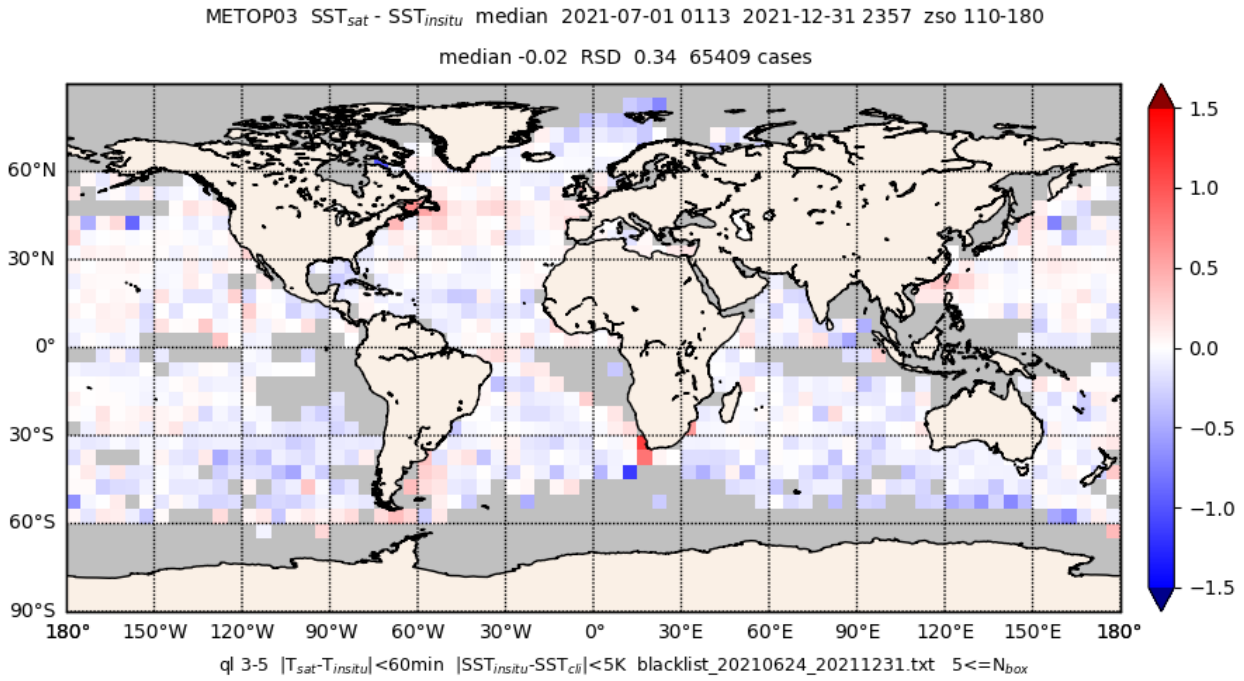


Figure 13: Metop-C night-time SST median difference with respect to buoys measurements for quality level 3,4,5

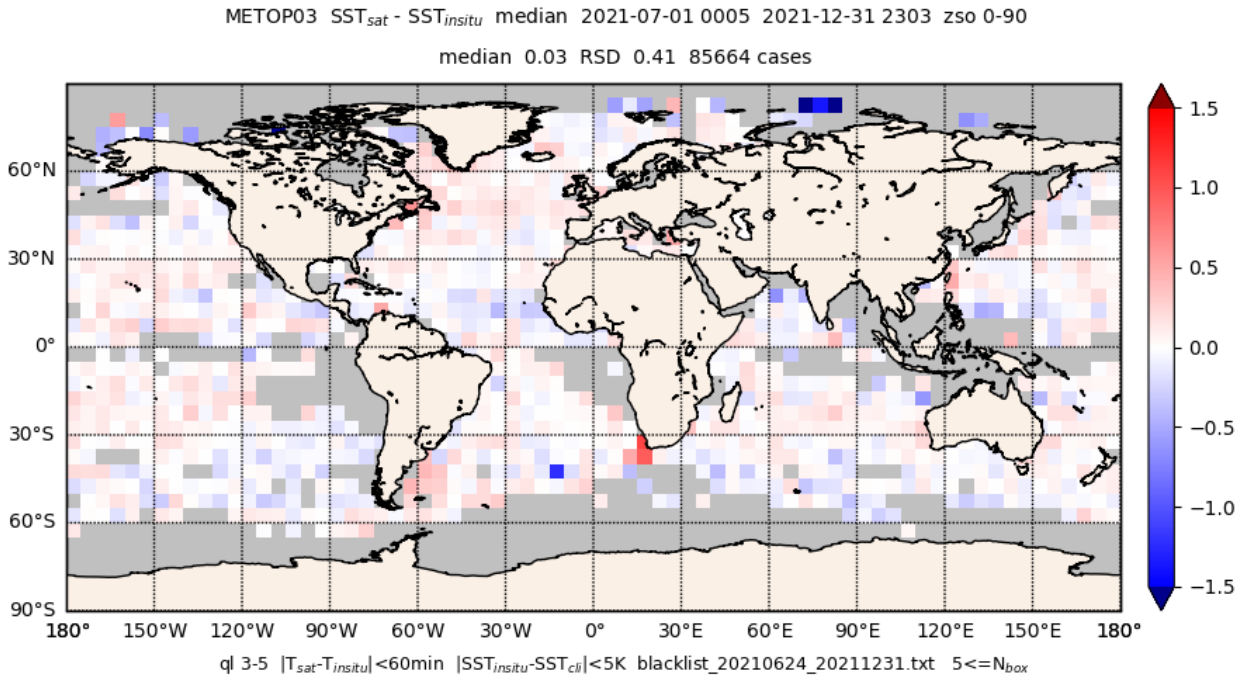


Figure 14: Metop-C day-time SST median difference with respect to buoys measurements for quality level 3,4,5

The following table provides the Metop-derived SST quality results over the reporting period.

Global Metop-C night-time SST quality results over 2nd half 2021					
Month	Number of cases	Mean diff. in K (req.: ± 0.5 K)	SD in K (req.: ± 0.8 K)	Median in K	RSD in K
JUL. 2021	8668	-0.13	0.48	-0.04	0.30
AUG. 2021	10247	-0.12	0.48	-0.04	0.30
SEP. 2021	11992	-0.12	0.53	-0.02	0.35
OCT. 2021	12751	-0.13	0.58	-0.01	0.37
NOV. 2021	10996	-0.13	0.57	-0.03	0.37
DEC. 2021	10755	-0.12	0.54	-0.01	0.36
Global Metop-C day-time SST quality results over 2nd half 2021					
JUL. 2021	14885	-0.14	0.69	-0.04	0.44
AUG. 2021	15454	-0.07	0.63	0.01	0.42
SEP. 2021	15696	0.01	0.53	0.07	0.42
OCT. 2021	15044	0.01	0.50	0.06	0.40
NOV. 2021	12485	0.00	0.49	0.04	0.40
DEC. 2021	12100	0.03	0.49	0.07	0.39

Tableau 9: Quality results for global Metop-C SST over 2nd half 2021, for 3,4,5 quality indexes

Comments:
Overall statistics are within the requirement.

5.1.7. High Latitude SST/IST (OSI-203-a, OSI-203-b, OSI-205-a, OSI-205-b) quality

The OSI-203 and OSI-205 series are high latitude SST and global ice surface temperature (IST) and marginal ice zone surface temperature products.

Conventional measures as Standard Deviation of mean differences (SD) and mean differences are calculated for monthly averages for day-time and night-time. Data with quality levels 3, 4 and 5 are used for both the SST and IST validation. Daytime is defined for data with sun-zenith angles smaller than 90 degrees and night-time data is defined for sun-zenith angles greater than 90 degrees. For the OSI-205 products, the in-situ observations and the centre of the level-2 pixel must be within 3 km of each other and observation times must be within 15 minutes of the satellite crossing time. For the OSI-203 products the in-situ observation must be within the 5 km level-3 pixel and within the 12 hour period that the product covers.
Buoy data used for the SST validation is from the Copernicus Marine Environment Monitoring Service (In Situ TAC).

The IST accuracy requirements are split into two parts in the Product Requirement Document: Namely, surface temperatures from IR radiometers, or similar high quality surface temperature observations, and air temperatures from drifting buoys or similar. The primary reason for splitting IST performance requirements into skin and air temperature requirements is a well documented physical difference between air and skin temperatures (Nielsen-Englyst et al., 2019(https://tc.copernicus.org/articles/13/1005/2019/)). Secondly, buoy temperatures are often associated with higher uncertainty due to unknown snow conditions around the buoy (discussed in the product ATBDs). In accordance with the OSISAF Product Requirement Document (PRD) the OSI-203 and OSI-205 IST target requirements against air temperature observations are: SD < 3 K and bias < 3.5 K; against surface temperature observations: SD < 2 K and bias < 1.5 K.

The air temperature requirements are applied to buoy reference data, including air temperatures from Ice Mass Balance Buoys (IMB), and air temperatures from land based weather stations, like the PROMICE stations on the Greenland Ice Sheet. The surface temperature requirements are applied for radiometric skin temperature measurements and surface temperature references from IMBs, when such data are available and to calculated surface temperature reference measurements for PROMICE stations. The PROMICE surface temperatures are calculated from Incoming and ourgoing lang wave radiation measurements at the PROMICE stations (https://essd.copernicus.org/preprints/essd-2021-80/essd-2021-80.pdf). These reference surface temperatures are considered of high quality.

Due to a 6 month delay on the release of PROMICE surface temperature data, the HYR reporting contains validation against both surface and air temperatures from PROMICE data. We anticipate to get near real time access to PROMICE surface temperatures soon, in order to cover the entire HYR period with PROMICE surface temperature data for future reportings.

5.1.7.1. Level 2 HL SST/IST based on Metop/AVHRR (OSI-205-a)

The Level 2 HL SST/IST (OSI-205-a) is derived from polar satellites data, currently from Metop-B. The following tables and figures provide the OSI-205-a SST quality results over the reporting period.

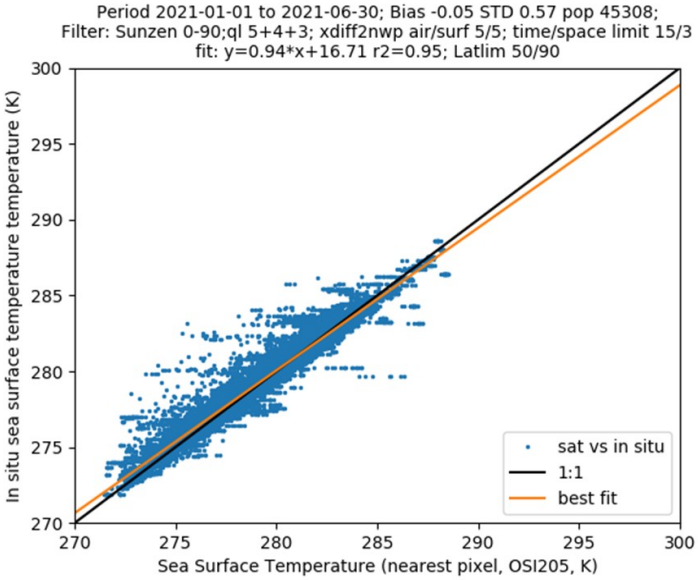


Figure 15: 1st half 2021 OSI-205-a SST mean difference and bias with respect to conventional buoys measurements from the Copernicus In Situ DB. Only daytime data for the northern hemisphere are shown.

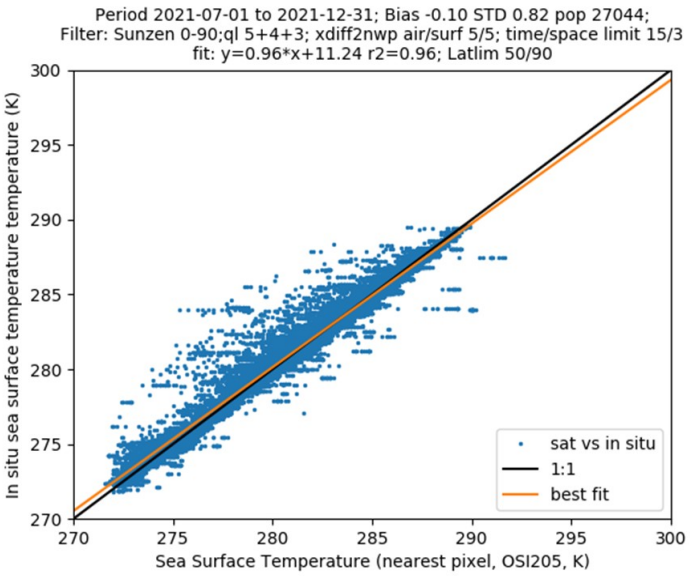


Figure 16: 2nd half 2021 OSI-205-a SST mean difference and bias with respect to conventional buoys measurements from the Copernicus In Situ DB. Only daytime data for the northern hemisphere are shown.

OSI-205-a AVHRR SST quality results over JAN. 2021 to DEC. 2021, night-time, NH					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
JAN. 2021	4989	-0.60	14.3	0.93	7.0
FEB. 2021	2981	-0.55	21.4	0.90	10.0
MAR. 2021	1474	-0.79	-12.9	0.80	20.0
APR. 2021	291	-0.72	-2.9	1.59	-59.0
MAY 2021	N/A	N/A	N/A	N/A	N/A
JUN. 2021	N/A	N/A	N/A	N/A	N/A
1st half 2021	*9735*	*-0.62*	*11.4*	*0.93*	*7.0*
JUL. 2021	N/A	N/A	N/A	N/A	N/A
AUG. 2021	9	0.32	54.3	0.26	74.0
SEP. 2021	1176	-0.45	35.7	0.92	8.0
OCT. 2021	5596	-0.49	30.0	0.93	7.0
NOV. 2021	4788	-0.58	17.1	0.95	5.0
DEC. 2021	3549	-0.60	14.3	1.12	-12.0
2nd half 2021	*15118*	*-0.54*	*22.9*	*0.98*	*2.0*
OSI-205-a AVHRR SST quality results over JAN. 2021 to DEC. 2021, day-time, NH					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
JAN. 2021	2159	-0.26	62.9	0.63	37.0
FEB. 2021	2505	-0.23	67.1	0.56	44.0
MAR. 2021	3242	-0.25	64.3	0.52	48.0
APR. 2021	12689	-0.07	90.0	0.47	53.0
MAY 2021	13513	-0.01	98.6	0.45	55.0
JUN. 2021	11200	0.05	92.9	0.75	25.0
1st half 2021	*45308*	*-0.05*	*92.9*	*0.57*	*43.0*
JUL. 2021	5537	-0.16	77.1	1.14	-14.0
AUG. 2021	3883	-0.07	90.0	0.96	4.0
SEP. 2021	6658	-0.07	90.0	0.71	29.0
OCT. 2021	6642	-0.08	88.6	0.62	38.0
NOV. 2021	2810	-0.14	80.0	0.63	37.0
DEC. 2021	1514	-0.10	85.7	0.58	42.0
2nd half 2021	*27044*	*-0.10*	*85.7*	*0.82*	*18.0*
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|)) (**) SD margin = 100 * (1 - (SD / SD req.)) 100 refers then to a perfect product, 0 to a quality just as required. without margin. A negative result indicates that the product quality does not fulfil the target requirement.					

Table 10: Quality results for OSI-205-a AVHRR SST, for the Northern Hemisphere, over JAN. 2021 to DEC. 2021, for quality level 5,4,3 by night and by day

Comments:
A visual inspection of extreme outliers has been carried out for the reporting period.
For the validation period of July-December 2021, 66 buoys were disqualified from the validation data, since they are supposedly grounded at coast lines.

Validation values for the second half year of 2021 are fully satisfactory and fulfil the requirements on mean error and standard deviation error. The only two values not satisfying the target accuracy

are standard deviation values close to the target accuracy, which still satisfies the threshold requirements of 1.5 K mean difference and standard deviation.
For the previous validation period, January-June 2021, 32 buoys were disqualified from the validation data, since they are supposedly grounded at coast lines.
Validation values for the first half year of 2021 are fully satisfactory and fulfil the requirements on mean error and standard deviation error. The only values not satisfying the target accuracy are night-time values with few observations, which still satisfies the threshold requirements of 1.5 K mean difference and standard deviation.

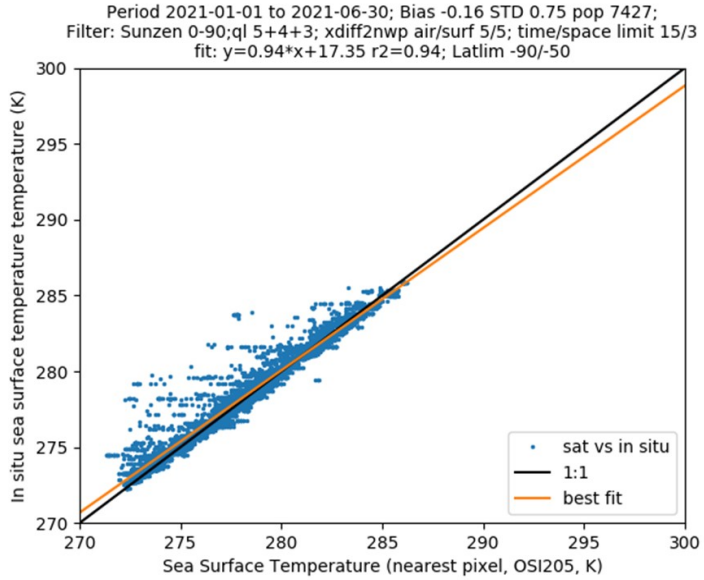


Figure 17: 1st half 2021 OSI-205-a SST mean difference and bias with respect to conventional buoys measurements from the Copernicus In Situ DB. Only daytime data for the southern hemisphere are shown.

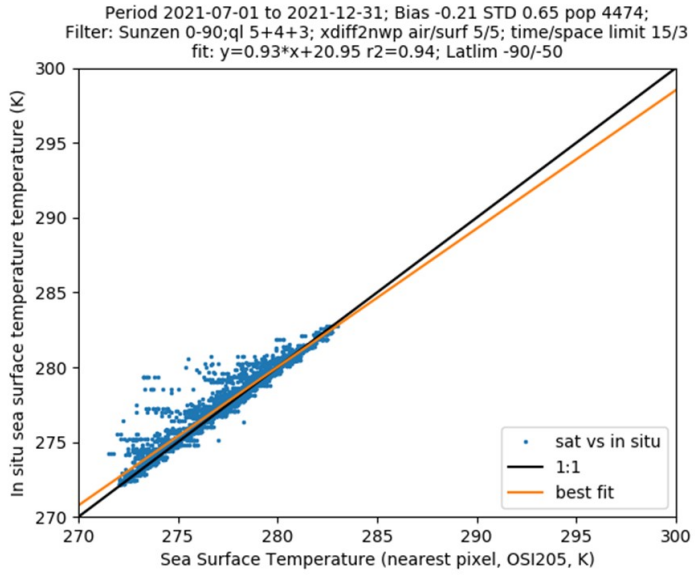


Figure 18: 2nd half 2021 OSI-205-a SST mean difference and bias with respect to conventional buoys measurements from the Copernicus In Situ DB. Only daytime data for the southern hemisphere are shown.

OSI-205-a AVHRR SST quality results over JAN. 2021 to DEC. 2021, night-time, SH					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
JAN. 2021	N/A	N/A	N/A	N/A	N/A
FEB. 2021	450	-0.30	57.1	1.31	-31.0
MAR. 2021	2014	-0.37	47.1	1.08	-8.0
APR. 2021	2391	-0.60	14.3	1.14	-14.0
MAY 2021	2094	-0.81	-15.7	1.19	-19.0
JUN. 2021	1888	-0.75	-7.1	1.08	-8.0
1st half 2021	*8837*	*-0.61*	*12.9*	*1.15*	*-15.0*
JUL. 2021	1282	-0.95	-35.7	1.18	-18.0
AUG. 2021	1028	-0.66	5.7	1.00	0.0
SEP. 2021	879	-0.66	5.7	1.19	-19.0
OCT. 2021	747	-0.37	47.1	0.89	11.0
NOV. 2021	90	-0.12	82.9	0.75	25.0
DEC. 2021	N/A	N/A	N/A	N/A	N/A
2nd half 2021	*4026*	*-0.68*	*2.9*	*1.10*	*-10.0*
OSI-205-a AVHRR SST quality results over JAN. 2021 to DEC. 2021, day-time, SH					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
JAN. 2021	1371	0.00	100.0	0.41	59.0
FEB. 2021	1211	0.03	95.0	0.45	55.0
MAR. 2021	1493	-0.07	90.0	0.46	54.0
APR. 2021	1756	-0.23	67.1	0.87	13.0
MAY 2021	1005	-0.23	67.1	0.84	16.0
JUN. 2021	591	-0.81	-15.7	1.30	-30.0
1st half 2021	*7427*	*-0.16*	*77.1*	*0.75*	*25.0*
JUL. 2021	639	-0.44	37.1	1.00	0.0
AUG. 2021	872	-0.38	45.7	0.74	26.0
SEP. 2021	659	-0.24	65.7	0.69	31.0
OCT. 2021	695	-0.16	77.1	0.39	61.0
NOV. 2021	786	0.01	98.6	0.36	64.0
DEC. 2021	823	-0.07	90.0	0.43	57.0
2nd half 2021	*4474*	*-0.21*	*70.0*	*0.65*	*35.0*
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|)) (**) SD margin = 100 * (1 - (SD / SD req.)) 100 refers then to a perfect product, 0 to a quality just as required. without margin. A negative result indicates that the product quality does not fulfil the requirement.					

Table 11: Quality results for OSI-205-a AVHRR SST, for the Southern Hemisphere, over JAN. 2021 to DEC. 2021, for quality level 5,4,3 by night and by day

Comments:
A visual inspection of extreme outliers has been carried out for the reporting period.
For the validation period of July-December 2021, 5 buoys were disqualified from the validation data, since they are supposedly grounded at coast lines.

Validation values for the second half year of 2021 are fully satisfactory and fulfil the requirements on mean error and standard deviation error. The night-time values not satisfying the target accuracy still satisfy the threshold requirement of 1.5 K for mean difference and standard deviation.

For the previous validation period, January-June 2021, 3 buoys were disqualified from the validation data, since they are supposedly grounded at coast lines.

Validation values for the first half year of 2021 are fully satisfactory and fulfil the requirements on mean error and standard deviation error. The values not satisfying the target accuracy still satisfy the threshold requirement of 1.5 K for mean difference and standard deviation.

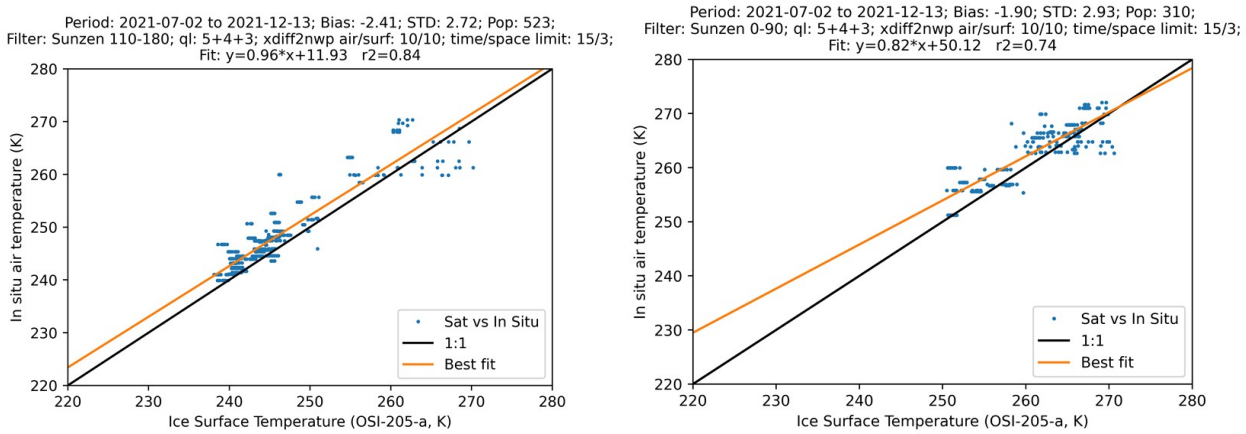


Figure 19: 2nd half 2021 OSI-205-a monthly mean IST mean difference and bias with respect to conventional buoys measurements from the SIMB3 buoys (air temperature). Only data from the Northern Hemisphere and data with quality level 3, 4, 5 are shown. The graph on the left shows night-time data, while the plot on the right only shows day-time observations.

OSI-205-a IST quality results over 2nd half 2021, night-time, air temperature, SIMB3					
Month	Number of cases	Mean diff. in K (req.: ± 3.5 K)	Mean diff. margin (*)	SD in K (req. : ± 3.0 K)	SD margin (**)
JUL. 2021	N/A	N/A	N/A	N/A	N/A
AUG. 2021	N/A	N/A	N/A	N/A	N/A
SEP. 2021	N/A	N/A	N/A	N/A	N/A
OCT. 2021	23	-6.61	-88.86	2.37	21
NOV. 2021	110	-1.07	69.43	1.62	46
DEC. 2021	390	-2.54	27.43	2.70	10
OSI-205-a IST quality results over 2nd half 2021, day-time, air temperature, SIMB3					
Month	Number of cases	Mean diff. in K (req.: ± 3.5 K)	Mean diff. margin (*)	SD in K (req. : ± 3.0 K)	SD margin (**)
JUL. 2021	N/A	N/A	N/A	N/A	N/A
AUG. 2021	17	-3.61	-3.14	0.41	86.33
SEP. 2021	76	-2.47	29.43	2.44	18.67
OCT. 2021	163	-2.11	39.71	2.81	6.33
NOV. 2021	7	-3.23	7.71	1.10	63.33
DEC. 2021	47	0.54	84.57	3.37	-12.33
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|)) (**) SD margin = 100 * (1 - (SD / SD req.)) 100 refers then to a perfect product, 0 to a quality just as required. without margin. A negative result indicates that the product quality does not fulfil the requirement.					

Table 12: Quality results for OSI-205-a Metop AVHRR IST against SIMB3 for the Northen Hemisphere, over 2nd half 2021, for quality levels 3, 4 and 5, by night and by day.

Comments:
For the validation against measured air temperatures of SIMB3 buoys in the Northern Hemisphere the target requirements are mostly satisfied. The exceptions, indicated by the negative margin values in the margin columns, satisfy the threshold requirements of ±4.5K for the mean difference and ±4.0K for the standard deviation, apart from the mean difference of night-time October 2021.

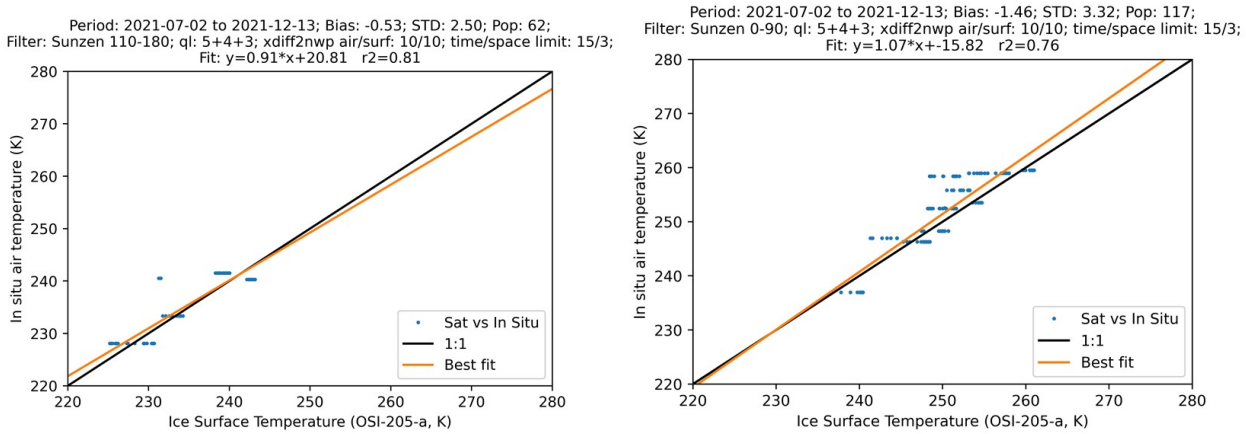


Figure 20: 2nd half 2021 OSI-205-a IST mean difference and bias with respect to air temperatures from the SIMB3 buoys. Only data from the Southern Hemisphere and with quality level 3, 4, 5 are shown. The graph to the left shows night-time observations, while the plot to the right shows day-time observations.

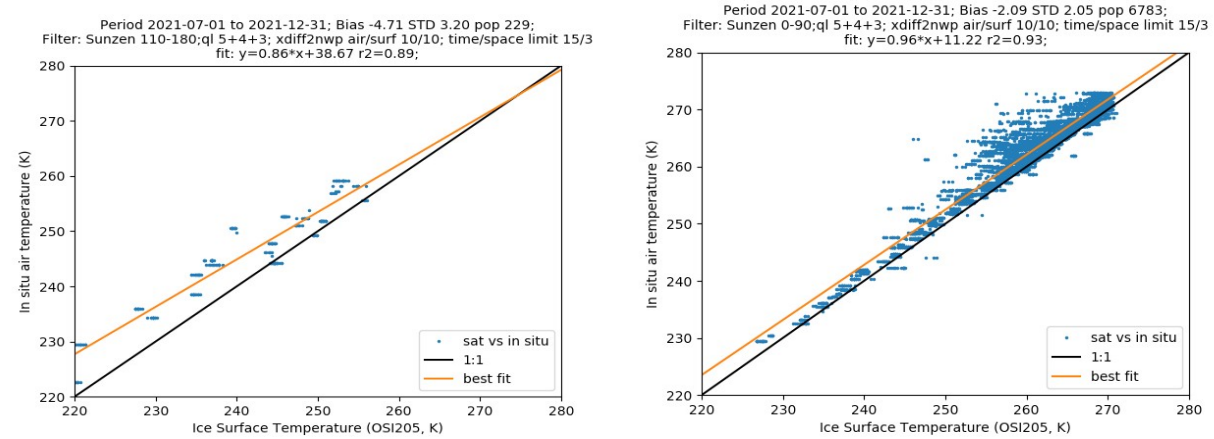


Figure 21: IST PROMICE air: 2nd half 2021 OSI-205 monthly mean IST with respect to air measurements from PROMICE. The graph on the left shows night-time data with quality flags 5, 4 & 3, while the plot on the right only shows day-time observations

OSI-205-a IST quality results over **2nd half 2021**, night-time, air temperature, PROMICE					
Month	Number of cases	Mean diff. in K (target: ±3.5 K)	Mean diff. margin (*)	SD in K (target : ±3.0 K)	SD margin (**)
JUL. 2021	N/A	N/A	N/A	N/A	N/A
AUG. 2021	N/A	N/A	N/A	N/A	N/A
SEP. 2021	16	-1.17	66,6	0.58	80
OCT. 2021	139	-1.48	57,7	1.55	48,3
NOV. 2021	218	-4.11	-17,4	3.46	-15,3
DEC. 2021	229	-4.71	-34,6	3.20	-6,7
OSI-205-a IST quality results over **2nd half 2021**, day-time, air temperature, PROMICE					
Month	Number of cases	Mean diff. in K (target: ±3.5 K)	Mean diff. margin (*)	SD in K (target : ±3.0 K)	SD margin (**)
JUL. 2021	1313	-1.42	59.4	2.07	31
AUG. 2021	1531	-1.68	52	1.90	36.7
SEP. 2021	2720	-2.44	30.3	2.18	27.3
OCT. 2021	1219	-2.53	27.7	1.60	46.7
NOV. 2021	N/A	N/A	N/A	N/A	N/A
DEC. 2021	N/A	N/A	N/A	N/A	N/A
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. target|)) (**) SD margin = 100 * (1 - (SD / SD target)) 100 refers then to a perfect product, 0 to a quality just as targeted. without margin. A negative result indicates that the product quality does not fulfil the target requirement.					

Table 13: Quality results for OSI-205-a Metop AVHRR IST over 2nd half 2021, for quality levels 3, 4 and 5, by night and by day. Compared to PROMICE measured air temperature

Comments:
For the validation against the measured PROMICE air temperatures, the target requirements are generally met as indcated by the margin columns.
However, night-time data for November and December are exceeding the target thresholds slightly.

The used PROMICE stations are all located in the upper ablation or lower accumulation zone, around the equilibrium line, except for the EastGRIP station on the central ice cap. Some of the stations are therefore very close to the ice edge and hence some noise is expected. For the same reason, it is expected that the wind has not had time to cool down before it reaches the weather stations which would explain why the IST is generally colder than the observed air temperature.

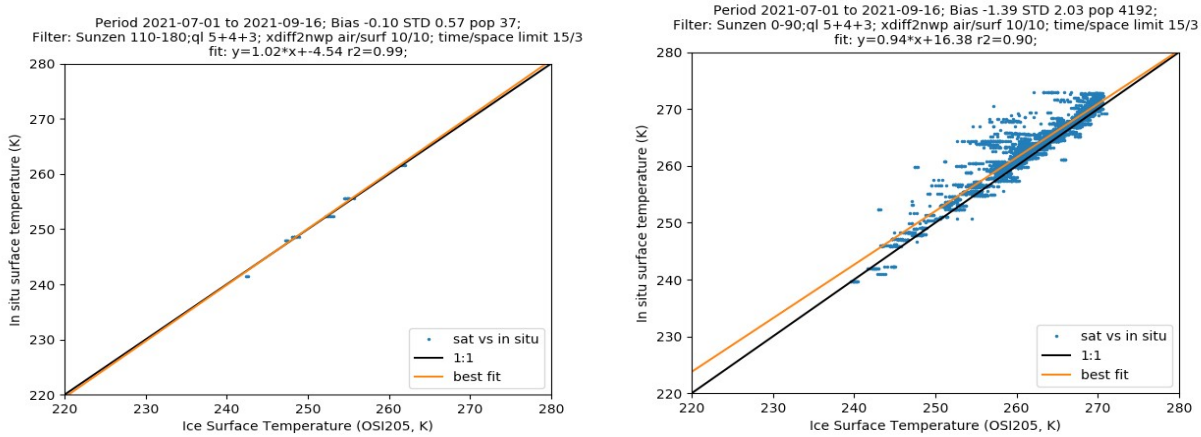


Figure 22: 2nd half 2021 OSI-205-a IST mean difference and bias with respect to surface temperatures from the PROMICE stations. Data with quality level 3, 4, 5 are shown. The graph on the left shows night-time data with quality flags 5, 4 & 3, while the plot on the right only shows day-time observations

OSI-205-a IST quality results over **2nd half 2021**, night-time, surface temperature, PROMICE					
Month	Number of cases	Mean diff. in K (target: ± 1.5 K)	Mean diff. margin (*)	SD in K (target : 2.0 K)	SD margin (**)
JUL. 2021	N/A	N/A	N/A	N/A	N/A
AUG. 2021	N/A	N/A	N/A	N/A	N/A
SEP. 2021	N/A	N/A	N/A	N/A	N/A
OCT. 2021	37	-0.10	93.3	0.57	71.5
NOV. 2021	N/A	N/A	N/A	N/A	N/A
DEC. 2021	N/A	N/A	N/A	N/A	N/A
OSI-205-a IST quality results over **2nd half 2021**, day-time, surface temperature, PROMICE					
Month	Number of cases	Mean diff. in K (target: -1.5 K)	Mean diff. margin (*)	SD in K (target : 2.0 K)	SD margin (**)
JUL. 2021	1213	-1.21	19.33	2.08	-4
AUG. 2021	1363	-1.33	11.33	2.21	-10.5
SEP. 2021	1418	-1.58	-5.33	1.85	7.5
OCT. 2021	198	-1.56	-4	1.41	29.5
NOV. 2021	N/A	N/A	N/A	N/A	N/A
DEC. 2021	N/A	N/A	N/A	N/A	N/A
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. target|))					
(**) SD margin = 100 * (1 - (SD / SD target))					
100 refers then to a perfect product, 0 to a quality just as targeted. without margin.					
A negative result indicates that the product quality does not fulfil the target requirement.					

Table 14: Quality results for OSI-205-a Metop AVHRR IST over 2nd half 2021, for quality levels 3, 4 and 5, by night and by day. Compared to PROMICE measured surface temperature

Comments:
For the validation against calculated surface temperatures from PROMICE stations, for the period July-December 2021, the target requirements are satisfied for night-time measurements. For the day-time however, the target requirements are generally not satisfied as indicated by the negative values in the margin columns. Still, all values satisfy the threshold requirements of ±2.5K for the mean difference and ±3.0K for the standard deviation.

5.1.7.2. Level 2 NHL SST/IST based on NPP/VIRRS (OSI-205-b)

The Level 2 Northern High Latitude Sea and Ice Surface Temperature (NHL SST/IST, OSI-205-b) is based on VIIRS data from SNPP. The following tables provides the OSI-205-b SST and IST quality results.

OSI-205-b NHL VIIRS SST quality results over JAN. 2021 to DEC. 2021, night-time					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
JAN. 2021	2818	-0.425	39.3	0.984	1.6
FEB. 2021	1417	-0.320	54.3	0.902	9.8
MAR. 2021	1047	-0.514	26.5	0.977	2.3
APR. 2021	715	-0.785	-12.1	1.025	-2.5
MAY 2021	394	-0.570	18.6	1.126	-12.6
JUN. 2021	1154	-0.366	47.7	0.961	3.9
JUL. 2021	852	-0.594	15.2	1.084	-8.4
AUG. 2021	1234	-0.324	53.8	1.034	-3.4
SEP. 2021	2382	-0.344	50.9	1.049	-4.9
OCT. 2021	3623	-0.369	47.2	0.979	2.1
NOV. 2021	2422	-0.425	39.3	0.966	3.4
DEC. 2021	3203	-0.418	40.3	0.916	8.4
OSI-205-b NHL VIIRS SST quality results over JAN. 2021 to DEC. 2021, day-time					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
JAN. 2021	1178	-0.407	41.8	0.712	28.8
FEB. 2021	1203	-0.342	51.1	0.664	33.6
MAR. 2021	616	-0.403	42.4	0.722	27.8
APR. 2021	66	-0.278	60.3	0.734	26.6
MAY 2021	595	-0.001	99.8	0.555	44.5
JUN. 2021	4081	-0.057	91.9	0.678	32.2
JUL. 2021	2804	-0.103	85.2	0.800	20.0
AUG. 2021	2008	-0.119	83.0	0.826	17.4
SEP. 2021	2908	-0.130	81.4	0.746	26.4
OCT. 2021	3240	-0.147	79.0	0.733	26.7
NOV. 2021	1328	-0.301	56.9	0.664	33.6
DEC. 2021	1022	-0.383	45.3	0.735	26.5
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|)) (**) SD margin = 100 * (1 - (SD / SD req.)) 100 refers then to a perfect product, 0 to a quality just as required. without margin. A negative result indicates that the product quality does not fulfil the requirement.					

Table 15: Quality results for OSI-205-b NHL VIIRS SST, over Northern Atlantic and Arctic Ocean, over JAN. 2021 to DEC. 2021, for 3,4,5 quality indexes, by night and by day. Comparison with drifting buoys.

Comments:
The validation of the SST part of the OSI-205-b product shows that mean difference is within the target requirement for all months, both daytime and night-time, except April at night-time. For the standard deviation the quality is within the target requirement for all months at daytime, but at nighttime only for half of the months. For the remaining night-time months the quality is within the threshold requirement.

These results now also contain the twilight condition data, for all months.

OSI-205-b NHL VIIRS IST quality results over JAN. 2021 to DEC. 2021, night-time					
Month	Number of cases	Mean diff. in K (req.: ± 3.5 K)	Mean diff. margin (*)	SD in K (req.: ± 3.0 K)	SD margin (**)
JAN. 2021	70	-1.281	14.6	1.060	47.0
FEB. 2021	45	-1.694	-12.9	1.699	15.1
MAR. 2021	46	-1.347	10.2	1.482	25.9
APR. 2021	44	-1.331	11.3	1.237	38.1
MAY 2021	18	-0.928	38.1	0.728	63.6
JUN. 2021	0				
JUL. 2021	8	-0.287	80.8	1.085	45.7
AUG. 2021	31	-1.630	-8.7	2.683	-34.1
SEP. 2021	103	-1.099	26.8	2.208	-10.4
OCT. 2021	38	-0.700	53.3	1.544	22.8
NOV. 2021	-				
DEC. 2021	-				
OSI-205-b NHL VIIRS IST quality results over JAN. 2021 to DEC. 2021, day-time					
Month	Number of cases	Mean diff. in K (req.: ± 3.5 K)	Mean diff. margin (*)	SD in K (req.: ± 3.0 K)	SD margin (**)
JAN. 2021	27	-1.400	6.6	0.751	62.4
FEB. 2021	26	-1.710	-14.0	1.285	35.7
MAR. 2021	40	-1.754	-16.9	1.453	27.3
APR. 2021	301	-1.772	-18.1	1.517	24.1
MAY 2021	487	-1.836	-22.4	1.601	19.9
JUN. 2021	247	-1.707	-13.8	1.842	7.9
JUL. 2021	288	-1.385	7.7	1.723	13.8
AUG. 2021	222	-1.478	1.5	1.686	15.7
SEP. 2021	220	-1.619	-7.9	1.640	18.0
OCT. 2021	49	-1.135	24.3	1.138	43.1
NOV. 2021	-				
DEC. 2021	-				
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|))					
(**) SD margin = 100 * (1 - (SD / SD req.))					
100 refers then to a perfect product, 0 to a quality just as required. without margin.					
A negative result indicates that the product quality does not fulfil the requirement.					

Table 16: Quality results for OSI-205-b NHL VIIRS IST, over Northern Atlantic and Arctic Ocean, over JAN. 2021 to DEC. 2021, for 3,4,5 quality indexes, by night and by day. Compared to PROMICE measured surface temperature. Data was not available for November and December.

Comments:
The validation of the IST part of the OSI-205-b for this period shows a quality for the mean difference that is within the target requirement for all months at daytime and nighttime, except August at nighttime and September at daytime. For the standard deviation the quality is within the target requirement for all months, except August and October at nighttime. The values outside target requirement are all within the threshold requirement.
This is the first time the PROMICE data are used for validation of this product.

5.1.7.3. Level 3 NHL SST/IST based on Metop/AVHRR (OSI-203-a)

The Level 3 Northern High Latitude Sea and Sea Ice Surface Temperature (NHL SST/IST, OSI-203-a) is derived from the level 2 SST/IST product OSI-205-a, which is based on AVHRR data from Metop-B.

The following tables provide the OSI-203-a SST quality, then IST quality results.

OSI-203-a NHL AVHRR SST quality results over JAN. 2021 to DEC. 2021, night-time					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
JAN. 2021	2817	-0.651	6.9	0.834	16.6
FEB. 2021	1585	-0.623	11.0	0.808	19.2
MAR. 2021	1443	-0.741	-5.8	0.711	28.9
APR. 2021	2585	-0.441	37.1	0.885	11.5
MAY 2021	1778	-0.284	59.4	0.836	16.4
JUN. 2021	906	-0.317	54.7	1.116	-11.6
JUL. 2021	849	-0.509	27.3	1.240	-24.0
AUG. 2021	1299	-0.231	67.0	1.016	-1.6
SEP. 2021	2285	-0.445	36.5	0.906	9.4
OCT. 2021	3586	-0.553	21.0	0.858	14.2
NOV. 2021	3969	-0.628	10.2	0.844	15.6
DEC. 2021	4537	-0.632	9.8	0.819	18.1
OSI-203-a NHL AVHRR SST quality results over JAN. 2021 to DEC. 2021, day-time					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
JAN. 2021	2002	-0.315	97.9	0.639	36.1
FEB. 2021	2029	-0.332	55.0	0.681	31.9
MAR. 2021	2916	-0.283	52.5	0.583	41.7
APR. 2021	9044	-0.160	59.6	0.471	52.9
MAY 2021	6409	-0.042	77.2	0.474	52.6
JUN. 2021	4788	-0.020	94.0	0.684	31.6
JUL. 2021	3381	-0.111	84.1	0.885	11.5
AUG. 2021	2760	-0.099	85.8	0.841	15.9
SEP. 2021	4920	-0.060	91.4	0.692	30.8
OCT. 2021	4847	-0.201	71.3	0.659	34.1
NOV. 2021	3308	-0.262	62.6	0.649	35.1
DEC. 2021	1806	-0.362	48.3	0.720	28.0
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|)) (**) SD margin = 100 * (1 - (SD / SD req.)) 100 refers then to a perfect product, 0 to a quality just as required. without margin. A negative result indicates that the product quality does not fulfil the requirement.					

Table 17: Quality results for OSI-203-a NHL AVHRR SST over JAN. 2021 to DEC. 2021, for 3,4,5 quality indexes, by night and by day. Comparison with drifting buoys.

Comments:
For this period the SST validation results are within the target requirement for both mean difference and standard deviation for all months, except for standard deviation at night-time in July and August (where it is within threshold requirement).
These results now also contain the twilight condition data, for all months.

OSI-203-a NHL AVHRR IST quality results over JAN. 2021 to DEC. 2021, night-time					
Month	Number of cases	Mean diff. in K (req.: ± 1.5 K)	Mean diff. margin (*)	SD in K (req.: ± 2.0 K)	SD margin (**)
JAN. 2021	29	-1.872	-24.8	2.004	-0.2
FEB. 2021	24	-2.988	-99.2	2.199	-9.9
MAR. 2021	26	-2.921	-94.7	2.478	-23.9
APR. 2021	16	-3.249	-116.6	2.506	-25.3
MAY 2021	0				
JUN. 2021	0				
JUL. 2021	0				
AUG. 2021	10	-3.182	-112.1	2.302	-15.1
SEP. 2021	52	-2.400	-60.0	2.507	-25.4
OCT. 2021	108	-2.388	-59.2	2.509	-25.5
NOV. 2021	-				
DEC. 2021	-				
OSI-203-a NHL AVHRR IST quality results over JAN. 2021 to DEC. 2021, day-time					
Month	Number of cases	Mean diff. in K (req.: ± 1.5 K)	Mean diff. margin (*)	SD in K (req.: ± 2.0 K)	SD margin (**)
JAN. 2021	12	-1.638	-9.2	1.844	7.8
FEB. 2021	13	-1.760	-17.3	1.484	25.8
MAR. 2021	24	-1.634	-8.9	2.195	-9.7
APR. 2021	131	-0.581	61.2	2.638	-31.9
MAY 2021	229	-0.164	89.1	2.541	-27.1
JUN. 2021	156	-2.181	-45.4	2.463	-23.2
JUL. 2021	116	-2.414	-61.0	2.614	-30.7
AUG. 2021	119	-2.791	-86.1	2.460	-23.0
SEP. 2021	144	-0.988	34.1	3.097	-54.8
OCT. 2021	96	-0.828	44.8	2.215	-10.8
NOV. 2021	-				
DEC. 2021	-				
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|))					
(**) SD margin = 100 * (1 - (SD / SD req.))					
100 refers then to a perfect product, 0 to a quality just as required. without margin.					
A negative result indicates that the product quality does not fulfil the requirement.					

Table 18: Quality results for OSI-203-a NHL AVHRR IST over JAN. 2021 to DEC. 2021, for 3,4,5 quality indexes, by night and by day. Comparison with air temperature from buoys.

Comments:
The IST validation results for this period show that the mean difference is within the target requirement at daytime for September and October, but outside for July and August. For nighttime the mean difference is outside for all months with data. For standard deviation the validation results are outside the target requirement both daytime and nighttime. All validation results outside target requirement are withing threshold requirement.
This is the first time the PROMICE data are used for validation of this product.

5.1.7.4. Level 3 NHL SST/IST based on NPP/VIRRS (OSI-203-b)

The Level 3 Northern High Latitude Sea and Ice Surface Temperature (NHL SST/IST, OSI-203-b) is derived from the Level 2 SST/IST product OSI-205-b, which is based on VIIRS data from SNPP.

The following tables provides the OSI-203-b SST and IST quality results.

OSI-203-b NHL VIIRS SST quality results over JAN. 2021 to DEC. 2021, night-time					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
JAN. 2021	4115	-0.455	35.0	0.884	11.6
FEB. 2021	2553	-0.390	44.3	0.893	10.7
MAR. 2021	2851	-0.522	25.3	0.888	11.2
APR. 2021	3682	-1.306	-86.6	0.954	4.6
MAY 2021	736	-0.881	-25.9	1.195	-19.5
JUN. 2021	1903	-0.510	27.1	0.993	0.7
JUL. 2021	1716	-0.770	-10.0	1.128	-12.8
AUG. 2021	1970	-0.628	10.3	1.144	-14.4
SEP. 2021	4482	-0.488	30.3	0.991	0.9
OCT. 2021	7159	-0.453	35.3	0.914	8.6
NOV. 2021	8352	-0.452	35.5	0.854	14.6
DEC. 2021	9117	-0.434	38.0	0.872	12.8
OSI-203-b NHL VIIRS SST quality results over JAN. 2021 to DEC. 2021, day-time					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
JAN. 2021	2887	-0.453	35.3	0.673	32.7
FEB. 2021	2436	-0.401	42.7	0.697	30.3
MAR. 2021	1490	-0.452	35.5	0.630	37.0
APR. 2021	885	-0.304	56.5	0.491	50.9
MAY 2021	551	-0.016	97.7	0.548	45.2
JUN. 2021	4773	-0.121	82.8	0.635	36.5
JUL. 2021	3067	-0.128	81.7	0.744	25.6
AUG. 2021	2374	-0.126	81.9	0.705	29.5
SEP. 2021	4219	-0.168	75.9	0.636	36.4
OCT. 2021	5810	-0.268	61.8	0.629	37.1
NOV. 2021	4793	-0.382	45.4	0.624	37.6
DEC. 2021	2746	-0,41	42.2	0.633	36.7
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|))					
(**) SD margin = 100 * (1 - (SD / SD req.))					
100 refers then to a perfect product, 0 to a quality just as required. without margin.					
A negative result indicates that the product quality does not fulfil the requirement.					

Table 19: Quality results for OSI-203-b NHL VIIRS SST over JAN. 2021 to DEC. 2021, for 3,4,5 quality indexes, by night and by day. Comparison with drifting buoys.

Comments:
For this period the SST validation results are within the target requirement for both mean difference and standard deviation for all months, except at nighttime in July and August for (where it is within threshold requirement).
These results now also contain the twilight condition data, for all months.

OSI-203-b NHL VIIRS IST quality results over JAN. 2021 to DEC. 2021, night-time					
Month	Number of cases	Mean diff. in K (req.: ± 1.5 K)	Mean diff. margin (*)	SD in K (req.: ± 2.0 K)	SD margin (**)
JAN. 2021					
FEB. 2021					
MAR. 2021	0				
APR. 2021	13	-3.530	-135.3	2.524	-26.2
MAY 2021	0				
JUN. 2021	0				
JUL. 2021	0				
AUG. 2021	13	-4.953	-230.2	1.468	26.6
SEP. 2021	43	-3.781	-152.0	2.502	-25.1
OCT. 2021	87	-2.030	-35.4	2.124	-6.2
NOV. 2021	-				
DEC. 2021	-				
OSI-203-b NHL VIIRS IST quality results over JAN. 2021 to DEC. 2021, day-time					
Month	Number of cases	Mean diff. in K (req.: ± 1.5 K)	Mean diff. margin (*)	SD in K (req.: ± 2.0 K)	SD margin (**)
JAN. 2021					
FEB. 2021					
MAR. 2021	0				
APR. 2021	90	-2.059	-37.2	2.336	-16.8
MAY 2021	141	-2.247	-49.8	2.051	-2.5
JUN. 2021	106	-2.862	-90.8	1.704	14.8
JUL. 2021	75	-3.244	-116.3	1.892	5.4
AUG. 2021	81	-3.080	-105.3	1.880	6.0
SEP. 2021	97	-1.254	16.4	3.164	-58.2
OCT. 2021	55	-0.341	77.3	1.839	8.0
NOV. 2021	-				
DEC. 2021	-				
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|)) (**) SD margin = 100 * (1 - (SD / SD req.)) 100 refers then to a perfect product, 0 to a quality just as required. without margin. A negative result indicates that the product quality does not fulfil the requirement.					

Table 20: Quality results for OSI-203-b NHL VIIRS IST over JAN. 2021 to DEC. 2021, for 3,4,5 quality indexes, by night and by day, compared to PROMICE measured surface temperature. Data was not available for November and December.

Comments:
The IST validation results for this period show that the mean difference is within the target requirement at daytime for September and October, but outside for July and August. July and August are also outside the threshold requirement. For night-time the mean difference is outside for the three months with data. For standard deviation the validation results are within the target requirement for half of the months and outside for the other months.

This is the first time the PROMICE data are used for validation of this product. The validation is done against the mean of the in situ data over the 12 hour period covered by each L3 product. The ice surface temperature can have large daily variation, and satellite data contributing to the 12 hourly composites is not evenly distributed through the day, as for the in situ observations. The validation results can therefore be significant worse the corresponding L2 validation results.

5.1.8. IASI SST (OSI-208-b) quality

The product requirements for IASI SSTs are to have a target accuracy of 0.5 K mean difference and 0.8 K standard deviation compared to drifting buoy SSTs.

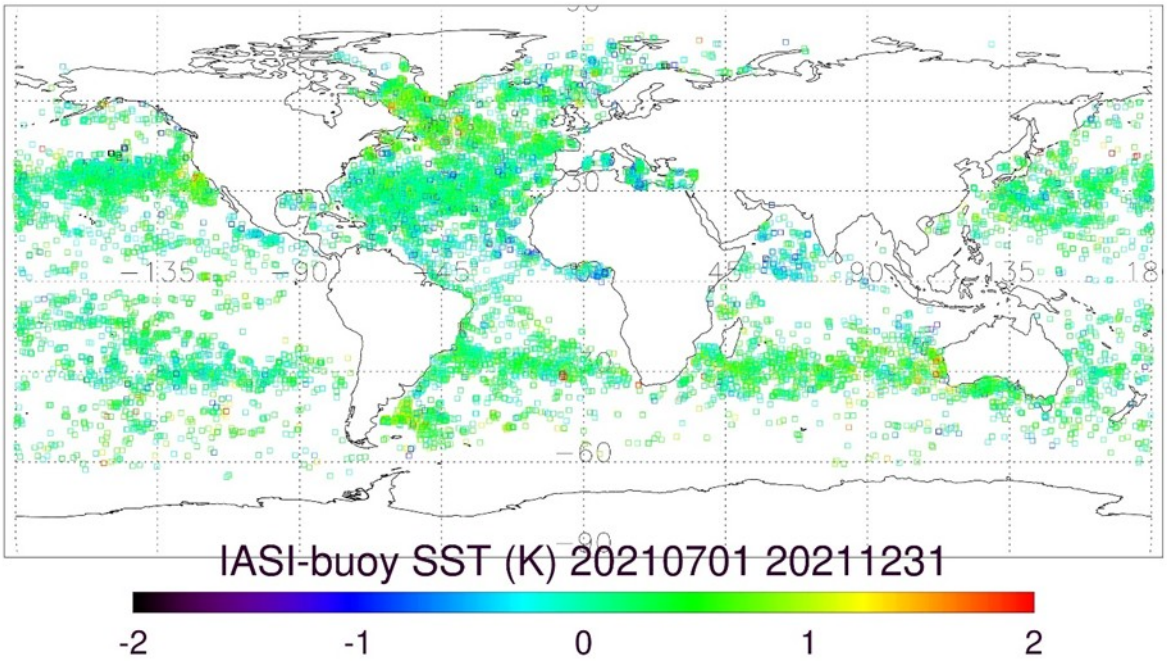


Figure 23: Mean Metop-B IASI night-time SST minus drifting buoy SST for Quality Levels 3, 4 and 5 from JUL. 2021 to DEC. 2021

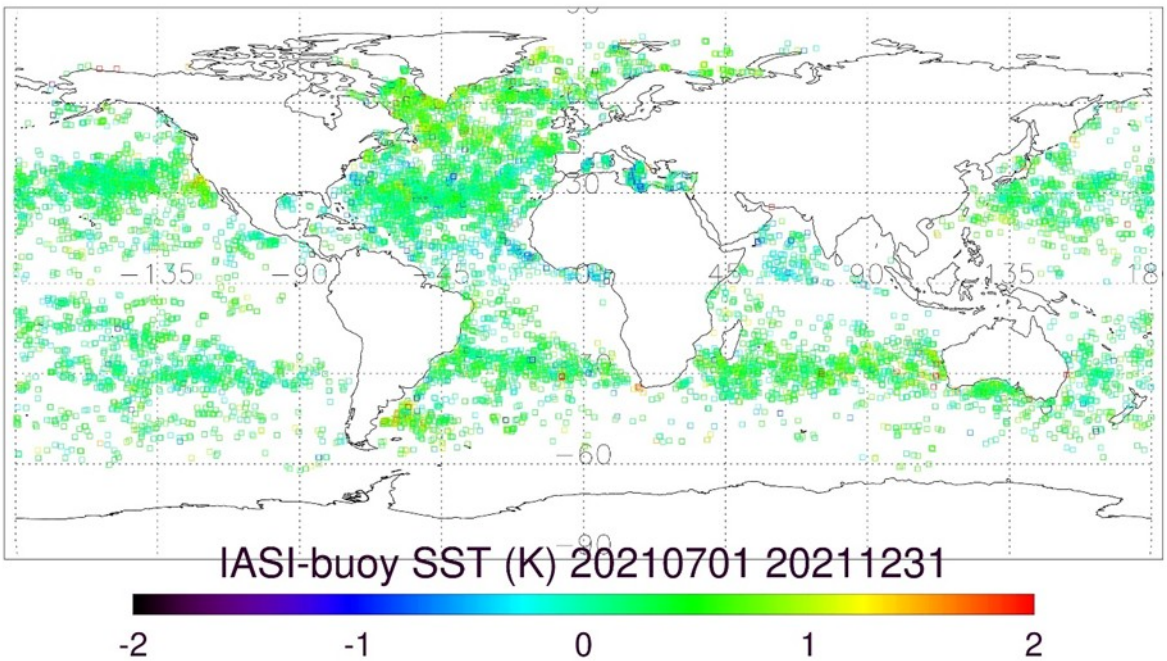


Figure 24: Mean Metop-B IASI day-time SST minus drifting buoy SST for Quality Levels 3, 4 and 5 from JUL. 2021 to DEC. 2021

The following table provides the Metop-B derived IASI SST quality results over the reporting period.

Global Metop-B IASI night-time SST quality results over 2nd half 2021					
Month	Number of cases	Mean diff. in K (req. : ± 0.5 K)	Mean diff. margin (*)	SD in K (req. : ± 0.8 K)	SD margin (**)
JUL. 2021	2014	0.19	62	0.47	41
AUG. 2021	3144	0.19	62	0.50	38
SEP. 2021	2696	0.22	56	0.52	35
OCT. 2021	2440	0.21	58	0.52	35
NOV. 2021	2292	0.17	66	0.52	35
DEC. 2021	2517	0.17	66	0.45	44
Global Metop-B IASI day-time SST quality results over 2nd half 2021					
JUL. 2021	1576	0.31	38	0.47	41
AUG. 2021	2261	0.30	40	0.45	44
SEP. 2021	2295	0.30	40	0.48	40
OCT. 2021	1937	0.26	48	0.46	43
NOV. 2021	1828	0.26	48	0.43	47
DEC. 2021	1952	0.28	44	0.45	44
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|)) (**) SD margin = 100 * (1 - (SD / SD req.)) 100 refers then to a perfect product, 0 to a quality just as required. without margin. A negative result indicates that the product quality does not fulfil the requirement.					

Table 21: Quality results for global Metop-B IASI SST over 2nd half 2021 , for Quality Levels 3, 4 and 5

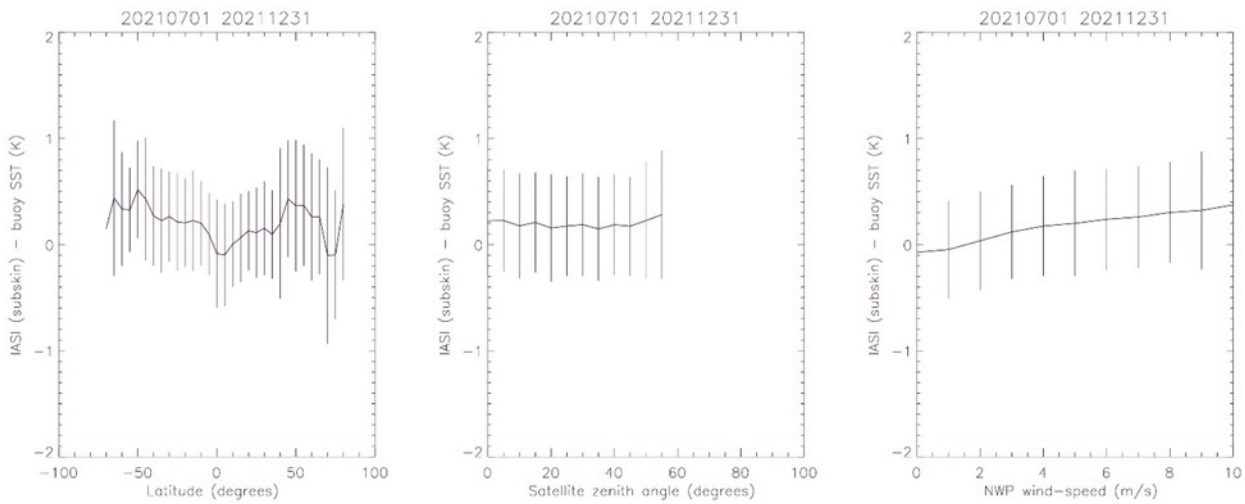


Figure 25: Mean Metop-B IASI night-time SST minus drifting buoy SST analyses for Quality Levels 3, 4 and 5, JAN. 2021 to DEC. 2021

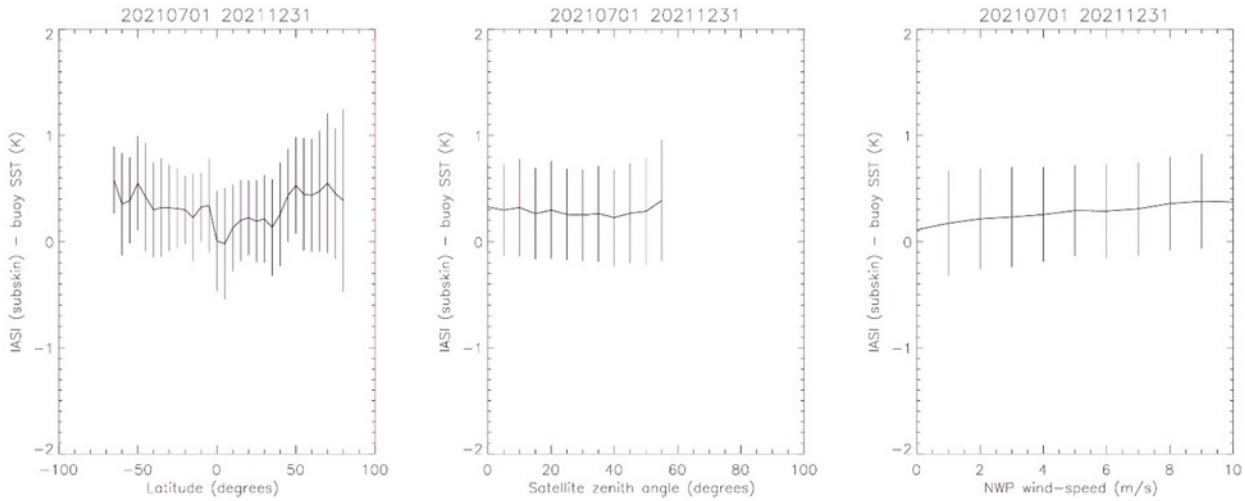


Figure 26: Mean Metop-B IASI day-time SST minus drifting buoy SST analyses for Quality Levels 3, 4 and 5, JAN. 2021 to DEC. 2021

Comments:
Over the six month reporting period the night-time mean IASI bias (for quality levels 3 and above) against drifting buoy SSTs is 0.19K with a standard deviation of 0.50K (n=15103); and the day-time mean bias is 0.28K, standard deviation 0.46K (n=11849). The monthly mean and whole time period results and within the target accuracy.

5.2. Radiative Fluxes quality

5.2.1. DLI quality

DLI products are constituted of the geostationary products (GOES-East, Meteosat 0°, Meteosat Indian Ocean) and the polar ones (Atlantic High Latitude). DLI values are required to have the following accuracy when compared to land pyrgeometer measurements:

- monthly relative mean difference less than 5%,
- monthly difference standard deviation less than 10%.

The match-up data base the statistics are based on is continuously enriched, so that, for the same period, results may evolve depending on the date when the statistics were calculated.

5.2.1.1. GOES-East DLI (OSI-305-b) quality

The list of pyrgeometer stations used for validating the geostationary DLI products is available on the OSI SAF Web Site from the following page:
http://osi-saf.eumetsat.int/lml/img/flx_map_stations.gif
The list of stations has been updated on the 8 October 2018: some stations have been removed because they had not provided data for more than one year, some stations have been added after assessment of their quality.

The following table provides the hourly and daily DLI quality results over the reporting period.

GOES-East hourly DLI quality results from JAN. 2021 to DEC. 2021								
Month	Number of cases	Mean DLI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)	Median	RSD
JAN. 2021	2540	266.27	-6.46	75.74	16.17	79.76	-4.58	12.82
FEB. 2021	3195	276.39	-6.56	76.27	18.19	78.06	-4.95	16.59
MAR. 2021	3676	309.44	-2.34	92.44	14.86	83.99	-1.61	13.82
APR. 2021	2839	304.05	-1.19	96.09	14.21	84.42	-0.51	12.41
MAY 2021	2854	334.62	-0.55	98.36	13.19	86.86	-0.50	12.34
JUN. 2021	2877	374.61	2.29	93.89	14.23	87.34	1.42	12.40
JUL. 2021	2962	386.70	2.15	94.44	14.33	87.65	1.36	12.58
AUG. 2021	2964	385.47	1.63	95.77	14.16	87.76	0.41	11.70
SEP. 2021	3254	356.65	0.98	97.25	14.48	86.47	0.54	12.77
OCT. 2021	3689	342.96	-3.61	89.47	14.94	85.48	-2.89	11.99
NOV. 2021	2861	274.75	-1.55	94.36	14.77	82.08	0.05	12.99
DEC. 2021	2974	277.85	-6.32	77.25	19.56	76.53	-4.08	16.80

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 5 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 – (SD in % / SD req. in %))
with SD req. = 10%
Same comment as for Mean diff. margin

Table 22: GOES-East hourly DLI quality results from JAN. 2021 to DEC. 2021.

GOES-East daily DLI quality results from JAN. 2021 to DEC. 2021								
Month	Number of cases	Mean DLI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)	Median	RSD
JAN. 2021	107	265.93	-6.20	76.69	9.10	88.59	-5.19	8.23
FEB. 2021	135	276.16	-6.86	75.16	11.75	85.82	-6.36	11.80
MAR. 2021	153	308.77	-2.40	92.23	8.23	91.12	-1.87	8.74
APR. 2021	118	304.23	-1.10	96.38	7.17	92.14	-0.88	6.63
MAY 2021	124	335.20	-0.29	99.13	6.50	93.54	0.48	6.76
JUN. 2021	120	374.65	2.28	93.91	7.10	93.68	2.32	6.84
JUL. 2021	124	386.70	2.09	94.60	8.21	92.92	1.97	7.94
AUG. 2021	123	385.53	1.66	95.69	7.36	93.64	1.47	6.53
SEP. 2021	132	356.82	0.89	97.51	8.62	91.95	1.70	8.81
OCT. 2021	153	343.05	-3.62	89.45	8.97	91.28	-3.05	8.24
NOV. 2021	117	275.49	-1.57	94.30	8.21	90.07	-0.45	8.49
DEC. 2021	124	277.87	-6.33	77.22	10.79	87.06	-6.31	11.52

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 5 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 - (SD / SD req.))
with SD req. = 10%
Same comment as for Mean diff. margin

Table 23: GOES-East daily DLI quality results from JAN. 2021 to DEC. 2021.

Comments:
Overall statistics are within the requirement.

5.2.1.2. Meteosat 0° DLI (OSI-303-a) quality

The following table provides the hourly and daily DLI quality results over the reporting period.

Meteosat 0° hourly DLI quality results from JAN. 2021 to DEC. 2021								
Month	Number of cases	Mean DLI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)	Median	RSD
JAN. 2021	744	290.85	-11.38	60.87	18.91	78.33	-10.52	15.65
FEB. 2021	640	292.42	-3.63	87.59	16.90	80.74	-2.56	14.64
MAR. 2021	744	288.00	-0.94	96.74	14.97	82.67	0.18	13.74
APR. 2021	718	287.16	5.60	80.50	13.81	83.97	5.13	11.89
MAY 2021	719	321.02	3.36	89.53	12.28	87.25	3.93	11.59
JUN. 2021	695	360.83	3.85	89.33	11.47	89.40	4.05	12.03
JUL. 2021	669	361.73	3.32	90.82	11.64	89.27	3.53	11.11
AUG. 2021	694	359.47	3.02	91.60	12.10	88.78	3.30	10.65
SEP. 2021	538	352.58	1.80	94.89	11.58	89.05	1.94	10.99
OCT. 2021	597	314.06	1.60	94.91	14.67	84.43	1.62	13.21
NOV. 2021	646	293.05	-5.68	80.62	17.38	80.23	-3.58	14.81
DEC. 2021	615	292.28	-16.19	44.61	22.48	74.36	-13.66	23.72

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 5 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 - (SD / SD req.))
with SD req. = 10%
Same comment as for Mean diff. margin

Table 24: Meteosat 0° hourly DLI quality results from JAN. 2021 to DEC. 2021.

Meteosat 0° daily DLI quality results from JAN. 2021 to DEC. 2021								
Month	Number of cases	Mean DLI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)	Median	RSD
JAN. 2021	31	290.91	-11.41	60.78	10.82	87.60	-10.72	10.30
FEB. 2021	27	292.51	-4.03	86.22	10.10	88.49	-3.18	12.31
MAR. 2021	31	288.03	-0.94	96.74	6.22	92.80	-0.34	4.54
APR. 2021	30	287.15	5.69	80.18	6.56	92.38	5.05	4.64
MAY 2021	30	320.97	3.37	89.50	4.20	95.64	3.38	5.26
JUN. 2021	29	360.83	3.84	89.36	5.37	95.04	4.14	5.34
JUL. 2021	28	361.72	3.30	90.88	4.71	95.66	3.82	5.18
AUG. 2021	29	359.46	3.06	91.49	4.86	95.49	2.44	3.98
SEP. 2021	22	352.39	1.62	95.40	5.42	94.87	0.92	6.11
OCT. 2021	25	314.12	1.58	94.97	6.15	93.47	2.96	5.91
NOV. 2021	27	293.09	-5.73	80.45	8.88	89.90	-3.67	10.11
DEC. 2021	25	291.94	-16.42	43.76	15.57	82.22	-11.05	15.55

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 5 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 - (SD / SD req.))
with SD req. = 10%
Same comment as for Mean diff. margin

Table 25: Meteosat 0° daily DLI quality results from JAN. 2021 to DEC. 2021.

Comments:
Overall statistics are within the requirement.

5.2.1.3. Meteosat Indian Ocean DLI (OSI-IO-DLI) quality

Since 2016, Meteosat-8 is in position 41.5 east for the Indian Ocean Data Coverage (IODC). Downward Long wave Irradiance is processed as a demonstration product.

The following table provides the hourly and daily DLI quality results over the reporting period.

Meteosat Indian Ocean hourly DLI quality results from JAN. 2021 to DEC. 2021								
Month	Number of cases	Mean DLI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)	Median	RSD
JAN. 2021	739	290.68	-11.48	60.51	20.37	76.64	-12.88	18.59
FEB. 2021	618	292.76	-2.31	92.11	18.41	79.04	-2.51	16.11
MAR. 2021	732	289.90	1.69	94.17	17.77	79.57	1.29	15.84
APR. 2021	720	289.54	8.09	72.06	15.38	82.29	7.84	12.04
MAY 2021	707	325.80	7.82	76.00	17.54	82.05	5.61	15.55
JUN. 2021	682	364.93	8.10	77.80	14.44	86.81	7.66	12.87
JUL. 2021	669	365.73	7.32	79.99	14.34	86.93	6.34	12.34
AUG. 2021	694	362.27	5.82	83.93	13.80	87.30	5.14	11.98
SEP. 2021	538	354.16	3.38	90.46	15.49	85.42	2.93	12.60
OCT. 2021	597	317.41	4.95	84.41	19.37	79.66	2.29	16.28
NOV. 2021	646	296.14	-2.58	91.29	21.32	76.00	-1.98	18.98
DEC. 2021	633	295.50	-13.53	54.21	23.43	73.57	-11.89	24.09

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 5 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 - (SD / SD req.))
with SD req. = 10%
Same comment as for Mean diff. margin

Table 26: Meteosat Indian Ocean hourly DLI quality results from JAN. 2021 to DEC. 2021.

Meteosat Indian Ocean daily DLI quality results from JAN. 2021 to DEC. 2021								
Month	Number of cases	Mean DLI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)	Median	RSD
JAN. 2021	31	290.80	-11.51	60.42	12.39	85.80	-11.17	11.36
FEB. 2021	25	292.70	-1.87	93.61	10.81	87.69	-2.53	10.65
MAR. 2021	31	290.12	1.15	96.04	8.18	90.60	1.34	9.73
APR. 2021	30	289.56	8.10	72.03	8.36	90.38	8.38	6.38
MAY 2021	30	325.50	7.90	75.73	6.60	93.24	7.72	6.41
JUN. 2021	29	364.91	7.92	78.30	7.22	93.40	8.26	8.06
JUL. 2021	28	365.71	7.29	80.07	7.21	93.43	6.58	8.15
AUG. 2021	29	362.23	5.83	83.91	5.53	94.91	5.56	5.73
SEP. 2021	22	354.06	3.30	90.68	7.68	92.77	1.22	7.63
OCT. 2021	25	317.45	4.92	84.50	7.58	92.04	6.06	5.10
NOV. 2021	27	296.15	-2.67	90.98	10.00	88.74	-2.53	11.80
DEC. 2021	27	295.99	-13.50	54.39	16.05	81.93	-8.94	19.17

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 5 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 - (SD / SD req.))
with SD req. = 10%
Same comment as for Mean diff. margin

Table 27: Meteosat Indian Ocean daily DLI quality results from JAN. 2021 to DEC. 2021.

Comments:
Overall statistics are within the requirement.

5.2.1.4. AHL DLI (OSI-301-b) quality

The pyrgeometer stations used for quality assessment of the AHL DLI product are briefly described at http://nowcasting.met.no/validering/flukser/. More information on the stations is provided in 5.2.2.4

The following table provides the AHL DLI quality results over the reporting period.

AHL DLI quality results from JAN. 2021 to DEC. 2021						
Month	Number of cases	Mean DLI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)
JAN. 2021	152	266.50	-7.23	45.71	18.59	30.26
FEB. 2021	137	255.10	-6.09	52.24	19.03	25.41
MAR. 2021	147	259.42	2.76	78.72	18.09	30.26
APR. 2021	142	271.47	0.25	98.13	14.52	46.50
MAY 2021	151	286.44	-2.63	81.63	13.68	52.24
JUN. 2021	122	316.07	-8.46	46.44	19.58	38.06
JUL. 2021	137	333.43	-0.35	97.92	18.39	44.86
AUG. 2021	122	331.54	-3.28	80.23	14.65	55.80
SEP. 2021	118	313.04	-5.49	64.90	15.19	51.47
OCT. 2021	122	299.65	-2.90	80.67	15.90	46.95
NOV. 2021	118	272.14	-0.48	96.45	16.19	40.51
DEC. 2021	122	256.68	-0.44	96.57	19.79	22.90

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 5 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 - (SD / SD req.))
with SD req. = 10%

Table 28: AHL DLI quality results from JAN. 2021 to DEC. 2021.

Comments:
The validation results for OSI-301-b are within target accuracy for all month, both mean difference and standard deviation.

5.2.2. SSI quality

SSI products are constituted of the geostationary products (GOES-East, Meteosat 0°, Meteosat Indian Ocean) and polar ones (Atlantic High Latitude). SSI values are required to have the following accuracy when compared to land pyranometer measurements:

- monthly relative mean difference less than 10 %,
- monthly difference standard deviation less than 30 %.

The match-up data base the statistics are based on is continuously enriched, so that, for the same period, results may evolve depending on the date when the statistics were calculated.

5.2.2.1. GOES-East SSI (OSI-306-b) quality

The following table provides the hourly and daily SSI quality results over the reporting period.

GOES-East hourly SSI quality results from JAN. 2021 to DEC. 2021								
Month	Number of cases	Mean SSI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)	Median	RSD
JAN. 2021	2136	313.18	1.16	96.30	71.22	24.20	-0.90	43.07
FEB. 2021	2640	363.13	-19.09	47.43	85.79	21.25	-12.05	52.23
MAR. 2021	3122	441.53	-1.86	95.79	87.97	33.59	-2.52	49.21
APR. 2021	2906	450.86	-6.75	85.03	81.93	39.43	-4.93	52.89
MAY 2021	3580	439.95	-6.81	84.52	79.12	40.05	-8.89	56.29
JUN. 2021	3573	471.21	-8.36	82.26	84.23	40.42	-13.38	52.15
JUL. 2021	3684	474.86	8.63	81.83	82.99	41.74	6.54	61.82
AUG. 2021	3400	487.14	5.58	88.55	92.78	36.51	1.93	57.36
SEP. 2021	3194	473.23	5.31	88.78	82.33	42.01	-2.19	48.39
OCT. 2021	3254	400.06	6.05	84.88	71.88	40.11	-0.88	43.73
NOV. 2021	2505	377.18	9.31	75.32	74.31	34.33	0.51	41.88
DEC. 2021	1031	217.35	-15.37	29.28	56.15	13.89	-9.34	35.10

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 10 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 - (SD / SD req.))
with SD req. = 30%
Same comment as for Mean diff. margin

Table 29: GOES-East hourly SSI quality results from JAN. 2021 to DEC. 2021.

GOES-East daily SSI quality results from JAN. 2021 to DEC. 2021								
Month	Number of cases	Mean SSI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)	Median	RSD
JAN. 2021	221	111.04	-0.16	98.56	14.74	55.75	0.17	8.82
FEB. 2021	228	147.98	-8.07	45.47	22.34	49.68	-5.95	15.96
MAR. 2021	196	201.52	-0.61	96.97	19.60	67.58	-0.36	13.01
APR. 2021	148	196.79	-2.84	85.57	21.60	63.41	-3.36	21.42
MAY 2021	153	211.81	-2.98	85.93	19.73	68.95	-2.71	17.50
JUN. 2021	145	210.84	-1.22	94.21	18.35	70.99	-1.38	16.73
JUL. 2021	150	218.29	0.15	99.31	22.04	66.34	-0.10	22.16
AUG. 2021	161	230.54	4.58	80.13	22.75	67.11	2.86	20.72
SEP. 2021	211	211.43	3.37	84.06	20.45	67.76	2.79	13.39
OCT. 2021	287	165.51	2.06	87.55	16.33	67.11	0.50	12.65
NOV. 2021	289	136.18	2.08	84.73	16.44	59.76	0.58	9.87
DEC. 2021	150	63.49	-5.96	6.13	12.35	35.16	-3.27	10.45

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 10 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 - (SD / SD req.))
with SD req. = 30%
Same comment as for Mean diff. margin

Table 30: GOES-East daily SSI quality results from JAN. 2021 to DEC. 2021.

Comments:
Overall statistics are within the requirement.

5.2.2.2. Meteosat 0° SSI (OSI-304-a) quality

The following table provides the hourly and daily SSI quality results over the reporting period.

Meteosat 0° hourly SSI quality results from JAN. 2021 to DEC. 2021								
Month	Number of cases	Mean SSI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)	Median	RSD
JAN. 2021	2307	277.51	-2.03	92.68	68.43	17.80	2.81	40.31
FEB. 2021	2655	350.73	-1.44	95.89	66.21	37.07	4.08	46.45
MAR. 2021	3719	446.31	1.12	97.49	68.46	48.87	5.89	42.17
APR. 2021	1609	480.61	-18.99	60.49	75.34	47.75	-15.65	58.25
MAY 2021	4415	449.33	-12.08	73.12	63.02	53.25	-13.99	45.76
JUN. 2021	4370	465.49	-13.51	70.98	61.89	55.68	-13.59	45.12
JUL. 2021	4411	444.11	-15.07	66.07	59.68	55.21	-12.06	42.44
AUG. 2021	4238	438.19	-14.47	66.98	59.30	54.89	-12.68	42.95
SEP. 2021	3655	456.34	-14.08	69.15	58.97	56.93	-11.90	41.35
OCT. 2021	3428	412.37	-6.07	85.28	65.38	47.15	-6.94	38.69
NOV. 2021	2835	362.15	5.90	83.71	76.48	29.61	4.07	41.09
DEC. 2021	133	125.04	-4.41	64.73	28.17	24.90	-3.86	21.69

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 10 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 - (SD / SD req.))
with SD req. = 30%
Same comment as for Mean diff. margin

Table 31: Meteosat 0° hourly SSI quality results from JAN. 2021 to DEC. 2021.

Meteosat 0° daily SSI quality results from JAN. 2021 to DEC. 2021								
Month	Number of cases	Mean SSI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)	Median	RSD
JAN. 2021	309	88.79	-1.48	83.33	14.26	46.47	0.10	7.46
FEB. 2021	289	134.61	-1.43	89.38	15.12	62.56	0.79	9.91
MAR. 2021	372	189.45	-0.51	97.31	16.11	71.65	1.86	12.92
APR. 2021	150	216.99	-9.54	56.03	18.29	71.90	-8.94	17.81
MAY 2021	371	226.13	-6.91	69.44	14.08	79.24	-6.25	13.58
JUN. 2021	359	239.92	-7.63	68.20	16.31	77.34	-8.12	15.17
JUL. 2021	365	225.98	-8.41	62.78	14.30	78.91	-7.38	12.00
AUG. 2021	366	211.56	-8.16	61.43	14.93	76.48	-8.84	14.65
SEP. 2021	340	200.98	-7.44	62.98	12.86	78.67	-6.17	12.53
OCT. 2021	365	163.97	-3.79	76.89	14.51	70.50	-3.28	8.65
NOV. 2021	344	127.16	1.14	91.03	17.04	55.33	-0.10	9.13
DEC. 2021	25	31.37	-1.37	56.33	3.62	61.53	-2.42	4.44

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 10 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 - (SD / SD req.))
with SD req. = 30%
Same comment as for Mean diff. margin

Table 32: Meteosat 0° daily SSI quality results from JAN. 2021 to DEC. 2021.

Comments:
Overall statistics are within the requirement.

5.2.2.3. Meteosat Indian Ocean SSI (OSI-IO-SSI)

Surface Solar Irradiance from Meteosat-8 (in position 41.5 east) is processed as a demonstration product since 2016.

The following table provides the hourly and daily SSI quality results over the reporting period.

Meteosat Indian Ocean hourly SSI quality results from JAN. 2021 to DEC. 2021								
Month	Number of cases	Mean SSI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)	Median	RSD
JAN. 2021	2256	291.68	10.36	64.48	70.03	19.97	13.58	46.03
FEB. 2021	2495	365.42	10.13	72.28	64.60	41.07	12.19	46.54
MAR. 2021	3699	451.44	6.71	85.14	64.97	52.03	7.73	41.09
APR. 2021	1609	495.11	-4.48	90.95	74.11	50.11	-11.05	56.24
MAY 2021	4411	450.74	-10.28	77.19	64.99	51.94	-11.17	48.12
JUN. 2021	4284	467.04	-9.70	79.23	64.99	53.62	-10.37	46.38
JUL. 2021	4409	449.67	-9.63	78.58	62.56	53.63	-7.78	43.68
AUG. 2021	4249	441.21	-10.47	76.27	63.47	52.05	-9.56	44.67
SEP. 2021	3660	458.65	-11.29	75.38	64.14	53.38	-8.48	43.71
OCT. 2021	3433	417.85	-0.13	99.69	67.55	46.11	-4.37	42.36
NOV. 2021	2836	367.03	10.86	70.41	71.78	34.81	5.44	43.96
DEC. 2021	138	120.93	-5.93	50.96	29.65	18.27	-4.08	24.67

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 10 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 - (SD / SD req.))
with SD req. = 30%
Same comment as for Mean diff. margin

Table 33: Meteosat Indian Ocean hourly SSI quality results from JAN. 2021 to DEC. 2021.

Meteosat Indian Ocean daily SSI quality results from JAN. 2021 to DEC. 2021								
Month	Number of cases	Mean SSI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)	Median	RSD
JAN. 2021	289	93.11	2.99	67.89	14.71	47.34	4.38	9.96
FEB. 2021	264	140.20	3.39	75.82	15.00	64.34	3.94	12.05
MAR. 2021	360	192.55	1.82	90.55	14.45	74.98	3.03	11.81
APR. 2021	150	223.50	-3.02	86.49	17.70	73.60	-3.09	17.56
MAY 2021	371	227.12	-5.91	73.98	15.05	77.91	-5.19	14.94
JUN. 2021	359	242.12	-5.43	77.57	18.18	74.97	-3.75	16.51
JUL. 2021	365	228.72	-5.66	75.25	15.56	77.32	-4.58	14.24
AUG. 2021	366	213.55	-6.17	71.11	16.74	73.87	-6.94	17.03
SEP. 2021	340	202.43	-5.99	70.41	15.36	74.71	-4.74	14.36
OCT. 2021	365	166.46	-1.30	92.19	16.06	67.84	-2.85	11.28
NOV. 2021	344	129.10	3.08	76.14	18.04	53.42	0.82	11.43
DEC. 2021	26	30.41	-1.42	53.30	4.31	52.76	-1.35	4.97

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 10 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 - (SD / SD req.))
with SD req. = 30%
Same comment as for Mean diff. margin

Table 34: Meteosat Indian Ocean daily SSI quality results from JAN. 2021 to DEC. 2021.

Comments:
Overall statistics are within the requirement.

5.2.2.4. AHL SSI (OSI-302-b) quality

The pyranometer stations used for quality assessment of the AHL SSI and DLI products are shown in the following table.

Station	StId	Latitude	Longitude		Status
Apelsvoll	11500	60.70°N	10.87°E	SSI	In use, under examination due to shadow effects.
Løken	23500	61.12°N	9.07°E	SSI	Not used currently
Landvik	38140	58.33°N	8.52°E	SSI	In use
Særheim	44300	58.78°N	5.68°E	SSI	Not used currently
Fureneset	56420	61.30°N	5.05°E	SSI	In use
Tjøtta	76530	65.83°N	12.43°E	SSI	Not used currently
Ekofisk	76920	56.50°N	3.2°E	SSI, DLI	The station was closed due to change platforms in the position. Instrumentation is recovered and work in progress to remount equipment.
Holt	90400	69.67°N	18.93°E	SSI	In use
Bjørnøya	99710	74.52°N	19.02°E	SSI, DLI	In use, Arctic station with snow on ground much of the year.
Hopen	99720	76.51°N	25.01°E	SSI, DLI	Not in use currently
Jan_Mayen	99950	70.93°N	-8.67°E	SSI, DLI	In use, Arctic station with snow on ground much of the year, volcanic ash deteriorates instruments in periods.
Schleswig	10035	54.53°N	9.55°E	SSI, DLI	Not in use currently
Hamburg-Fuhlsbuettel	10147	53.63°N	9.99°E	SSI, DLI	Not used currently
Jokioinen	1201	60.81°N	23.501°E	SSI, DLI	In use. DLI was added to this station during the spring of 2016.
Sodankylä	7501	67.37°N	26.63°E	SSI, DLI	In use, temporarily disabled for SSI validation. Problems likely to be connected with snow on ground.
Kiruna	02045	67.85°N	20.41°E	SSI, DLI	Not used currently
Visby	02091	57.68°N	18.35°E	SSI, DLI	Not used currently
Svenska Högarna	02492	59.45°N	19.51°E	SSI, DLI	Not used currently

Table 35: Validation stations that may be used for AHL radiative fluxes quality assessment.

The stations listed in table 35 are owned and operated by the Norwegian Meteorological Institute, University of Bergen, Geophysical Institute, Bioforsk, Finnish Meteorological Institute (FMI), Swedish Meteorological Institute (SMHI) and Deutscher Wetterdienst (DWD). Data from DWD and SMHI are extracted from WMO GTS, data from the other sources are received by email or through

other direct connections. More stations are being considered for inclusion.

The station at Ekofisk was closed in July 2015, instruments are recovered and work in progress to remount equipment on a new platform. This is however pending financial support. As this was the only pure maritime station available, this is a serious drawback for evaluation of the performance of the flux products.

The pyranometer stations used for validation of the AHL SSI product are the stations listed in table 35. There are some differences in the stations used for SSI validation compared to DLI. The reason for this is partly the observation programme at stations, but also that SSI validation is more sensitive to station characteristics than DLI.

A report from OSI SAF about the validation data used for validating the high latitude surface radiative flux products is available here: http://osisaf.met.no/docs/osisaf_cdop2_ss2_rep_flux-val-data_v1p0.pdf

The following table provides the AHL SSI quality results over the reporting period.

AHL SSI quality results from JAN. 2021 to DEC. 2021						
Month	Number of cases	Mean SSI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. margin in % (*)	SD in Wm^{-2}	SD margin in % (**)
JAN. 2021	26	19.95	-4.44	-122.77	17.05	-184.80
FEB. 2021	121	34.64	-4.31	-24.45	18.44	-77.47
MAR. 2021	220	64.80	-11.79	-82.00	20.31	-4.50
APR. 2021	229	135.60	-7.76	42.78	38.46	5.45
MAY 2021	245	182.90	-11.83	35.35	42.07	23.32
JUN. 2021	218	197.19	1.00	94.93	36.23	38.76
JUL. 2021	210	192.92	4.43	77.06	40.08	30.75
AUG. 2021	215	141.93	1.73	87.83	32.95	22.62
SEP. 2021	208	75.13	-3.31	55.91	20.08	10.91
OCT. 2021	160	35.08	-2.63	24.98	12.20	-15.94
NOV. 2021	72	19.69	-4.53	-130.21	7.13	-20.65
DEC. 2021	0	-	-	-	-	-

(*) Mean diff. margin = 100 * (1 - (|mean diff. in %/ mean diff. req. in %|))
with mean diff. in % = 100*Mean diff/Mean DLI
and mean diff. req. = 10 %
100 refers then to a perfect product, 0 to a quality just as required, without margin.
A negative result indicates that the product quality does not fulfil the requirement.

(**) SD margin = 100 * (1 - (SD / SD req.))
with SD req. = 30%

Table 36: AHL SSI quality results from JAN. 2021 to DEC. 2021.

Comments:
The validation for OSI-302-b for this period shows that product is within or close to target accuracy requirement for most months. The mean difference and standard deviation margin shows the usual pattern with good results in spring, summer and autumn, and poorer results in the winter months with very little sunlight at high latitudes. For this period the product is outside target requirement for mean difference in November and for standard deviation in October and November. There are now validation data avaliable for December as only Norwegian and Finnish station has been used and the sun was too low at these stations.

5.3. Sea Ice quality

5.3.1. Global sea ice concentration (OSI-401-b) quality

The OSI SAF sea ice concentration product is validated against navigational ice charts, as these are believed to be the best independent source of reference data currently available. These navigational ice charts originates from the operational ice charting divisions at DMI, MET Norway and National Ice Center (NIC). The ice charts are primarily based on SAR (Radarsat and Sentinel-1) data, together with AVHRR and MODIS data in several cases. The quality assessment results are shown separately for the three different sets of ice charts.
For the quality assessment at the Northern Hemisphere, performed twice a week, the concentration product is required to have a mean difference and standard deviation less than 10% ice concentration on an annual basis. For the weekly quality assessment at the Southern Hemisphere the concentration product is required to have a mean difference and standard deviation less than 15% ice concentration on an annual basis.
For each ice chart concentration level the deviation between ice chart concentration and OSI SAF ice concentration is calculated. Afterwards deviations are grouped into categories, i.e. ±10% and ±20%. Furthermore the mean difference and standard deviation are calculated and reported for ice (100% ice concentration) and for water (0% ice concentration). We use conventional mean difference and standard deviations for all calculations.
In addition, statistics from manual evaluation (on the confidence level of the products) are shown as additional information. There is no requirement on these statistics. The error codes for the manual evaluation are shown below.

Error code	Type	Description
1	area	missing data
2	point	open water where ice was expected
3	area	false ice where open water was expected
4	point	false ice induced from SSM/I processing errors
5	point	other errors
6	point	noisy false ice along coast

Table 37: Error codes for the manual registration

For the Northern Hemisphere, these quality assessment results are given for the Greenland area. This area is the area covered by the Greenland overview ice charts made by DMI used for the comparison to the sea ice concentration data. The charts can be seen at http://www.dmi.dk/hav/groenland-og-arktis/iskort/.

They cover the waters surrounding Greenland including the Lincoln Sea, the Fram Strait, the Greenland Sea, the Denmark Strait and Iceland, the Southern Greenland area including Cape Farewell, the Davis Strait and all of Baffin Bay.

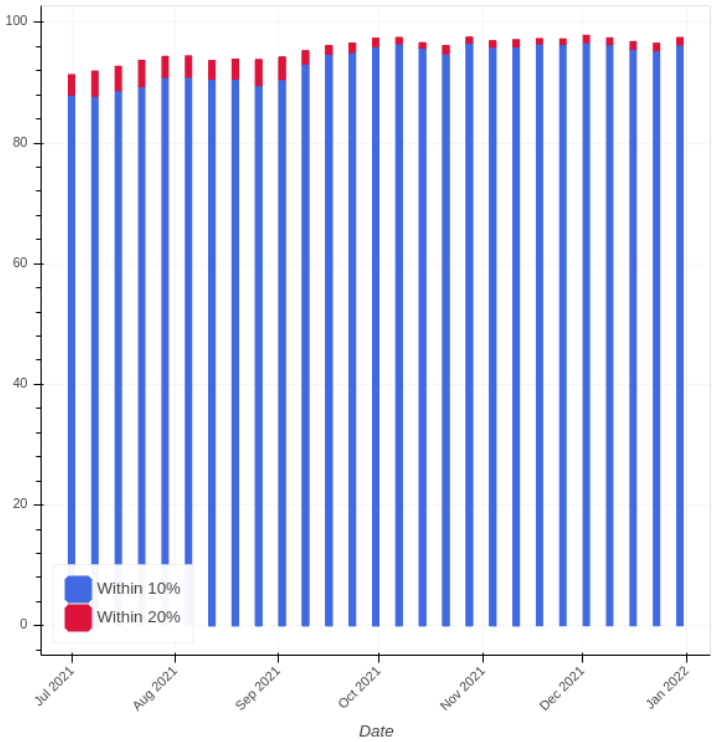


Figure 27: Comparison of ice concentrations from the NIC ice analysis and the OSI SAF concentration product. Northern hemisphere. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/- 10%, and likewise for +/-20%.

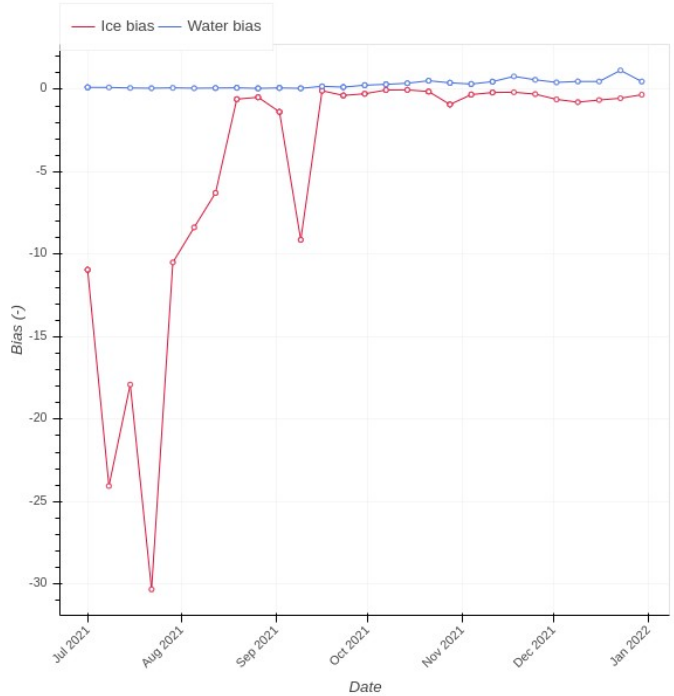


Figure 28: Difference between ice concentrations from the NIC ice analysis and OSI SAF concentration product for two categories: water and ice. When the difference is below zero, the OSI SAF sea ice concentration has a lower estimate than the ice analysis. Northern hemisphere.

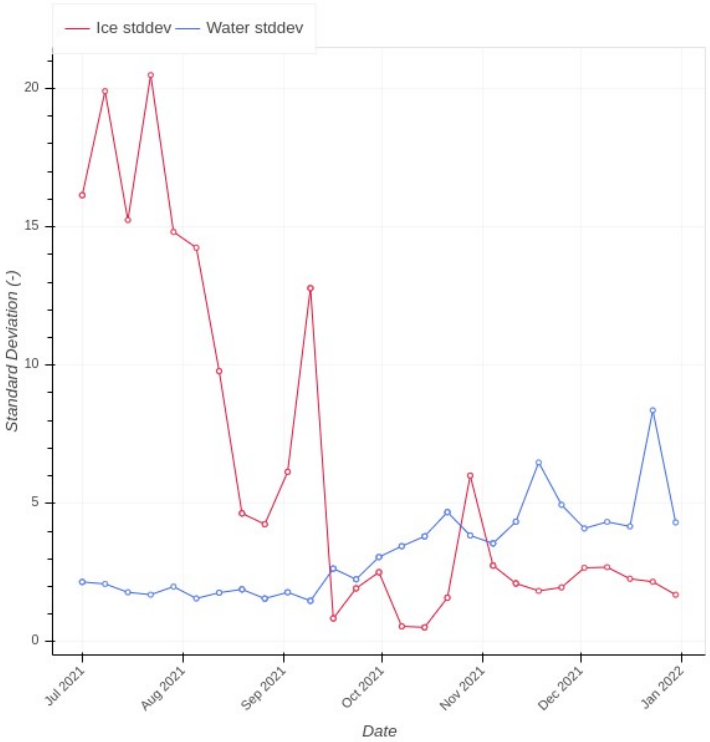


Figure 29: Standard deviation of the difference in ice concentrations from NIC ice analysis and OSI SAF concentration product for two categories: water and ice. Northern hemisphere.

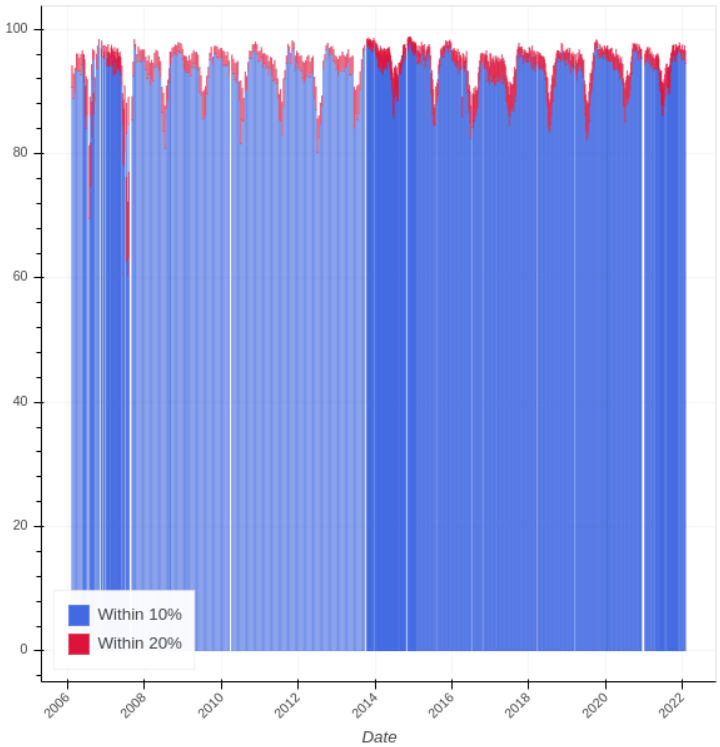


Figure 30: Multiyear variability. Comparison between ice concentrations from the NIC ice analysis and the OSI SAF concentration product. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/- 10%, and likewise for +/-20%. Northern hemisphere.

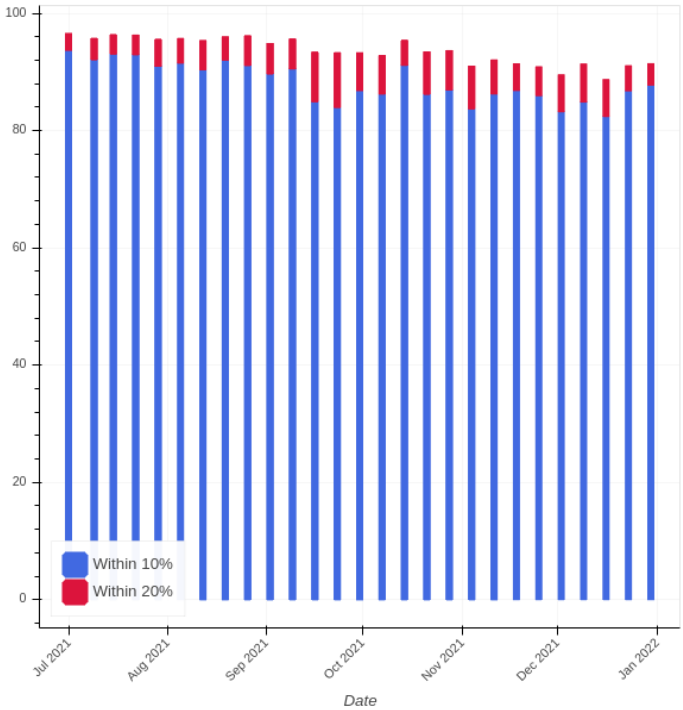


Figure 31: Comparison between ice concentrations from the NIC ice analysis and the OSI SAF concentration product. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/-10%, and likewise for +/-20%. Southern hemisphere.

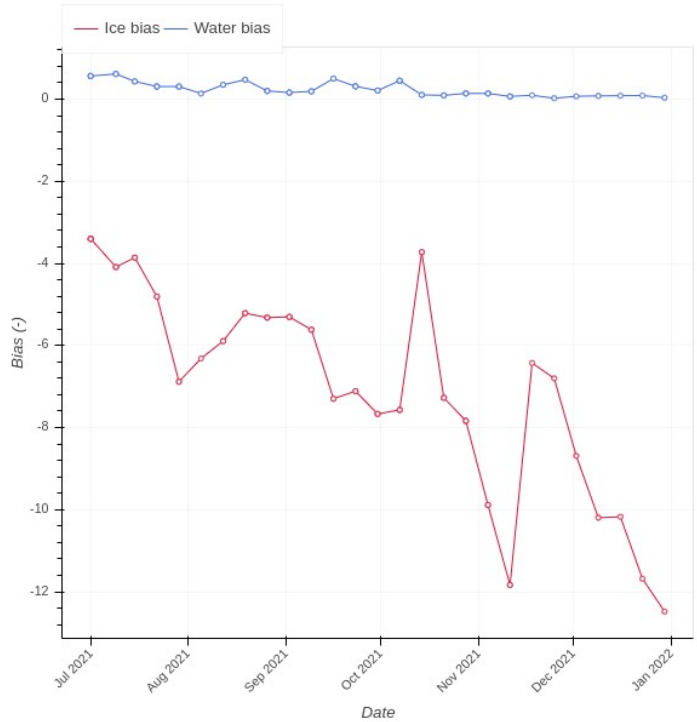


Figure 32: Difference between the ice concentrations from the NIC ice analysis and OSI SAF concentration product for two categories: water and ice. When the difference is below zero, the OSI SAF sea ice concentration has a lower estimate than the ice analysis. Southern hemisphere.

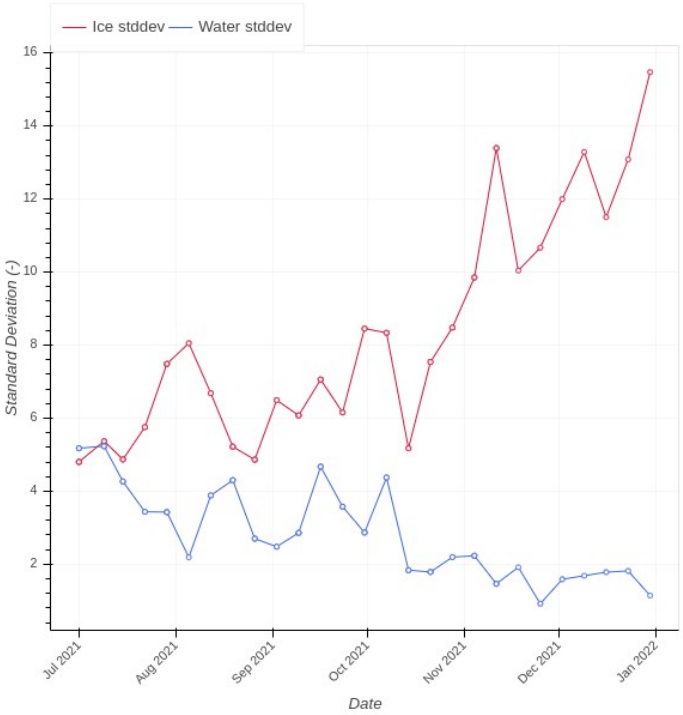


Figure 33: Standard deviation of the difference in ice concentrations from the NIC ice analysis and OSI SAF concentration product for two categories: water and ice. Southern hemisphere.

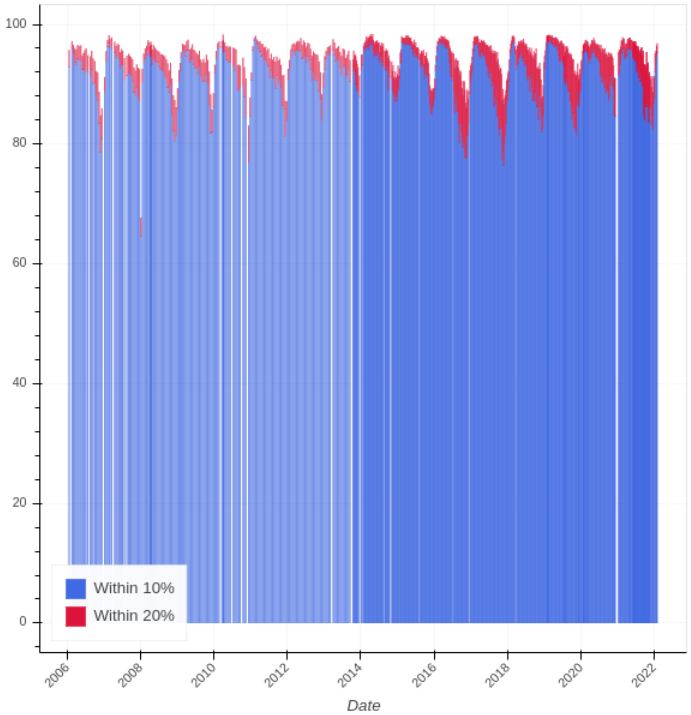


Figure 34: Multiyear variability. Comparison between ice concentrations from the NIC ice analysis and the OSI SAF concentration product. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/- 10%, and likewise for +/-20%. Southern hemisphere.

Concentration product					
Month	+/- 10% [%]	+/- 20% [%]	Mean difference [%]	SD [%]	Number of obs.
JAN. 2021	95.93	97.01	-1.55	6.22	356231
FEB. 2021	96.12	97.28	-1.50	6.44	295038
MAR. 2021	94.98	96.24	-1.94	7.00	350218
APR. 2021	93.02	94.44	-2.59	8.47	330725
MAY 2021	92.07	93.69	-2.84	8.79	301164
JUN. 2021	89.79	91.31	-3.90	10.87	433125
JUL. 2021	93.23	93.97	-2.89	9.15	516871
AUG. 2021	95.22	95.86	-1.97	8.05	581821
SEP. 2021	97.17	97.65	-1.17	5.44	652607
OCT. 2021	98.91	99.25	-0.47	3.00	545448
NOV. 2021	97.92	98.69	-0.82	4.39	433093
DEC. 2021	97.27	98.11	-1.27	5.99	350722

Table 38: Monthly quality assessment results from comparing the OSI SAF sea ice concentration product to MET Norway ice service analysis for the Svalbard area. From JAN. 2021 to DEC. 2021. First two columns shows how often there is agreement within 10 and 20% concentration.

Based on the quality flags in the sea ice products, monthly statistics for the confidence levels are derived for each product type as Code 0-5: 0 -> not processed, no input data; 1 -> computation failed; 2 -> processed but to be used with care; 3 -> nominal processing, acceptable quality; 4 -> nominal processing, good quality; 5 -> nominal processing, excellent quality'. Code 1-5 is given as fraction of total processed data (code 5+4+3+2+1 = 100%). 'Unprocessed' is given as fraction of total data (total data = processed data + unprocessed data).

Month	Code=5	code=4	code=3	code=2	code=1	Unprocessed
JUL. 2021	74.63	25.37	0	0	0	0
AUG. 2021	79.86	20.14	0	0	0	0
SEP. 2021	82.54	17.46	0	0	0	0
OCT. 2021	82.76	17.24	0	0	0	0
NOV. 2021	80.08	19.92	0	0	0	0
DEC. 2021	76.69	23.31	0	0	0	0

Table 39: Statistics for sea ice concentration confidence levels, Code 0-5, Northern Hemisphere, over 2nd half 2021.

Month	Code=5	code=4	code=3	code=2	code=1	Unprocessed
JUL. 2021	68.54	31.46	0	0	0	0
AUG. 2021	64.66	35.34	0	0	0	0.03
SEP. 2021	62.80	37.20	0	0	0	0.03
OCT. 2021	65.45	34.55	0	0	0	0.03
NOV. 2021	68.42	31.58.	0	0	0	0.02
DEC. 2021	77.75	22.25	0	0	0	0

Table 40: Statistics for sea ice concentration confidence levels, Code 0-5, Southern Hemisphere, over 2nd half 2021.

Comments:
Figure 29 and Figure 33 provide the essential information on the compliance of the sea ice concentration product accuracy, showing the std. dev. of the difference in ice concentration between the OSI SAF product and the NIC ice analysis for NH and SH, respectively.
Average yearly SD for the period can be seen in the table just below. The product are with target accuracy of 10 % and 15 % for the NH and SH products, respectively.

Average yearly standard deviation		
	Average SD Ice	Average SD Water
Northern Hemisphere	5.84	3.11
Southern Hemishpere	7.73	3.06

5.3.2. Global sea ice concentration (OSI-408) quality

The OSI-408 Global Sea Ice concentration is based on AMSR-2 data. Two ice concentration fields are computed: the primary on which is computed with the OSI SAF Hybrid Dynamic (OSHD) algorithm similar to the SSMIS Sea Ice Concentration (OSI-401-b) and a second which is computed using the Technical University of Denmark (TUD) algorithm which utilizes the high frequency channels. It is validated against ice charts as described under the previous section on Global SSMIS Sea Ice Concentration.

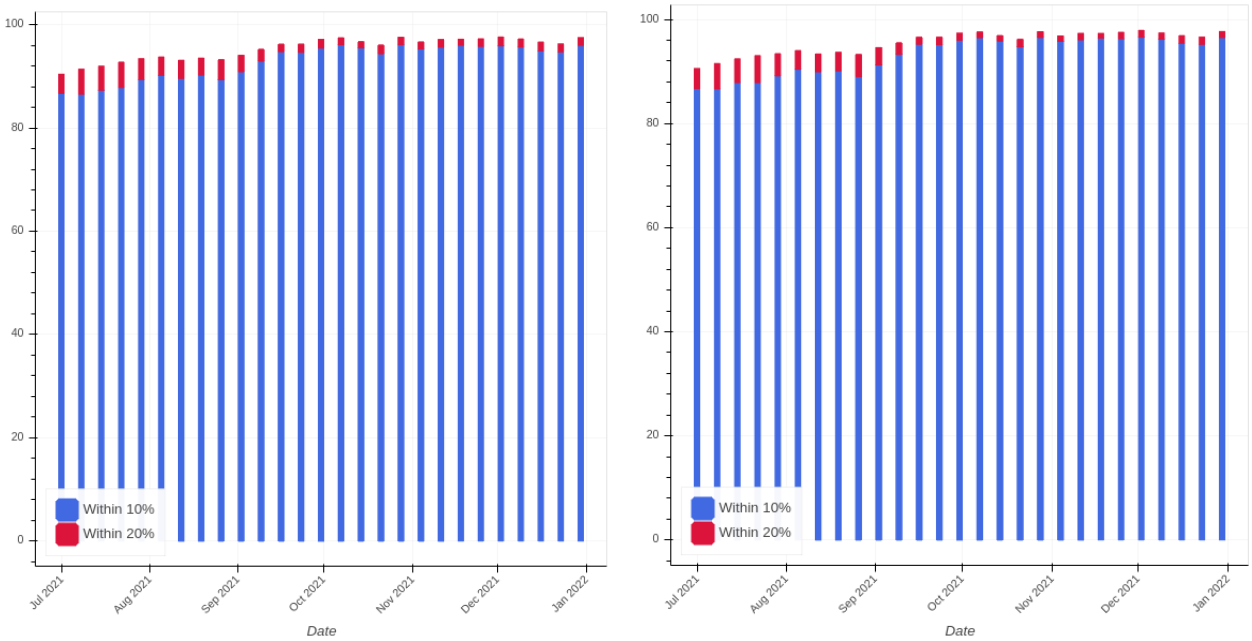


Figure 35: Comparison of ice concentrations from the NIC ice analysis and the OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right. Northern hemisphere. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/- 10%, and likewise for +/-20%

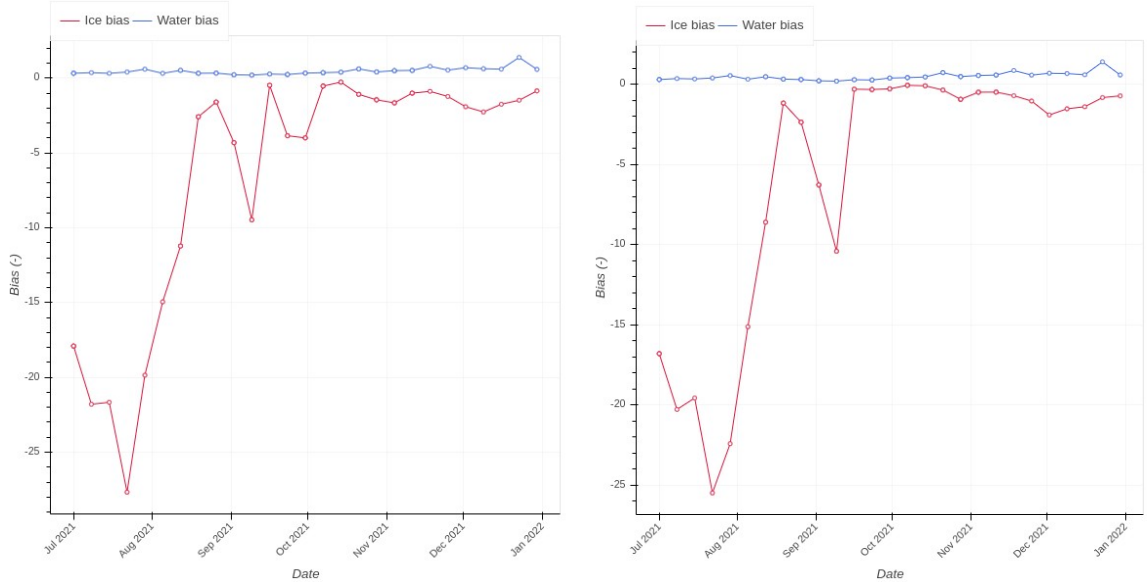


Figure 36: Difference between ice concentrations from the NIC ice analysis and OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right for two categories: water and ice. Northern Hemisphere

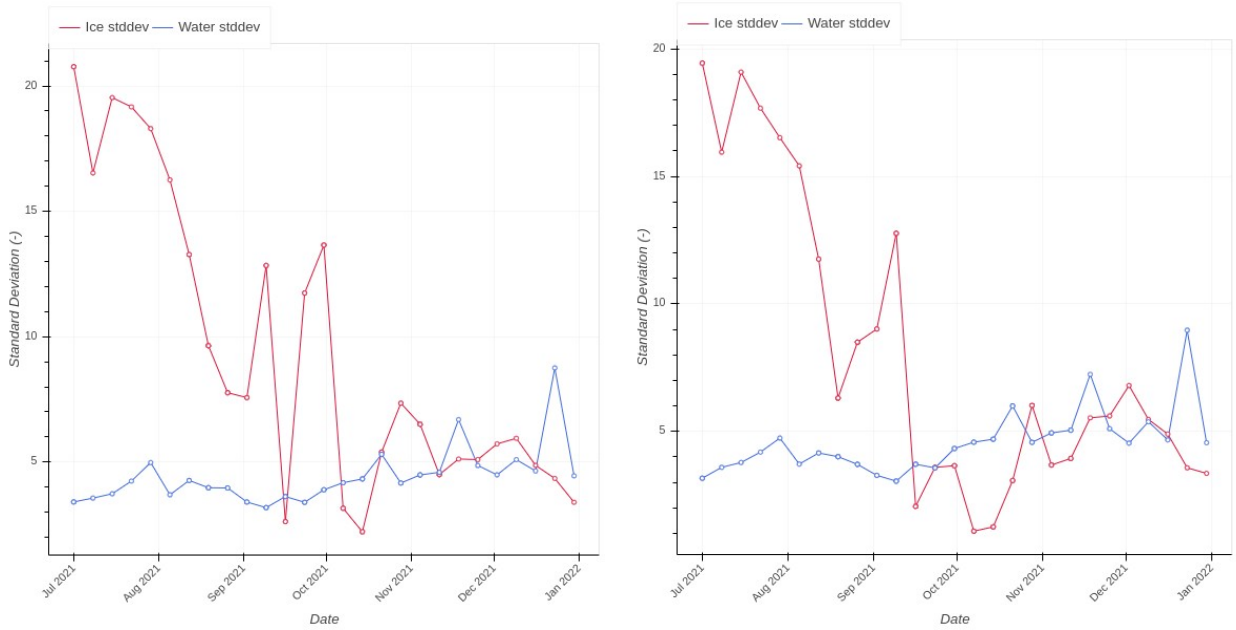


Figure 37: Standard deviation of the difference in ice concentrations from the Greenland overview charts made by DMI and OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right for two categories: water and ice. Northern hemisphere.

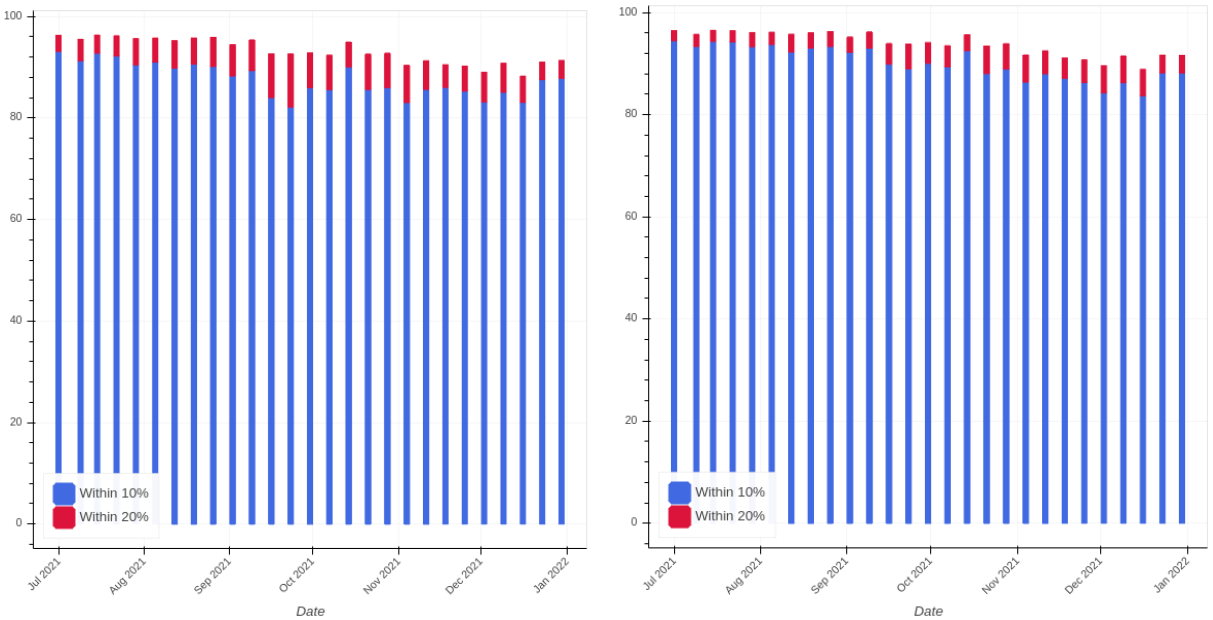


Figure 38: Comparison of ice concentrations from the NIC ice analysis and the OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right. Southern hemisphere. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/- 10%, and likewise for +/-20%

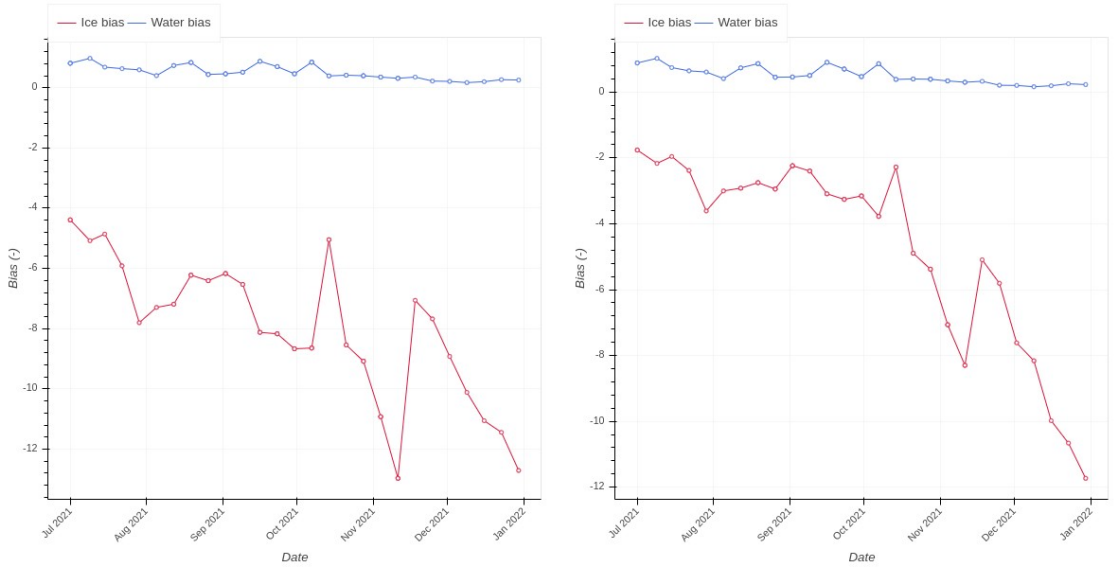


Figure 39: Difference between ice concentrations from the NIC ice analysis and OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right for two categories: water and ice. Southern Hemisphere

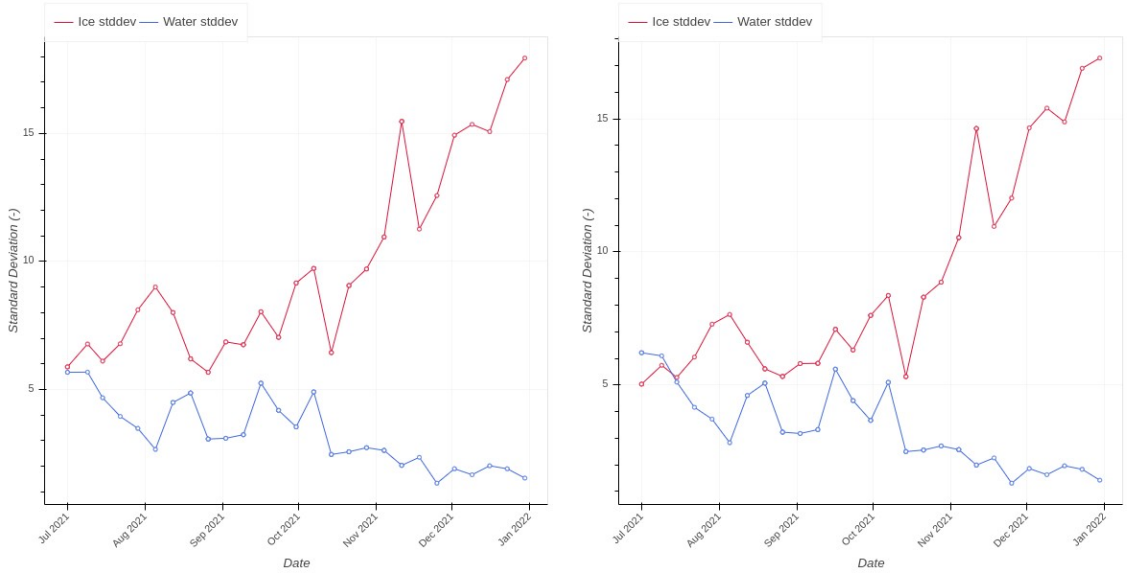


Figure 40: Standard deviation of the difference in ice concentrations from the NIC ice analysis and OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right for two categories: water and, ice. Southern hemisphere.

Comments:
Figure 37 and Figure 40 provide the essential information on the compliance of the sea ice concentration product accuracy, showing the std. dev. of the difference in ice concentration between the OSI SAF product and the NIC ice analysis for NH and SH, respectively. Average yearly SD for the period can be seen in the table just below. The product are with target accuracy of 10 % and 15 % for the NH and SH products, respectively.

Average yearly standard deviation			
		Average SD Ice	Average SD Water
OSHD algorithm	NH	9.10	4.27
	SH	9.31	3.39
TUD algorithm	NH	7.43	4.43
	SH	8.49	3.51

5.3.3. Global sea ice edge (OSI-402-d) quality

The OSI SAF sea ice edge product is validated against navigational ice charts, as explained under the previous section on ice concentration.

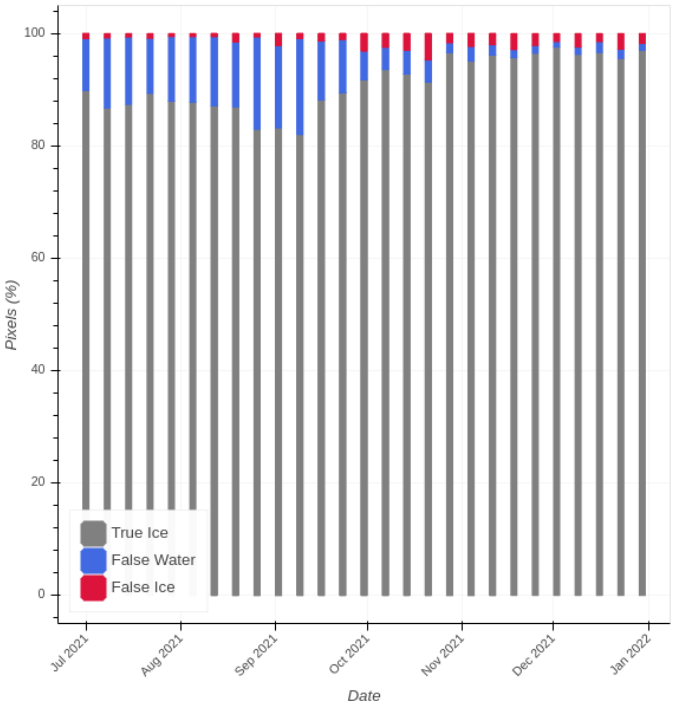


Figure 41: Comparison between the NIC ice analysis and the OSI SAF sea ice edge product. Northern hemisphere. 'False Water' means grid points where the OSI SAF product indicated water and the DMI ice analysis indicated ice and vice versa for the 'False Ice' category.

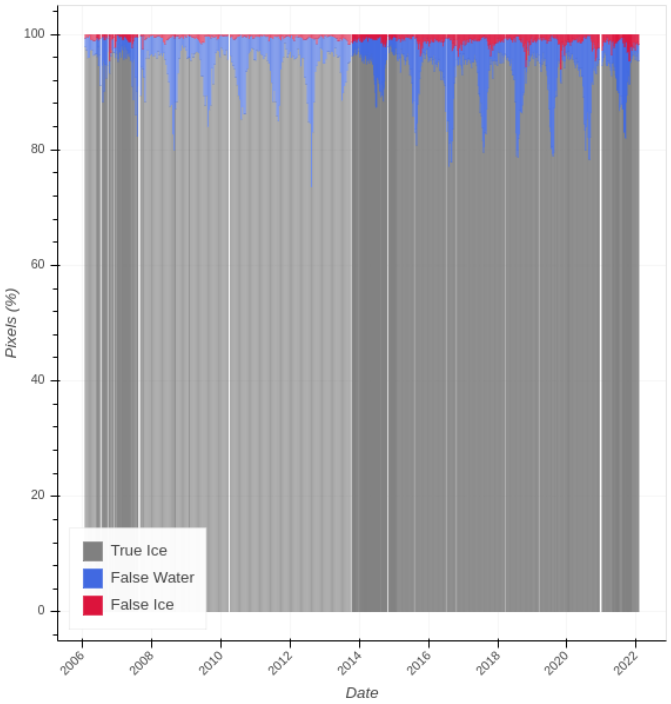


Figure 42: Multiyear variability. Comparison between the NIC ice analysis and the OSI SAF sea ice edge product. Northern hemisphere. 'False Water' means grid points where the OSI SAF product indicated water and the DMI ice analysis indicated ice and vice versa for the 'False Ice' category.

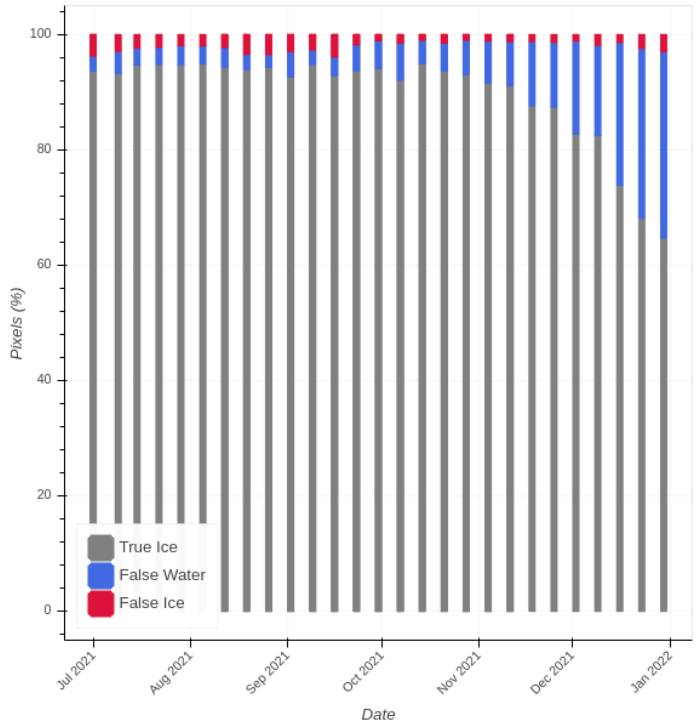


Figure 43: Comparison between the NIC ice analysis and the OSI SAF sea ice edge product. Southern hemisphere. 'False Water' means grid points where the OSI SAF product indicated water and the NIC ice analysis indicated ice and vice versa for the 'False Ice' category.

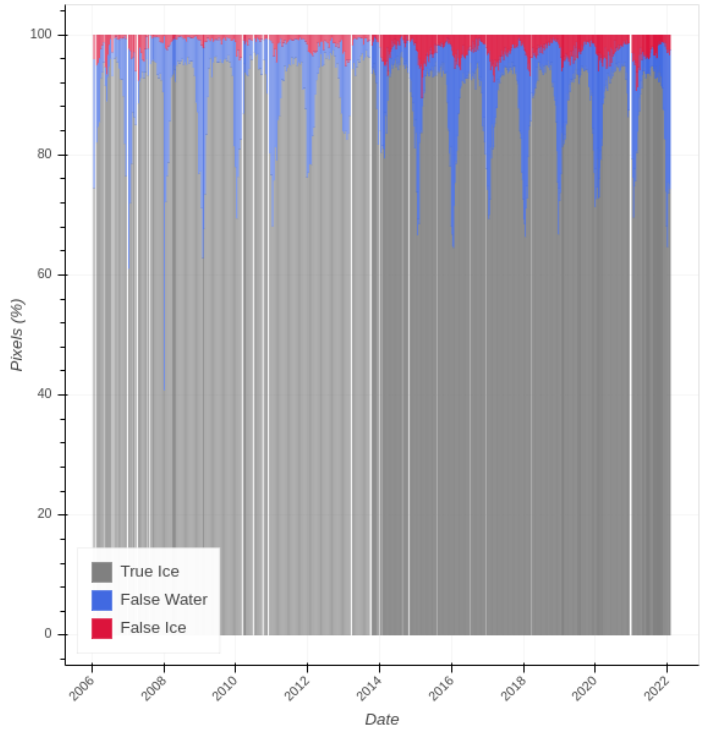


Figure 44: Multiyear variability. Comparison between the NIC ice analysis and the OSI SAF sea ice edge product. Southern hemisphere. 'False Water' means grid points where the OSI SAF product indicated water and the NIC ice analysis indicated ice and vice versa for the 'False Ice' category.

Month	Correct [%]	SAF lower [%]	SAF higher [%]	Mean edge diff [km]	Number of obs.
JAN. 2021	97.24	1.24	1.52	11.16	613962
FEB. 2021	97.52	1.58	0.90	13.11	600579
MAR. 2021	97.17	2.25	0.58	18.87	727652
APR. 2021	96.76	1.75	1.49	17.60	631140
MAY 2021	96.61	2.03	1.36	17.80	564151
JUN. 2021	95.61	3.60	0.79	29.37	685766
JUL. 2021	97.14	2.59	0.27	31.00	672329
AUG. 2021	97.87	1.92	0.21	32.50	689123
SEP. 2021	98.96	0.73	0.31	28.93	752933
OCT. 2021	99.18	0.23	0.59	9.31	688621
NOV. 2021	98.62	0.67	0.71	10.28	675794
DEC. 2021	98.02	0.91	1.07	8.82	646648

Table 41: Monthly quality assessment results from comparing OSI SAF sea ice products to MET Norway ice service analysis for the Svalbard area, from JAN. 2021 to DEC. 2021. Mean edge diff is the mean difference in distance between the ice edges in the OSI SAF edge product and MET Norway ice chart.

Month	Correct [%]	SAF lower [%]	SAF higher [%]	Mean edge diff [km]	Number of obs.
JAN. 2021	95.50	4.13	0.36	80.68	370276
FEB. 2021	97.56	2.18	0.26	65.24	370664
MAR. 2021	98.64	1.28	0.08	39.30	463720
APR. 2021	98.84	0.84	0.32	22.83	370324
MAY 2021	-	-	-	-	-
JUN. 2021	-	-	-	-	-
JUL. 2021	-	-	-	-	-
AUG. 2021	-	-	-	-	-
SEP. 2021	-	-	-	-	-
OCT. 2021	98.54	1.24	0.21	31.02	277299
NOV. 2021	97.58	2.31	0.11	30.00	462165
DEC. 2021	93.60	5.91	0.49	54.80	369808

Table 42: Monthly quality assessment results from comparing OSI SAF sea ice products to MET Norway ice service analysis for the Weddell Sea area, from JAN. 2021 to DEC. 2021. Mean edge diff is the mean difference in distance between the ice edges in the OSI SAF edge product and MET Norway ice chart.

Comments:
In figure 42, the Northern Hemisphere OSI SAF sea-ice edge product is compared with navigational ice charts from the Svalbard region (MET Norway ice service). The yearly averaged edge difference for the recent 12 months in 2021 is 19.1 km and the target accuracy requirement of 20 km edge difference per year is therefore met. As previous years, the monthly differences are well below the yearly requirement all months except the summer months of June-September when melting of snow and ice makes the product quality worse.
In figure 43, the Southern Hemisphere OSI SAF sea-ice edge product is compared with weekly navigational ice charts from the Weddel Sea region (MET Norway ice service) covering SH summer period October-April. The yearly averaged edge difference for the 7 months containing ice charts within the recent 12 months is 46.3 km and hereby exceeds the target accuracy requirement of 45 km. The monthly differences are especially high in SH mid-summer month of December-Februray, when melting of snow and ice makes the product quality worse. These 3 months dominate the annual average.

5.3.4. Global sea ice type (OSI-403-d) quality

The sea ice type quality assessment is done as a monitoring of the monthly variation of the multi year ice area coverage, as presented in the table below. The monthly standard deviation (st dev) in the difference from the running mean of the multi-year ice (MYI) area coverage shall be below 100.000km2 to meet the target accuracy requirement.

Month	SD wrt running mean [km²]	Mean MYI coverage [km²]
JAN. 2021	50,469	1,854,820
FEB. 2021	47,508	1,743,696
MAR. 2021	58,901	1,795,449
APR. 2021	43,698	1,458,930
MAY 2021	25,201	1,266,262
JUN. 2021	-	-
JUL. 2021	-	-
AUG. 2021	-	-
SEP. 2021	-	-
OCT. 2021	111,269	2,671,888
NOV. 2021	33,364	2,676,821
DEC. 2021	70,297	2,381,007

Table 43: Monitoring of NH sea ice type quality by comparing the multi year coverage with the 11-days running mean, from JAN. 2021 to DEC. 2021.

Month	SD wrt running mean [km²]	Mean MYI coverage [km²]
JAN. 2021	-	-
FEB. 2021	-	-
MAR. 2021	65,882	276,131
APR. 2021	55,538	453,154
MAY 2021	79,110	552,519
JUN. 2021	75,392	730,022
JUL. 2021	83,269	824,266
AUG. 2021	103,208	1,145,150
SEP. 2021	-	-
OCT. 2021	-	-
NOV. 2021	-	-
DEC. 2021	-	-

Table 44: Monitoring of SH sea ice type quality by comparing the multi year coverage with the 11-days running mean, from JAN. 2021 to DEC. 2021.

Comments:
Table 43 shows the sea-ice type monitoring for NH. The mid-column represents the monthly standard deviations of the daily MYI coverage variability. All months have values well below the target requirement of 100.000 km2, except October 2021 which has a value just above the requirement.

Table 44 shows the monitoring of the new sea-ice type product for SH since the beginning of operationalisation in March 2021. All months have values below the target requirement of 100.000 km2, except August 2021 which has a value just above the requirement.

5.3.5. Sea ice emissivity (OSI-404) quality

The near 50 GHz sea ice emissivity product is compared to the 50.3 GHz and 52.8 GHz vertical polarized surface emissivity (which is the same at these two frequencies) at an incidence angle at 50 degrees. The product emissivity covers all incidence angles from nadir to 60 degrees but the validation product is derived from measurements at 50 degrees. The validation emissivity product is derived from NWP data and SSMIS satellite data. Both the OSI SAF product and the validation products cover the entire northern and southern hemisphere sea ice cover, including all ice types and seasons. The total mean difference plot in figure 45 is the difference between the hemispheric OSI SAF product and the validation product.

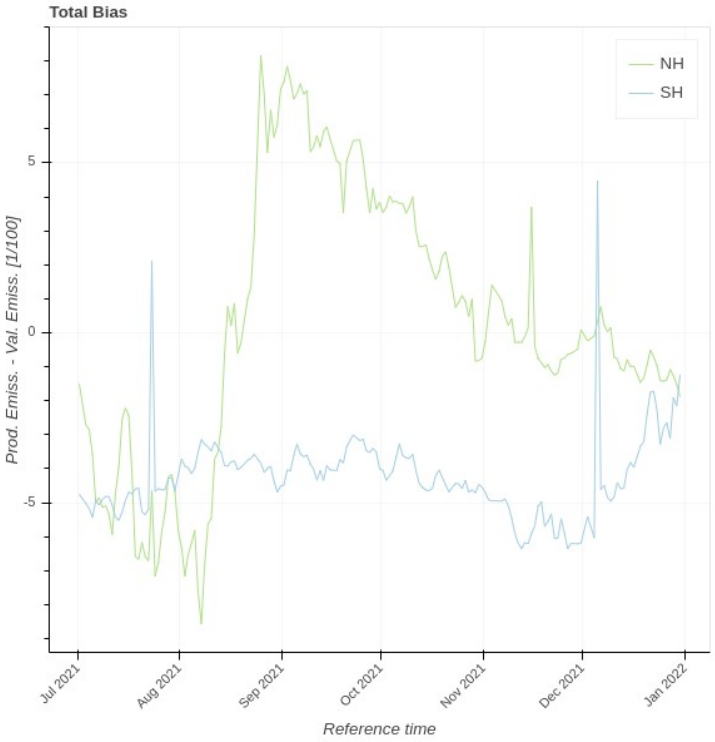


Figure 45: The mean hemispheric difference between the OSI SAF operational product and the validation product derived from NWP and SSMIS data. The y-axis unit is in hundreds (1/100)

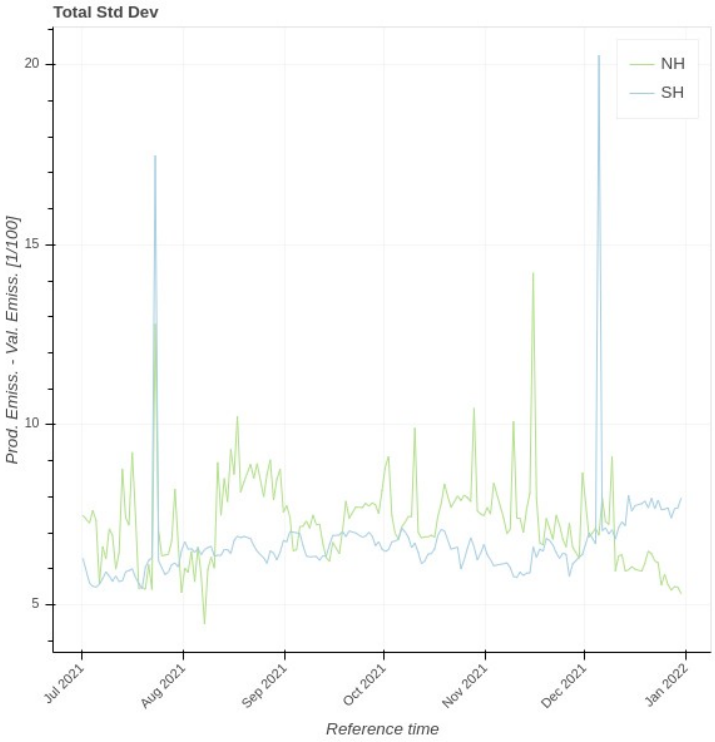


Figure 46: The standard deviation of the difference between the OSI SAF operational product and the validation product for the northern and southern hemispheres. The y-axis unit is in hundreds (1/100)

Comments:
The mean annual difference on the Northern Hemisphere is 0.001 and on the Southern Hemisphere it is -0.04. There is no clear seasonal cycle neither on the northern nor southern hemisphere. The standard deviation is just above the target accuracy, but below the threshold accuracy.

	Mean difference	SD	Target accuracy	Threshold accuracy
NH	0.001	0.07	± 0.05	± 0.15
SH	-0.04	0.07	± 0.05	± 0.15

5.3.6. Low resolution sea ice drift (OSI-405-c) quality

Not available yet.

5.3.7. Medium resolution sea ice drift (OSI-407-a) quality

Quality assessment dataset

Quality assessment is performed by collocation of the drift vectors with the trajectories of in situ drifters. Those drifting objects are buoys (e.g. the Ice Tethered Profilers) or ice camps (e.g. the Russian manned stations) that report their position at typically hourly to 3 hourly intervals. They are made available in near-real-time via the GTS network at DMI. Argos data in the DMI GTP data have no quality flags and accuracy can be greater than 1500 m. It has been shown that the MR ice drift mean difference statistics improves significantly when validation is performed against high accuracy GPS drifters only (OSI-407 validation report and Phil Hwang, 2013. DOI: 10.1080/01431161.2013.848309). The CDOP3 WP22910 'HL temperature and sea ice drift in-situ validation database' includes work to archive and improve quality control of drifter data to be used in the MR ice drift validation.

A nearest-neighbor approach is implemented for the collocation and any collocation pair whose distance between the product and the buoy is larger than 20 km or temporal difference greater than ±60 minutes from the satellite start time and, likewise, satellite end time is disregarded. The temporal mismatch between satellite pairs and the corresponding buoy data is thus maximum 2 hours, but zero in average.

The product requirements for the MR ice drift product on threshold accuracy, target accuracy and optimal accuracy is 5 km, 2 km and 1 km yearly standard deviation, respectively.

Reported statistics

The Medium Resolution Sea Ice Drift product comprises two production modes, a summer mode from May to August, and a winter mode from September to April. These modes are using Visible (AVHRR channel 2) and Thermal Infra-Red (AVHRR channel 4), respectively.

Quality assessment statistics

Table 45 below, show selected mean difference statistics against drifting buoys. Mean differences (x-mean, y-mean) and standard deviation of mean differences (x-SD, y-SD) are shown, in meters, for the 2 perpendicular drift components (x, y). Statistics from the best fit between OSI-407-a and buoy data are shown as slope of fit (α) and correlation coefficient (r). N, indicate the number of data pairs that are applied in the mean difference statistics.

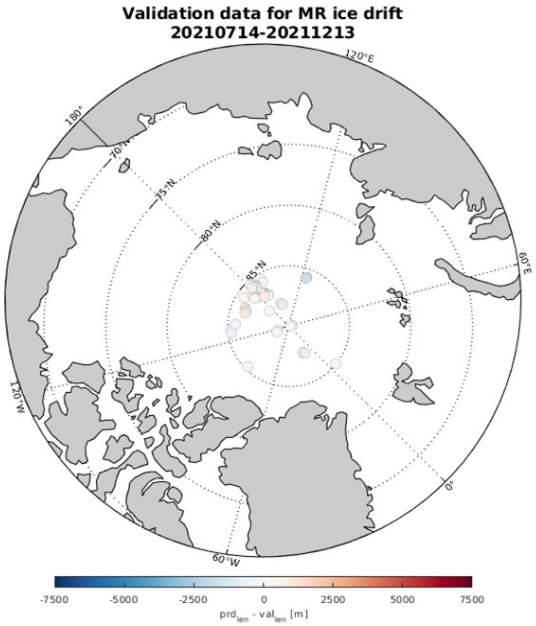


Figure 47: Location of GPS drifters for the quality assessment period (2nd half 2021). The shade of each symbol represents the difference (prod-def) in drift length in meters

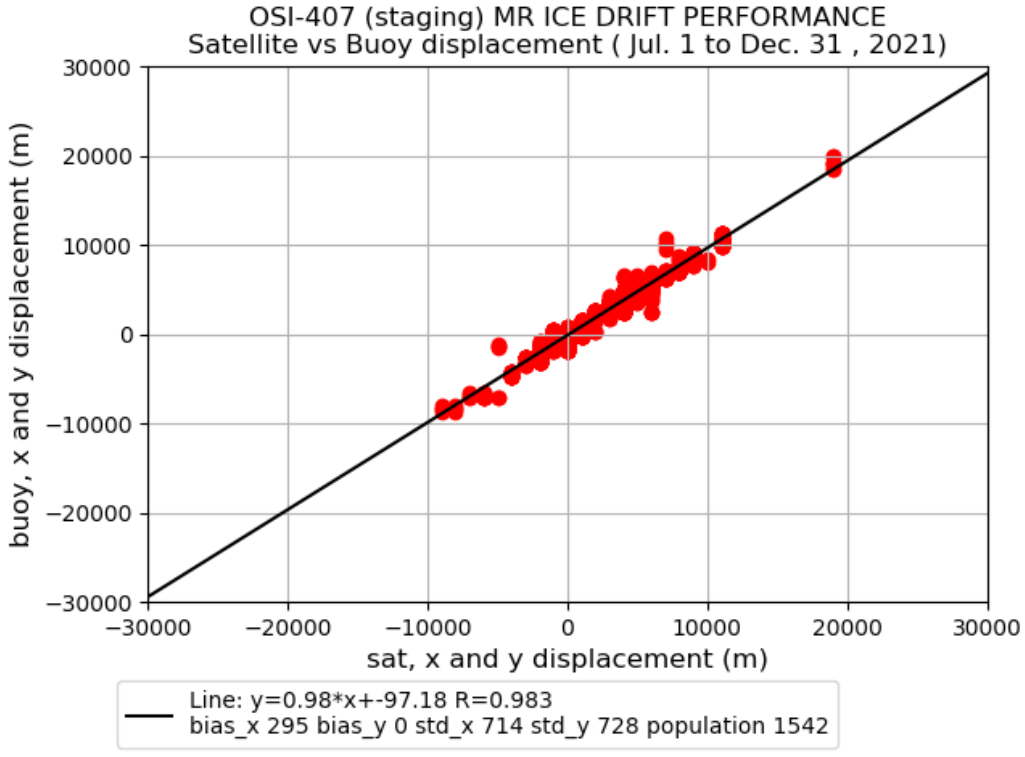


Figure 48: Scatter plot for all the observations of the buoys shown in the previous figure (2nd half 2021).

Month	b(X) [m]	b(Y) [m]	σ(X) [m]	σ(Y) [m]	α	β [m]	ρ	N
JAN. 2021	204	-50	1452	1445	0.99	-76	0.964	4140
FEB. 2021	118	-52	672	1091	0.96	10	0.976	3606
MAR. 2021	61	-60	798	820	0.98	17	0.986	5070
APR. 2021	-8	154	928	1217	0.96	-114	0.983	2130
MAY 2021	73	-73	626	794	0.97	-25	0.985	1336
JUN. 2021	NA	NA	NA	NA	NA	NA	NA	NA
JUL. 2021	232	-323	670	4	0.95	277	0.997	30
AUG. 2021	NA	NA	NA	NA	NA	NA	NA	NA
SEP. 2021	-504	-825	1689	1215	1.05	692	0.970	40
OCT. 2021	539	-179	366	505	0.86	-154	0.977	82
NOV. 2021	-192	117	983	509	1.00	33	0.997	38
DEC. 2021	319	39	650	715	0.97	120	0.980	1352
Last 12 months	118	-26	973	1092	0.98	-35	0.978	17824

Table 45: MR sea ice drift product (OSI-407-a) performance, JAN. 2021 to DEC. 2021

Comments:
Note that the matchups for the statistics above are also shown in the latest scatter plot shown above.

The product requirement target accuracy of 2 km standard deviation is met.
Semi-automatic quality control (based on threshold on maximum buoy drift, 20+km difference between observation and product, visual inspection on drift scatter plots (buoy vs. satellite), and inspection of extreme outliers) has been carried out for the whole validation period.

For the second half period of 2021, match-ups were found with 15 individual buoys during this period, after carrying out the automated nearest-neighbour approach.
It should be noted that only few observations were available for the second half year. Nevertheless, the validation results satisfy the target, and most of the time even the optimal accuracy.

5.4. Global Wind quality (OSI-102 series, OSI-104 series)

The wind products are required to have an accuracy of better than 2.0 m/s in wind component standard deviation with a mean difference of less than 0.5 m/s in wind speed.

The scatterometer winds are monitored against forecast winds of the ECMWF global model. Forecasts of +3 to +15 hours are used and the model winds are interpolated with respect to time and location. The monitoring of relevant quality parameters as a function of time yields a sensitive method of detecting deviations of normal operation. However, one must be careful to regard the difference with reference background NWP model winds as the 'true' accuracy of the product, since both the NWP model winds and the scatterometer winds contain errors. Deviations in product quality usually appear as a step in one or more of the plots. See section 5.4.1 for the monthly averages.

The scatterometer winds are also compared to in situ equivalent neutral wind data from moored buoys, monthly averages are shown in section 5.4.2

Seasonal weather variations imply differences in mean atmospheric stability, differences in dynamics, and differences in the distribution of wind speeds. These differences cause variations in the spatial representativeness errors associated with scatterometer wind quality assessment and in the difference statistics. Such effects cause seasonal oscillations that appear mainly in the wind speed mean differences plots against both model winds and buoy winds. For more background information we refer to: Hans Hersbach (2010) *Comparison of C-band scatterometer CMOD5.N equivalent neutral winds with ECMWF*, J. Atmos. Oceanic Technol., 27, 721–736.

We have studied the scatterometer wind speed mean differences against buoy winds for the tropics and the Northern Hemisphere mid latitudes separately. It appears that the mean differences in the tropics are fairly constant throughout the year, whereas the wind speed mean differences in the NH are higher in the winter than in the summer. Hence the seasonal cycles are mainly caused by weather variations in the mid latitudes.

5.4.1. Comparison with ECMWF model wind data

The figure below shows the monthly results of January 2020 to December 2021.

It is clear from the plots in this section, that the products do meet the accuracy requirements from the Service Specification Document [AD-1] (mean difference less than 0.5 m/s and wind component standard deviation accuracy better than 2 m/s) in most cases when they are compared to buoy winds. Note that local small scale wind variations, which are resolved by the buoys but not by the scatterometer, contribute to the standard deviations. The scatterometer errors are therefore smaller than what is shown in the plots as we know from triple collocation analysis. The OSI SAF winds are routinely compared to Met Office NWP model data in the NWP SAF project. Monthly statistics of the products are available as e.g. 2D histograms and map plots, see http://nwpsaf.eu/site/monitoring/winds-quality-evaluation/scatterometer-mon/.

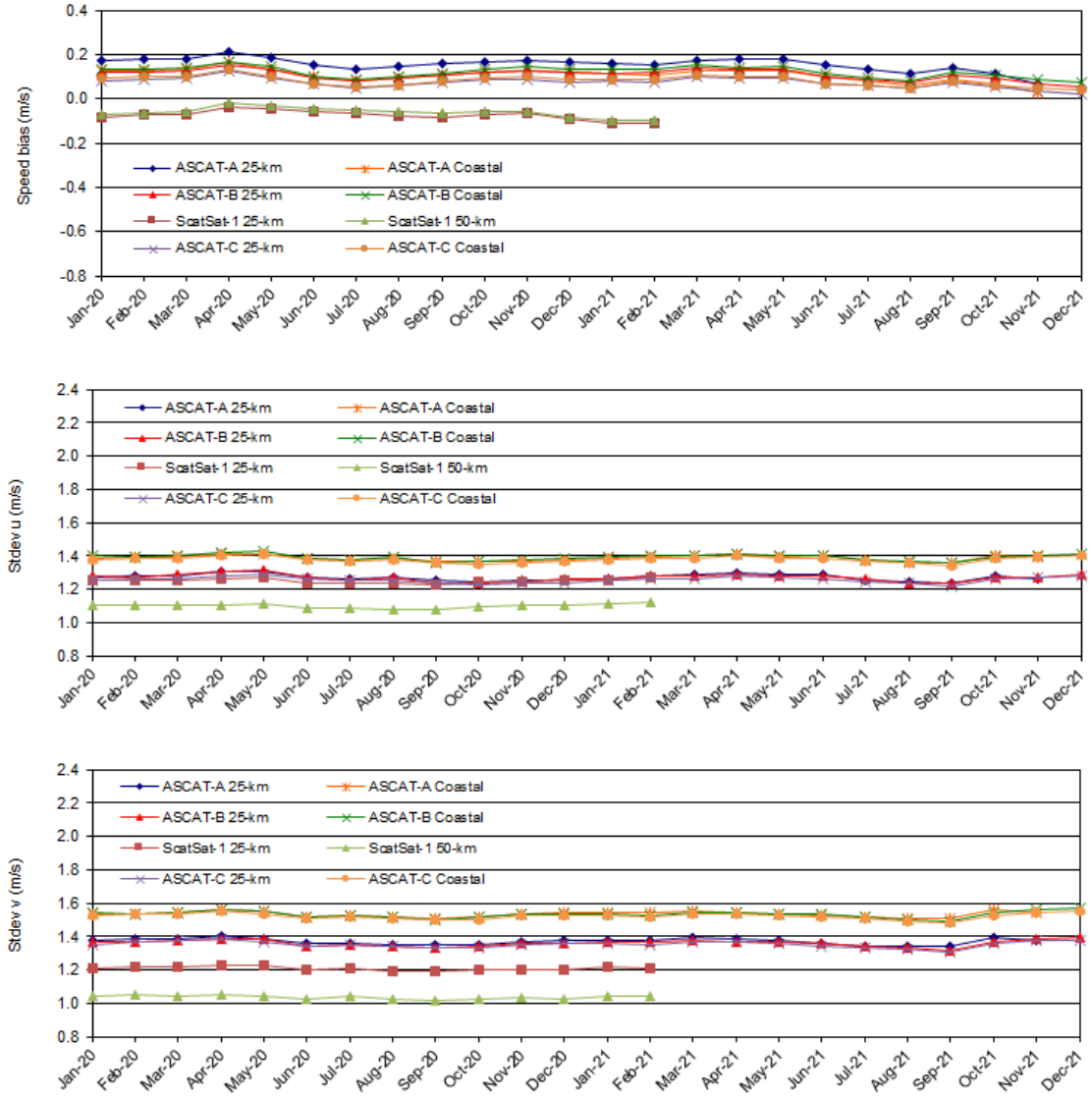


Figure 49: Comparison of ASCAT and ScatSat-1 scatterometer winds against ECMWF NWP forecast winds (monthly averages). For each product, the wind speed mean difference (scatterometer minus ECMWF, top), wind u component standard deviation (middle) and wind v component standard deviation (bottom) are shown.

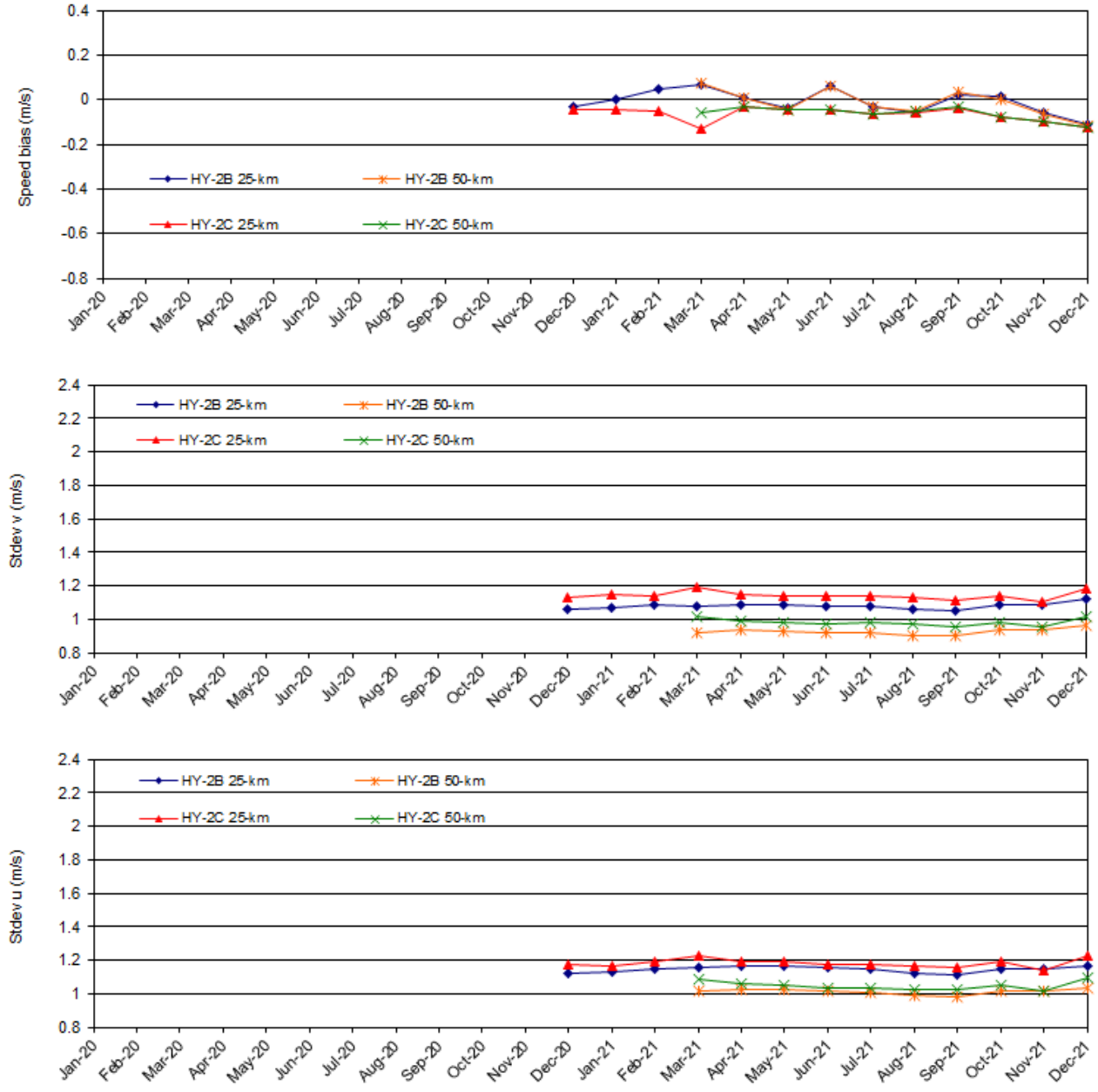


Figure 50: Comparison of HY-2B and HY-2C scatterometer winds against ECMWF NWP forecast winds (monthly averages). For each product, the wind speed mean difference (scatterometer minus ECMWF, top), wind u component standard deviation (middle) and wind v component standard deviation (bottom) are shown.

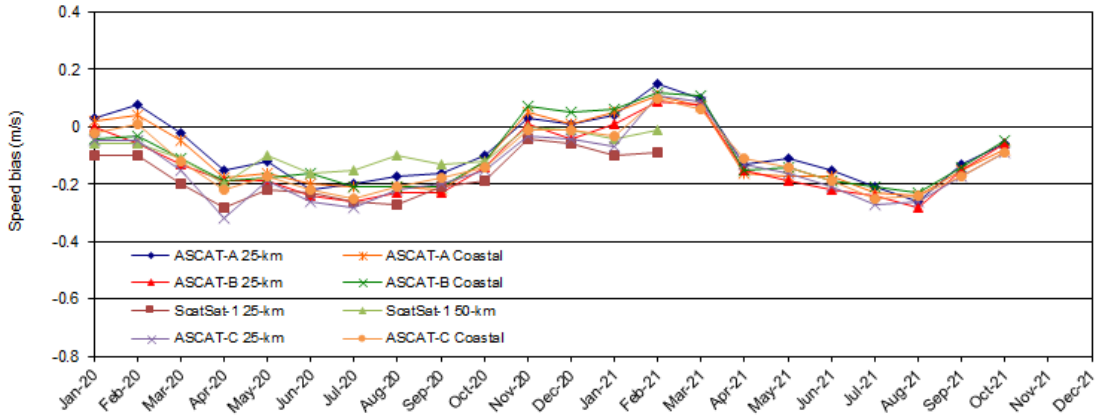
5.4.2. Comparison with buoys

We compare the scatterometer winds with wind data from moored buoys on a monthly basis. The buoy data of approximately 150 buoys spread over the oceans (most of them in the tropical oceans and near Europe and North America) are retrieved from the ECMWF MARS archive and collocated with scatterometer winds. The buoy winds are converted to 10-m neutral winds using the LKB model, see Liu, W.T., K.B. Katsaros, and J.A. Businger, *Bulk parameterization of air-sea exchanges of heat and water vapor including the molecular constraints in the interface*, J. Atmos. Sci., vol. 36, 1979.

The figure below shows the monthly results of January 2020 to October 2021.The last months of the reporting period could not be covered since the blacklists from ECMWF were not available yet. These months will be included in the next Operations Report.

Note that the statistics as shown for the different ASCAT products are not from a common set of buoy measurements. So the number of scat/buoy collocations differs per product, in some cases we do have an ASCAT coastal wind but no 12.5 km or 25 km wind due to (small) differences in quality control. Also the number of available buoys changes over time as is shown in the bottom plot. This sampling issue gives rise to different mean difference and standard deviation scores in the plots below.

It is clear from the plots in this section, that the products do meet the accuracy requirements from the Service Specification Document [AD-1] (mean difference less than 0.5 m/s and wind component standard deviation accuracy better than 2 m/s) when they are compared to buoy winds.



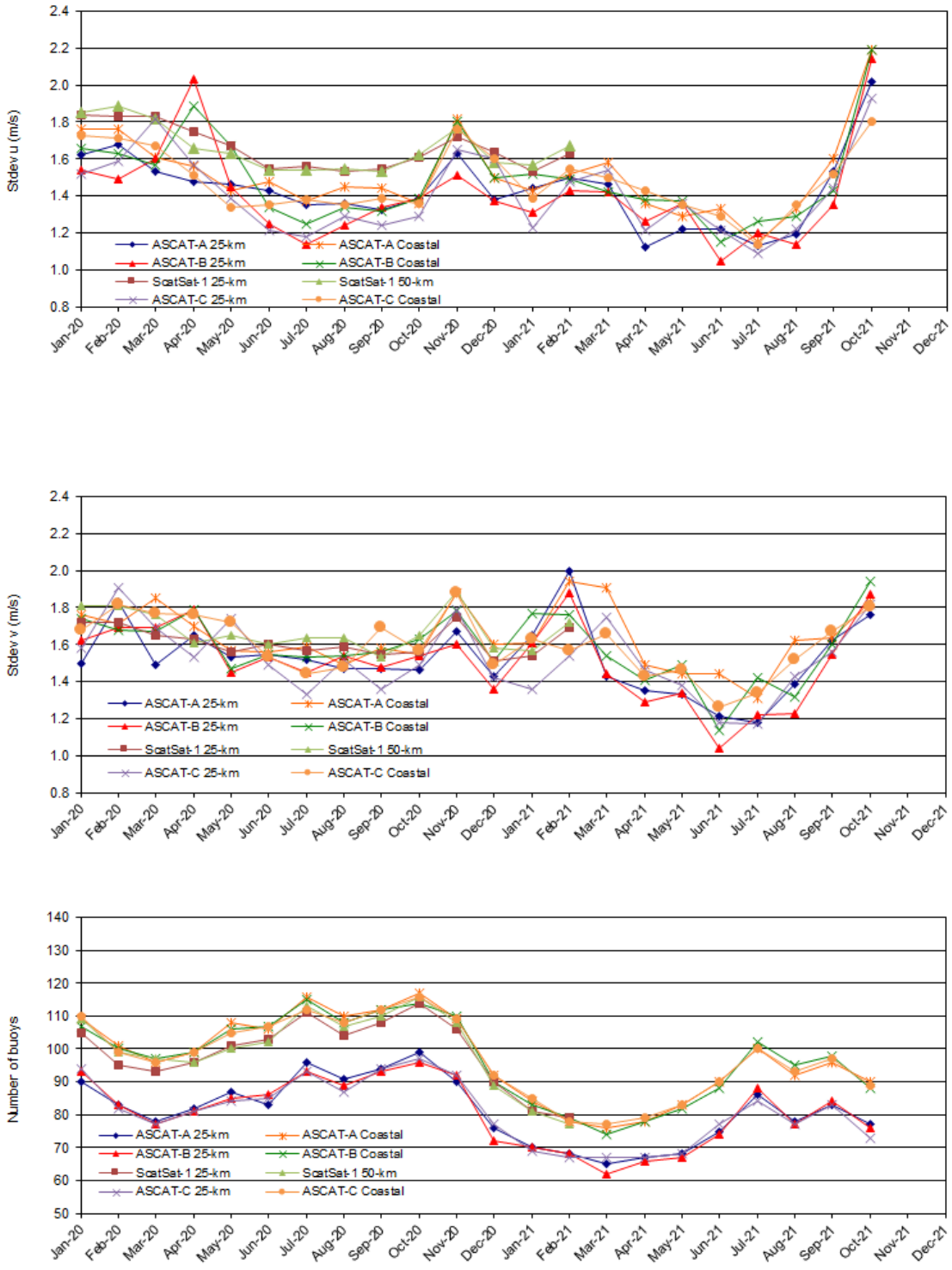


Figure 51: Comparison of scatterometer winds against buoy winds (monthly averages). For each product, the wind speed mean difference (scatterometer minus buoy, top), wind u component standard deviation (2nd plot) and wind v component standard deviation (3rd plot) are shown. Also the number of buoys available for the comparisons is shown (bottom).

6. Service and Product usage

6.1. Statistics on the web site and help desk

The OSI SAF offers to the users

- a central web site, http://osi-saf.eumetsat.int, managed by MF/CMS,
- a web site for LML, http://osi-saf.eumetsat.int/lml/, managed by MF/CMS,
- a web site for HL, http://osisaf.met.no/, managed by MET Norway,
- a web site for WIND, https://scatterometer.knmi.nl/osisaf/, managed by KNMI.

Users are recommended to make requests preferably through the central web site Help desk, with the guarantee that their demand will be acknowledged or answered quickly. However for requests concerning the HL or Wind products they may get access to direct contact points at MET Norway or KNMI.

6.1.1. Statistics on the registered users

Statistics on the central Web site use		
Month	Registered users	Pages
JUL. 2021	2112	NA
AUG. 2021	2115	NA
SEP. 2021	2124	2509
OCT. 2021	2132	3057
NOV. 2021	2139	3530
DEC. 2021	2146	3167

Table 46: Statistics on central OSI SAF web site use over 2nd half 2021.

Comment: Following the change of the website at the beginning of July 2021, we do not have the statistics for the months July and August.

The following graph illustrates the evolution of external registered users on the central web site.

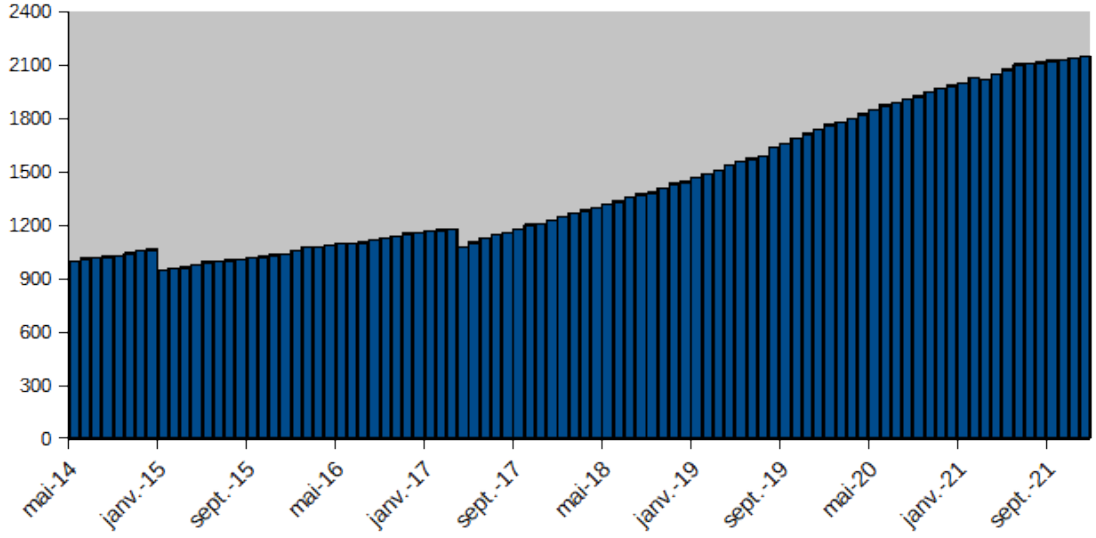


Figure 52: Evolution of external registered users on the central Web Site from April 2014 to DEC. 2021.

The following table lists the institutions or companies the new registered users (over 2nd half 2021) are from.

Country	Institution, establishment or company
Algeria	Ecole Polytechniques d'Architecture et d'Urbanisme APAU Alger
Armenia	Department of Meteorology
Australia	Bureau of Meteorology (Australia)
Belgium	University of Liege
Cambodia	Department of Meteorology
China	Second Institute of Oceanography, State Oceanic Administration
Denmark	Danish Meteorological Institute
France	Actimar
France	Collecte localisation Satellites
France	Institut Français de Recherche pour l'Exploitation de la Mer
France	Météo-France
Germany	European Organisation for the Exploitation of Meteorological Satellites
Italy	Institute of Marine Science - CNR
Italy	Istituto di Scienza e Tecnologie dell'Informazione "Alessandro Faedo" (ISTI)
Russian Federation	Saint Petersburg State University
Russian Federation	Shirshov Institute of Oceanology RAS
Singapore	National University of Singapore
Tanzania, United Republic	Tanzania Meteorological Agency
United Kingdom	British Antarctic Survey
United States of America	Cooperative Institute for Research in Environmental Sciences
United States of America	Jet Propulsion Laboratory

Table 47: List of institutes of the newly registered users over 2nd half 2021 on the central Web Site

Moreover 21 new individual users, i.e. persons independent from any institute, establishment or company, registered on the period.

The following table gives the list of the newly registered wind users at KNMI.

Country	Institution, establishment or company	Acronym
Brazil	National Institute for Space Research	
China	Guangdong Meteorology Bureau	
China	Jiangsu Meteorological Observatory	
China	National Space Science Center	NSSC
China	China Meteorological Administration	CMA
Equador	Instituto Oceanográfico de la Armada	
India	NCMRWF	
Japan	Japan Meteorological Agency	JMA
Phillipines	Philippine Atmospheric, Geophysical, and Astronomical Services Administration	
The Netherlands	Infoplaza Marine Weather	
USA	I.M. Systems Group (IMSG), NOAA/NESDIS/STAR	
USA	Brigham Young University	BYU
USA	Weather Routing, Inc.	WRI
	3 independent users, not affiliated to an organisation	

Table 48: List of institutes of the newly registered wind users at KNMI

6.1.2. Status of user requests made via the helpdesk

The user requests are split into 4 categories:

- Unavailable: one or several product(s) are unavailable
- Anomaly: anomaly in one or several product(s)/services
- Archive: request for archived data
- Information: request for information

	Total number of helpdesk inquiries	Number of inquiries acknowledged within3 working days	Inquiries categorized as 'information'	Inquiries categorized as 'archive'	Inquiries categorized as 'unavailable'	Inquiries categorized as 'anomaly'
LML subsystem	8	8	4		4	
HL subsystem	17	17	10	3	2	2
WIND subsystem	47	47	43	2	2	0

Table 49: Helpdesk inquires over 2nd half 2021

6.1.3. Visitors statistics

Since the respective websites and technologies differ, and also the tools to get the statistics, it is not easy to compare the statistics. The following statistics are mainly useful to see changes over time.

The following graph shows the evolution of page views on the central web site (https://osi-saf.eumetsat.int/) which includes the pages for the LML processing center (https://osi-saf.eumetsat.int/lml-processing-center).

Figure 53: Evolution of page views on the central OSI SAF web site over the past 2 years

The following graph illustrates the evolution of page views on the OSI SAF High Latitude portal (http://osisaf-hl.met.no).

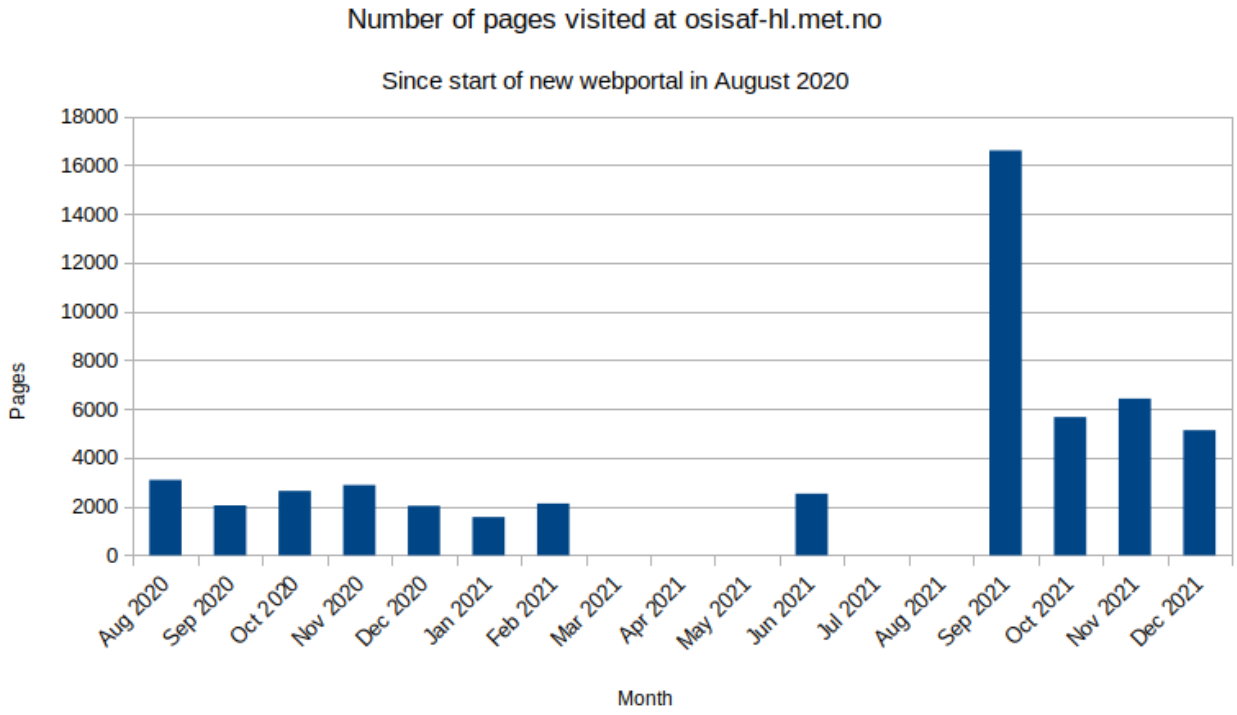


Figure 54: Evolution of page views on the HL OSI SAF Sea Ice portal over the past 2 years. Some months are missing statistics due to web traffic logs deleted by mistake.

The following graph illustrates the evolution of page views on the KNMI scatterometer web pages (https://scatterometer.knmi.nl/home/), which are partly devoted to the OSI SAF wind products.
Note: each click in a product viewer (to zoom in on a specific region) results in a new page view, That's why there are so many page views.

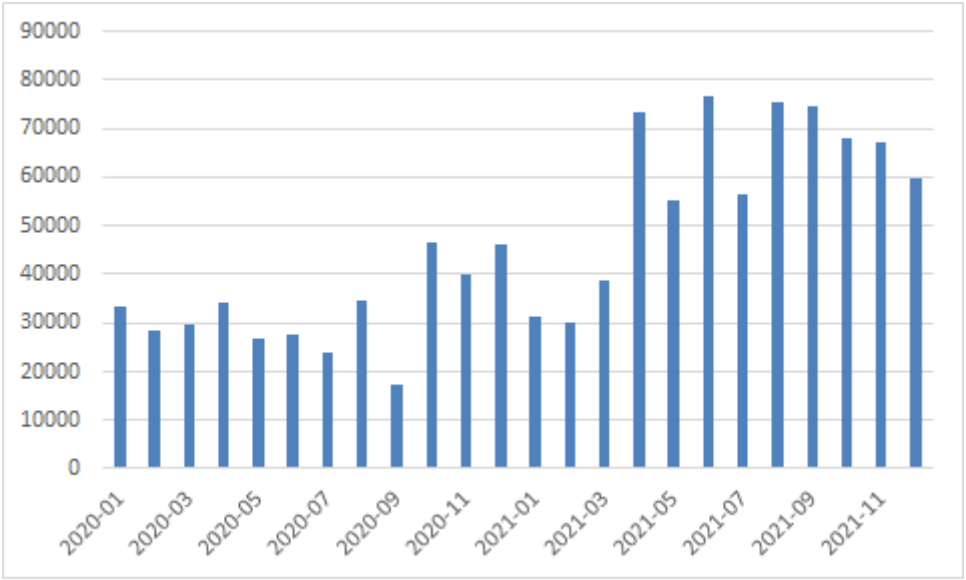


Figure 55: Evolution of page views on KNMI scatterometer website over the past 2 years

6.2. Statistics on the OSI SAF FTP servers use

6.2.1. Downloads statistics from the OSI SAF LML subsystem and from PO.DAAC

SST and Fluxes products are available on Ifremer FTP server. Some SST products are also available at the PODAAC. Although outside the OSI SAF the PODAAC kindly provides the OSI SAF with statistics on the downloading of the OSI SAF products on their server.

		JUL. 2021		AUG. 2021		SEP. 2021		OCT. 2021		NOV. 2021		DEC. 2021	
		Ifremer FTP/ HTTP/ OpenDap	PO.DAAC	Ifremer FTP/ HTTP/ OpenDap	PO.DAAC	Ifremer FTP/ HTTP/ OpenDap	PO.DAAC	Ifremer FTP/ HTTP/ OpenDap	PO.DAAC	Ifremer FTP/ HTTP/ OpenDap	PO.DAAC	Ifremer FTP/ HTTP/ OpenDap	PO.DAAC
SST MAP +LML			x		x		x		x		x		x
SSI MAP +LML			x		x		x		x		x		x
DLI MAP +LML			x		x		x		x		x		x
OSI-201 series	GBL SST		238		240		204		220		2038		0
OSI-202 series	NAR SST		506		491		454		720		906		0
OSI-204 series	MGR SST		34278		33073		31959		37015		30847		0
OSI-206 series	Meteosat SST		3309		3599		3124		4628		21270		0
OSI-207 series	GOES-East SST		30		29		31		32		31		0
OSI-IO-SST	Meteosat-8 SST		986		918		948		978		2383		0
OSI-208 series	IASI SST		62		60		57		65		69		0
OSI-250	Meteosat SST Data record												
OSI-303 series	Meteosat DLI		x		x		x		x		x		x
OSI-304 series	Meteosat SSI		x		x		x		x		x		x
OSI-305 series	GOES-East DLI		x		x		x		x		x		x
OSI-306 series	GOES-East SSI		x		x		x		x		x		x
OSI-IO-DLI	Meteosat-8 DLI		x		x		x		x		x		x
OSI-IO-SSI	Meteosat-8 SSI		x		x		x		x		x		x

Table 50: Number of OSI SAF products downloaded from Ifremer FTP server and PO.DAAC server over 2nd half 2021.

Note: PO.DAAC statistics about the NAR SST product is the sum of NOAA-17, NOAA-18, NOAA-19, Metop-A and Metop-B NAR SST products.

6.2.2. Downloads statistics from the OSI SAF HL subsystem, and from CMEMS and C3S

Sea Ice, SST and Flux products are available on MET Norway FTP server. Some products are also made available through Copernicus CMEMS, and statistics are kindly made available for these products.

OSI SAF HL FTP server		JUL. 2021	AUG. 2021	SEP. 2021	OCT. 2021	NOV. 2021	DEC. 2021
OSI-401 series	Global Sea Ice Concentration (SSMIS)	222440	45990	128874	66375	149152	52654
OSI-402 series	Global Sea Ice Edge	19878	6870	40270	9616	14007	12946
OSI-403 series	Global Sea Ice Type	27688	58595	9163	7491	22767	83880
OSI-404 series	Global Sea Ice Emissivity	108	18	1	31	1	0
OSI-405 series	Low resolution Sea Ice Drift	8567	18259	9708	16798	7931	11957
OSI-407 series	Medium resolution Sea Ice Drift	900	114	2678	7620	2628	8115
OSI-408 series	Global Sea Ice Concentration (AMSR-2)	1762	9391	2571	6228	8525	3872
OSI-410	Level 2 PMW sea ice concentration	3059	634	4383	4676	6581	6344
OSI-409	Ice Concentration Data Record v1.2	3314	898	425	1	23090	7651
OSI-430	Ice Concentration ICDR v1.2	1528	56	609	0	3240	0
OSI-430-b	Ice Concentration ICDR v2.0	8092	17045	6000	10159	7057	8350
OSI-450	Ice Concentration Data Record v2.0	23866	11969	27084	97868	97598	24254
OSI-203 series	AHL SST	784	4465	983	164	4666	384
OSI-205 series	L2 SST/IST	53461	132337	11562	40199	104511	49804
OSI-301 OSI-302 series	AHL DLI - SSI	45	261	504	496	485	1664

Table 51: Number of OSI SAF products downloaded from OSI SAF HL FTP server over 2nd half 2021

Redistribution by CMEMS and C3S		JUL. 2021		AUG. 2021		SEP. 2021		OCT. 2021		NOV. 2021		DEC. 2021	
		CMEMS	C3S	CMEMS	C3S	CMEMS	C3S	CMEMS	C3S	CMEMS	C3S	CMEMS	C3S
OSI-401 series	Global Sea Ice Concentration (SSMIS)	38457	-	50111	-	41812	-	37380	-	41419	-	32472	-
OSI-402 series	Global Sea Ice Edge	33740	-	45078	-	35049	-	25406	-	27318	-	24521	-
OSI-403 series	Global Sea Ice Type	37508	-	48549	-	36298	-	24970	-	26898	-	24017	-
OSI-405 series	Low resolution Sea Ice Drift	32898	-	44860	-	35776	-	32920	-	34837	-	26932	-
OSI-430-b	Ice Concentration ICDR v2.0	0	7440	23	22458	27	2570	6	15856	45	14039	30	4650
OSI-450	Ice Concentration Data Record v2.0	4200	40211	4196	78805	4117	35244	4061	11587	4175	43736	3931	11376

Table 52: Number of OSI SAF products redistributed by CMEMS (downloads/product/day) and C3S (number of files) over 2nd half 2021

6.2.3. Downloads statistics from the OSI SAF WIND subsystem and from PO.DAAC

Wind products are available on KNMI FTP server. The products are also available at the PODAAC in NetCDF. Although outside the OSI SAF the PODAAC kindly provides the OSI SAF with statistics on the downloading of the OSI SAF products on their server.

The numbers for the KNMI FTP server are the average number of downloads per product file of the near-real time products. The numbers for PO.DAAC are the downloaded number of archived product files (containing one orbit each) which may cover the whole product history. Note that the BUFR products are also disseminated through EUMETCast.

From the KNMI FTP server we get loggings of the number of downloads of a certain product (i.e., all files of a product) per day. These numbers are fairly constant over a period of one month. The reported number of downloads is obtained by dividing the number of downloads per day by the number of product files produced per day. The KNMI FTP server contains a rolling archive of the last 3 days so these numbers reflect the real NRT usage and we believe it should be close to the number of product users.

For PO.DAAC the situation is different since it contains the full history of products. The downloaded files can be recent or they can be from the past. Also, PO.DAAC contains ASCAT files in full orbits whereas the KNMI FTP sever contains ASCAT files in 3 minute PDUs for BUFR format and full orbits for NetCDF format. This makes comparing of the numbers difficult.

		JUL. 2021		AUG. 2021		SEP. 2021		OCT. 2021		NOV. 2021		DEC. 2021	
		KNMI FTP	PO.DAAC	KNMI FTP	PO.DAAC	KNMI FTP	PO.DAAC	KNMI FTP	PO.DAAC	KNMI FTP	PO.DAAC	KNMI FTP	PO.DAAC
OSI-102	ASCAT-A	15 per file	85211	15 per file	432029	15 per file	422391	15 per file	687707	15 per file	373090		9199

	25 km	(BUFR), 19 per file (NetCDF)		(BUFR), 19 per file (NetCDF)		(BUFR), 19 per file (NetCDF)		(BUFR), 19 per file (NetCDF)		(BUFR), 19 per file (NetCDF)			
OSI-102-b	ASCAT-B 25 km	56 per file (BUFR), 18 per file (NetCDF)	89273	56 per file (BUFR), 18 per file (NetCDF)	102185	56 per file (BUFR), 18 per file (NetCDF)	427665	19 per file (BUFR), 36 per file (NetCDF)	719283	19 per file (BUFR), 36 per file (NetCDF)	782750	19 per file (BUFR), 36 per file (NetCDF)	596324
OSI-102-c	ASCAT-C 25 km	20 per file (BUFR), 11 per file (NetCDF)	77009	20 per file (BUFR), 11 per file (NetCDF)	40111	20 per file (BUFR), 11 per file (NetCDF)	385230	20 per file (BUFR), 20 per file (NetCDF)	646914	20 per file (BUFR), 20 per file (NetCDF)	674473	20 per file (BUFR), 20 per file (NetCDF)	575430
OSI-104	ASCAT-A Coastal	42 per file (BUFR), 19 per file (NetCDF)	9769	42 per file (BUFR), 19 per file (NetCDF)	63797	42 per file (BUFR), 19 per file (NetCDF)	4553	42 per file (BUFR), 19 per file (NetCDF)	43133	42 per file (BUFR), 19 per file (NetCDF)	15730		264
OSI-104-b	ASCAT-B Coastal	46 per file (BUFR), 18 per file (NetCDF)	24722	46 per file (BUFR), 18 per file (NetCDF)	71326	46 per file (BUFR), 18 per file (NetCDF)	3412	9 per file (BUFR), 36 per file (NetCDF)	27138	9 per file (BUFR), 36 per file (NetCDF)	4640	9 per file (BUFR), 36 per file (NetCDF)	2594
OSI-104-c	ASCAT-C Coastal	12 per file (BUFR), 11 per file (NetCDF)	29142	12 per file (BUFR), 11 per file (NetCDF)	12471	12 per file (BUFR), 11 per file (NetCDF)	1569	10 per file (BUFR), 20 per file (NetCDF)	33545	10 per file (BUFR), 20 per file (NetCDF)	23106	10 per file (BUFR), 20 per file (NetCDF)	1872
OSI-114-a	HY-2B 25 km wind vectors							4 per file (BUFR), 7 per file (NetCDF)		4 per file (BUFR), 7 per file (NetCDF)		4 per file (BUFR), 7 per file (NetCDF)	
OSI-114-b	HY-2B 50 km wind vectors							2 per file (BUFR), 6 per file (NetCDF)		2 per file (BUFR), 6 per file (NetCDF)		2 per file (BUFR), 6 per file (NetCDF)	
OSI-115-a	HY-2C 25 km wind vectors							4 per file (BUFR), 7 per file (NetCDF)		4 per file (BUFR), 7 per file (NetCDF)		4 per file (BUFR), 7 per file (NetCDF)	
OSI-115-b	HY-2C 50 km wind vectors							2 per file (BUFR), 6 per file (NetCDF)		2 per file (BUFR), 6 per file (NetCDF)		2 per file (BUFR), 6 per file (NetCDF)	

Table 53: Number of OSI SAF products downloaded from KNMI FTP server and PO.DAAC server over 2nd half 2021

6.3. Statistics from EUMETSAT central facilities

6.3.1. Users from EUMETCast

Here below the list of the OSI SAF users identified by EUMETSAT for the distribution by EUMETCast. The table below shows the overall number of OSI SAF users by country on the 12 January 2022.

Albania	4	Greece	18	Qatar	3
Algeria	9	Guinea	2	Reunion	1
Angola	3	Guinea-Bissau	3	Romania	11
Austria	24	Hong Kong	1	Russian Federation	7
Azerbaijan	3	Hungary	9	Rwanda	6
Bahrain	1	Iceland	2	San Marino	1
Belgium	11	India	3	Sao Tome And Principe	2
Benin	4	Iran, Islamic Republic Of	34	Saudi Arabia	4
Bosnia And Herzegovina	1	Iraq	1	Senegal	9
Botswana	6	Ireland	8	Serbia	2
Brazil	6	Israel	6	Seychelles	3
Bulgaria	6	Italy	300	Sierra Leone	2
Burkina Faso	4	Jordan	2	Slovakia	8
Burundi	2	Kazakhstan	5	Slovenia	1
Cameroon	6	Kenya	14	Somalia	1
Canada	1	Korea, Republic Of	1	South Africa	22
Cape Verde	3	Kuwait	3	South Sudan	1
Central African Republic	2	Kyrgyzstan	1	Spain	52
Chad	4	Latvia	1	Sudan	4
China	5	Lebanon	3	Sweden	6
Comoros	2	Lesotho	4	Switzerland	17
Congo	3	Liberia	3	Syrian Arab Republic	1
Congo, The Democratic Republic Of The	5	Libyan Arab Jamahiriya	1	Tajikistan	1
Cote D'Ivoire	6	Lithuania	2	Tanzania, United Republic Of	6
Croatia	2	Luxembourg	1	Togo	4
Cyprus	1	Madagascar	6	Tunisia	5
Czech Republic	22	Malawi	4	Turkey	7
Denmark	7	Mali	3	Turkmenistan	1
Djibouti	2	Malta	2	Uganda	4
Egypt	6	Mauritania	5	Ukraine	3
Equatorial Guinea	2	Mauritius	8	United Arab Emirates	6

Eritrea	2	Morocco	10	United Kingdom	143
Estonia	3	Mozambique	5	United States	4
Eswatini	4	Namibia	6	Uzbekistan	1
Ethiopia	9	Netherlands	29	Viet Nam	1
Finland	6	Niger	8	Yemen	1
France	67	Nigeria	6	Zambia	4
Gabon	4	North Macedonia	1	Zimbabwe	4
Gambia	3	Norway	4		
Georgia	1	Oman	5		
Germany	130	Pakistan	2		
Ghana	10	Poland	14		
		Portugal	6		

Table 54: Overall number of EUMETCast users by country on the 12 January 2022.

6.3.2. Users and retrievals from EUMETSAT Data Center

Orders Summary over the 2nd half 2021

The table below lists the products downloaded from the EUMETSAT Data Center (EDC), the volume of the downloaded data in megabytes (MB) and the number of files over the **2nd half 2021**.

Product id	Item	Volume in MB	Number of files
OSI-410	F-16_OSICOL2_OPE	2	1
OSI-410	F-16_OSICOL2_TST	2	1
OSI-410	F-17_OSICOL2_OPE	4	3
OSI-410	F-17_OSICOL2_TST	2	1
OSI-410	F-18_OSICOL2_OPE	2	1
OSI-410	F-18_OSICOL2_TST	2	1
OSI-306 series	GOES-13_OSIHSSI_OPE	5063	744
Daily OSI-305-b/OSI-306-b	GOES-16_ODDLISSI_OPE	130	10
Houly OSI-305-b/OSI-306-b	GOES-16_OHDLISSI_OPE	103203	11769
OSI-207-b	GOES-16_OSIHSSTN_OPE	218	8753
OSI-408	GW-1_OSICOAMSRGB_OPE	47044	2605
OSI-410	GW-1_OSICOL2_OPE	6	2
OSI-410	GW-1_OSICOL2_TST	18	6
OSI-102-b	M01_OAS025_OPE	49265	33867
OSI-104-b	M01_OASWC12_OPE	48600	7487
OSI-407-a	M01_OMRSIDRN_OPE	11087	1451

Product id	Item	Volume in MB	Number of files
OSI-201-b	M01_OSSTGLBN_OPE	51144	2956
OSI-205-a	M01_OSSTIST2_OPE	64483	8351
OSI-203-a	M01_OSSTIST3A_OPE	84	6
Ascat winds 12.5 25 km	M02_OAS012_OPE	5970	431
OSI-102-a	M02_OAS025_OPE	40694	23925
Ascat winds 25 km	M02_OASW025_OPE	33	11
OSI-104-a	M02_OASWC12_OPE	25383	4107
OSI-201 series	M02_OSSTGLB_OPE	160	8
OSI-205 series	M02_OSSTIST2_OPE	1537	139
OSI-202	M02_OSSTNAR_OPE	340	32
OSI-102-c	M03_OAS025_OPE	54145	21136
OSI-104-c	M03_OASWC12_OPE	65177	5339
OSI-401-b	MML_OSICOGBN_OPE	70945	5652
OSI-405-c	MML_OSIDRGB_OPE	12988	18245
OSI-402 series	MML_OSIEDGB_OPE	59	684
OSI-402 series	MML_OSIEDGBN_OPE	6773	910
OSI-403 series	MML_OSITYGB_OPE	10	118
OSI-403 series	MML_OSITYGBN_OPE	20712	3372
OSI-304 series (daily)	MSG1_OSIDSSI_OPE	2280	23
Houly OSI-303-a/OSI-304-a	MSG2_OHDLISSI_OPE	59396	328
OSI-304 series (daily)	MSG2_OSIDSSI_OPE	5535	407
OSI-206 series	MSG2_OSIHSST_OPE	42927	8780
OSI-206 series	MSG2_OSIHSSTN_OPE		167
Houly OSI-303-a/OSI-304-a	MSG3_OHDLISSI_OPE	15476	1
OSI-304 series (daily)	MSG3_OSIDSSI_OPE	10468	1160
OSI-304 series	MSG3_OSIHSSI_OPE	5040	737
Daily OSI-303-a/OSI-304-a	MSG4_ODDLISSI_OPE	1349	112
Houly OSI-303-a/OSI-304-a	MSG4_OHDLISSI_OPE	115940	13292
OSI-206 series	MSG4_OSIHSSTN_OPE	33296	11271
OSI-205-b	NPP_OSSTIST2B_OPE	4505	27
OSI-203-b	NPP_OSSTIST3B_OPE	81	6
OSI-112-a	SCATSAT1_OSSW025_OPE	101953	53361
OSI-112-b	SCATSAT1_OSSW050_OPE	2412	402

Table 55: Volume of data downloaded (in MB) by products from EDC over 2nd half 2021.

Ingestion Summary over the 2nd half 2021

The next table lists the received percentage of OSI SAF products by month over the period. In red, there was clearly an outage of products as well under the OSI SAF monthly target performance of 95%.

There might be some differences between disseminated values over EUMETCast and the data ingested in the EDC. We assume it is due to how the availability is calculated in both cases. In the EUMETCast case, the statistics are calculated depending on the number of inputs received, while in UMARF the number of expected products is static (it is considered a theoretical number of expected products).

Product id.	Product name	JUL. 2021	AUG. 2021	SEP. 2021	OCT. 2021	NOV. 2021	DEC. 2021
OSI-404	Global Sea Ice Emissivity (DMSP-F18)	100	100	100	96.8	100	93.6
OSI-305-b	Daily Downward Longwave Irradiance (GOES-16)	100	100	100	100	100	96.8
OSI-306-b	Daily Surface Solar Irradiance (GOES-16)						
OSI-305-b	Hourly Downward Longwave Irradiance (GOES-16)	99.6	99.7	100	100	100	97.0
OSI-306-b	Hourly Surface Solar Irradiance (GOES-16)						
OSI-207-b	Hourly Sea Surface Temperature (GOES-16)	99.6	99.9	100	100	100	97.2
OSI-408	Sea Ice Concentration (AMSR-2)	100	100	100	100	100	96.8
OSI-102-b	ASCAT 25km Wind (Metop-B)	100	99.8	100	100	100	97.3
OSI-104-b	ASCAT 12.5km Coastal Wind (Metop-B)	100	100	99.8	100	100	97.3
OSI-102	ASCAT 25km Wind (Metop-A)	99.3	99.8	100	95.4	100	0
OSI-104	ASCAT 12.5km Coastal Wind (Metop-A)	99.3	100	100	95.2	100	0
OSI-102-c	ASCAT 25 km Wind (Metop-C)	100	100	100	100	99.8	97.3
OSI-104-c	ASCAT 12.5 km Coastal Wind (Metop-C)	100	100	100	100	100	97.3
OSI-201-b	Global Sea Surface Temperature (Metop-B)	100	100	100	100	93.3	96.8
OSI-202-b	NAR Sea Surface Temperature (Metop-B)	100	100	100	100	93.3	96.8
OSI-202-c	NAR Sea Surface Temperature (NOAA-20)	?	?	?	0	100	96.8
OSI-407-a	Sea Ice Drift (Multi Mission)	99.2	100	99.2	100	100	92.0
OSI-205-a	SST/IST L2 (Metop-B)	100	100	100	100	100	100
OSI-205-b	SST/IST L2 (NPP)	100	100	100	100	100	100
OSI-203-a	SST/IST L3 (Metop-B)	100	100	100	100	96.8	96.8
OSI-203-b	SST/IST L3 (NPP)	100	100	100	100	100	96.8
OSI-401-b	Global Sea Ice Concentration (Multi Mission)	100	100	100	100	100	93.5
OSI-405-c	Global Low Resolution Sea Ice Drift	100	100	100	100	100	90.3
OSI-402-d	Global Sea Ice Edge (Multi Mission)	100	100	100	100	100	93.5
OSI-403-d	Global Sea Ice Type (Multi Mission)	100	98.4	100	100	100	93.5
OSI-301-b	Atlantic High Latitude Downward Longwave Irradiance	100	100	100	100	100	96.8
OSI-302-b	Atlantic High Latitude Surface Solar Irradiance	100	100	100			
OSI-303-a	Daily Downward Longwave Irradiance (MSG)	100	100	100	100	100	93.6
OSI-304-a	Daily Surface Solar Irradiance (MSG)						
OSI-303-a	Hourly Downward Longwave Irradiance (MSG)	99.7	99.9	100	100	100	95.7
OSI-304-a	Hourly Surface Solar Irradiance (MSG)						
OSI-206-a	Hourly Sea Surface Temperature (MSG)						

Product id.	Product name	JUL. 2021	AUG. 2021	SEP. 2021	OCT. 2021	NOV. 2021	DEC. 2021
OSI-410	Level 2 PMW sea ice concentration	?	?	?	100	100	100
OSI-114-a	HY-2B 25 km wind vectors	?	?	?	?	?	?
OSI-114-b	HY-2B 50 km wind vectors	?	?	?	?	?	?
OSI-115-a	HY-2C 25 km wind vectors	?	?	?	?	?	?
OSI-115-b	HY-2C 50 km wind vectors	?	?	?	?	?	?

Table 56: Percentage of received OSI SAF products in EDC in 2nd half 2021

Expected values are calculated using the number of days in the month, and not taking into account if all the orbits/slots were produced or if they had the quality required for producing the related SAF products. Therefore these expected values and the derived percentages are just informative and they should not be taken as the real performance of the SAF ingestion.

The following anomalies were observed:

- OSI SAF: OSI-102 and OSI-104-c missing products in October. These products were not received between 11th – 12th October 2021.
- OSI SAF: there is a gap of products between 19th Dec. 2021 and 20th Dec. 2021. These products have been already requested to be sent again to UMARF.

7. Training

Early 2022, with the help of the EUMETSAT training team, the OSI SAF team presented a series of webinars providing an overview of the OSI SAF products and their applications.

The purpose of each webinar was to present the products: explain how they are processed and validated, what they can be used for, and how they can be used. Means for accessing the data have also been highlighted. Participants had the opportunity to ask questions and discuss with OSI SAF teams, before and during the event. These webinars were free and open to all. They were recorded and are accessible on EUMETSAT training page:
https://training.eumetsat.int/course/index.php?categoryid=97

- 25 January – Sea Surface Temperature
  - Over 80 external participants
  - Stéphane Saux Picart, Steinar Eastwood (Met Norway) and Jean-François Piolle (Ifremer) delivered a general presentation of the products and their acces means that was followed by 2 use cases presented by users: Gary Wick (NOAA) and Simon Good (UK Met Office).
- 27 January – Sea ice parameters
  - Over 100 external participants
  - Steinar Eastwood, Thomas Lavergne and Signe Aaboe (Met Norway), Gorm Dybkjaer, Fabrizio Baordo, Jacob Høyer and Johanne Oelund (DMI) presented the different OSI SAF Sea Ice parameters monitored and their processing. 3 users were invited to share a few words: Ioanna Karagali (DMI), Stefan Hendicks (AWI), Helen Beggs (BOM Asustralia)

- 1 February – Climate Data Records Course
  - Over 60 external participants
  - Thomas Lavergne (Met Norway), Ad Stoffelen (KNMI) and Olivier Membrive (Meteo France) presented the processing of Climate Data Records at OSI SAF. Especially Wind, and Sea Ice Data records. External users: Rianne Giesen (KNMI / CMEMS) and Julien Nicolas (ECMWF / C3S) presented how they use OSI SAF CDRs and ICDRs.

8. Documentation update

The following table provides the list of documents modified during the reporting period, as well as new documents made available to users. Last version of documents and new documents are available on the central Web Site (http://osi-saf.eumetsat.int).

Name of the Document	Reference	Latest versions	date
Advances in Ku-band scatterometer Quality Control	SAF/OSI/CDOP3/KNMI/SCI/TN/404	1.1	Sep 2021
ASCAT Wind Product User Manual	SAF/OSI/CDOP/KNMI/TEC/MA/126	1.17	Dec 2021

Table 57: Documentation updates

Recent publications

Li, Z., A. Stoffelen, A. Verhoef and J. Verspeek, Numerical Weather Prediction Ocean Calibration for the Chinese-French Oceanography Satellite Wind Scatterometer and Wind Retrieval Evaluation Earth and Space Science, 2021, 8, 10, doi:10.1029/2020EA001606.

Xu, X. and A. Stoffelen, A Further Evaluation of the Quality Indicator Joss for Ku-Band Wind Scatterometry in Tropical Regions
2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS, 2021, 7299-7302, doi:10.1109/IGARSS47720.2021.9553442.