EUMETSAT OSI SAF

OCEAN AND SEA ICE

Half-Yearly Operations Report

1st half 2021

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Prepared by Météo-France, Ifremer, MET Norway, DMI and KNMI

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Document Change record

Document version	Date	Author	Change description
0.1	June 2021	CH	First version sent to OSI SAF partners
1.0	30 August 2021	CH	Version with the partner's inputs merged
1.1	25 October 2021	CH	HL radiative fluxes validation added

Table of contents

1. Introduction

1.1. Scope of the document

The present report covers from January to June 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
CDOP 3 Service Specification (SeSp)
SAF/OSI/CDOP3/MF/MGT/PL/003, version 1.11, 12 August 2021

1.4. Reference documents

[RD.1] ASCAT Wind Product User Manual
OSI-102, OSI-102-b, OSI-102-c, OSI-103 (discontinued), OSI-104, 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, OSI-112-b
SAF/OSI/CDOP2/KNMI/TEC/MA/287

[RD.4] ASCAT L2 winds Data Record Product User Manual
OSI-150-a, OSI-150-b
SAF/OSI/CDOP2/KNMI/TEC/MA/238

[RD.5] Reprocessed SeaWinds L2 winds Product User Manual
OSI-151-a, OSI-151-b
SAF/OSI/CDOP2/KNMI/TEC/MA/220

[RD.6] ERS L2 winds Data Record Product User Manual
OSI-152
SAF/OSI/CDOP2/KNMI/TEC/MA/279

[RD.7] Oceansat-2 L2 winds Data Record Product User Manual
OSI-153-a, OSI-153-b
SAF/OSI/CDOP3/KNMI/TEC/MA/297

[RD.8] Low Earth Orbiter Sea Surface Temperature Product User Manual
OSI-201-b, OSI-202-c, OSI-204-b, OSI-204-c, OSI-208-b
SAF/OSI/CDOP3/MF/TEC/MA/127

[RD.9] 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.10]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.11]Geostationary Sea Surface Temperature Product User Manual
OSI-206-a, OSI-207-b, OSI-IO-SST
SAF/OSI/CDOP3/MF/TEC/MA/181

[RD.12]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.13]MSG/SEVIRI Sea Surface Temperature data record Product User Manual
OSI-250
SAF/OSI/CDOP3/MF/TEC/MA/309

[RD.14]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.15]Product User Manual for OSI SAF Global Sea Ice Concentration
OSI-401-b
SAF/OSI/CDOP3/DMI_MET/TEC/MA/204

[RD.16]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.17]50 Ghz Sea Ice Emissivity Product User Manual
OSI-404-a
SAF/OSI/CDOP3/DMI/TEC/MA/191

[RD.18]Low Resolution Sea Ice Drift Product User's Manual
OSI-405-c
SAF/OSI/CDOP/met.no/TEC/MA/128

[RD.19]Medium Resolution Sea Ice Drift Product User Manual
OSI-407-a
SAF/OSI/CDOP/DMI/TEC/MA/137

[RD.20]Product User Manual for the OSI SAF AMSR-2 Global Sea Ice Concentration
OSI-408
SAF/OSI/CDOP2/DMI/TEC/265

[RD.21]Global Sea Ice Concentration Reprocessing Product User Manual
OSI-409, OSI-409-a, OSI-430
SAF/OSI/CDOP3/MET-Norway/TEC/MA/138

[RD.22]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	Jan. 2021	Feb. 2021	Mar. 2021	Apr. 2021	May 2021	Jun. 2021
OSI-102	ASCAT-A 25 km wind	99.6	99.9	100.0	100.0	99.9	100.0
OSI-102-b	ASCAT-B 25 km wind	99.6	100.0	100.0	100.0	99.9	100.0
OSI-102-c	ASCAT-C 25 km wind	99.5	99.2	100.0	100.0	99.8	99.9
OSI-104	ASCAT-A Coastal wind	99.3	99.4	99.7	99.8	99.8	99.2
OSI-104-b	ASCAT-B Coastal wind	99.5	99.7	99.9	99.9	99.9	99.9
OSI-104-c	ASCAT-C Coastal wind	99.4	99.4	99.9	99.9	99.8	99.9
OSI-112-a	ScatSat-1 25 km wind vectors	89.7	86.1	NA	NA	NA	NA
OSI-112-b	ScatSat-1 50 km wind vectors	89.9	86.3	NA	NA	NA	NA
OSI-201-b	GBL SST	100	98.2	95.2	98.3	100	98.3
OSI-202-b	NAR SST	100	100	96.8	98.3	99.2	98.3
OSI-203-a	NHL SST/IST (L3)	98.4	100	98.4	96.4	100	100
OSI-203-b	NHL SST/IST (L3)	98.4	100	98.4	93.0	100	100
OSI-204-b	MGR SST	99.9	99.8	97.7	99.2	99.4	98.3
OSI-205-a	SST/IST (L2)	99.7	100	100	99.9	100	99.8
OSI-205-b	SST/IST (L2)	95.6	100	99.8	97.2	99.3	100
OSI-206-a	Meteosat SST	99.7	100	97.8	99.3	99.5	98.3
OSI-207-b	GOES-East SST	99.2	99.9	97.6	99.6	99.6	98.3
OSI-208-b	IASI SST	100	99.4	97.5	99.6	99.7	98.5
OSI-301	AHL DLI	93.6	100	96.7	100	100	100
OSI-302	AHL SSI	93.6	100	96.7	100	100	100
OSI-303-a	Meteosat DLI - hourly	99.7	99.7	97.7	99.0	99.6	98.2
	Meteosat DLI - daily	100	100	100	100	100	100
OSI-304-a	Meteosat SSI - hourly	99.7	99.7	97.7	99.0	99.6	98.2
	Meteosat SSI - daily	100	100	100	100	100	100
OSI-305-b	GOES-East DLI - hourly	99.6	99.9	97.3	99.2	99.6	98.2
	GOES-East DLI - daily	100	100	100	100	100	100
OSI-306-b	GOES-East SSI - hourly	99.6	99.9	97.3	99.2	99.6	98.2
	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-c	Global Sea Ice Edge	100	100	100	100	100	100
OSI-403-c	Global Sea Ice Type	100	100	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	100	100	100	100	100
OSI-407-a	Medium Res. Sea Ice Drift	100	99.1	100	99.2	99.2	99.1
OSI-408	Global Sea Ice Concentration (AMSR-2)	100	100	100	100	100	100
OSI-430-a	Global Sea Ice Concentration interim climate data record	100	100	93.5	100	100	100

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

2.2. Availability via EUMETCast

Ref.	Product	Jan. 2021	Feb. 2021	Mar. 2021	Apr. 2021	May 2021	Jun. 2021
OSI-102	ASCAT-A 25 km wind	99.6	99.9	100	100	99.9	100
OSI-102-b	ASCAT-B 25 km wind	99.6	100	100	100	99.9	100
OSI-102-c	ASCAT-C 25 km wind	99.5	99.2	100	100	99.8	99.9
OSI-104	ASCAT-A Coastal wind	99.3	99.4	99.7	99.8	99.8	99.2
OSI-104-b	ASCAT-B Coastal wind	99.5	99.7	99.9	99.9	99.9	99.9
OSI-104-c	ASCAT-C Coastal wind	99.4	99.4	99.9	99.9	99.8	99.9
OSI-112-a	ScatSat-1 25 km wind vectors	89.7	86.1	NA	NA	NA	NA
OSI-112-b	ScatSat-1 50 km wind vectors	89.9	86.3	NA	NA	NA	NA
OSI-201-b	GBL SST	100	100	100	98.3	96.8	100
OSI-202-b	NAR SST	96.8	100	100	99.2	98.4	100
OSI-203-a	NHL SST/IST (L3)	98.4	96.4	100	95	100	100
OSI-203-b	NHL SST/IST (L3)	100	96.4	96.8	95	100	100
OSI-204-b	MGR SST	98.3	99.7	99.9	98.6	98.8	99.9
OSI-205-a	SST/IST (L2)	99.3	99.8	100	100	99.8	99.7
OSI-205-b	SST/IST (L2)	96.6	97.9	96.6	97.2	97.7	98.6
OSI-206-a	Meteosat SST	97.8	100	100	98.2	98.7	100
OSI-207-b	GOES-East SST	97.3	100	100	98.5	98.8	100
OSI-208-b	IASI SST	98.8	98.5	99.8	99.7	99.3	100
OSI-301	AHL DLI	100	96.4	100	100	100	100
OSI-302	AHL SSI	100	96.4	100	100	100	100
OSI-303-a	Meteosat DLI - hourly	97.3	99.7	100	99.2	98.7	100
	Meteosat DLI - daily	100	100	100	100	100	100
OSI-304-a	Meteosat SSI - hourly	97.3	99.7	100	99.2	98.7	100
	Meteosat SSI - daily	100	100	100	100	100	100
OSI-305-b	GOES-East DLI - hourly	97.4	99.9	100	99.2	98.7	100
	GOES-East DLI - daily	100	100	100	100	100	100
OSI-306-b	GOES-East SSI - hourly	97.4	99.9	100	99.2	98.7	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-c	Global Sea Ice Edge	96.8	96.4	96.8	96.7	100	100
OSI-403-c	Global Sea Ice Type	96.8	96.4	96.8	96.7	100	100
OSI-404-a	Global Sea Ice Emissivity	100	100	100	100	100	100
OSI-405-c	Low Res. Sea Ice Drift	96.8	100	96.8	100	100	100
OSI-407-a	Medium Res. Sea Ice Drift	100	99.1	100	99.2	99.2	99.2
OSI-408	Global Sea Ice Concentration (AMSR-2)	100	100	100	100	100	100

Table 2: Percentage of OSI SAF products delivered via EUMETCast within the specified time over 1st half 2021.

Comment:
Frequent outages and delays occur in the provision of ScatSat-1 input data by the Indian Space Research Organisation (ISRO). This leads to lower availabilities for the OSI-112-a and OSI-112-b wind products. Although the end-to-end availability is not met for ScatSat-1 winds, the OSI SAF availability is met.
ScatSat-1 experienced an instrument failure on 28th of February which appeared to be unrecoverable. Hence there are no statistics for ScatSat-1 as of March.

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
19 March	All data	Outage of LML FTP server at Ifremer	Cleaning solved the lack of space
14 April-12 May	All data	Intermittent problem to send files by FTP to EUMETSAT HQ	Update of the configuration of the FTP transfer

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

Date	Impacted products or services	Anomaly	Corrective and preventive measures
10 January	OSI-203-a,OSI-203-b, OSI-205-b	Outage of production system, products were delayed	Users were informed
18 January	All HL products	Outage of EUMETCast between 02 and 07 UTC lead to delayed distribution of all OSI SAF products in this period	Users were informed
08 March	OSI-430-a	Missing products due to missing input data	Users were informed
20 March	OSI-402-c, OSI-403-c, OSI-405-c	Some OSI SAF sea ice products were delayed EUMETCast, due to a software upgrade error	Users were informed
12 April	OSI-203-a,OSI-203-b, OSI-205-b	Missing products due to major HPC outage at MET Norway	Users were informed
30 June	OSI-407-a	Missing product due to missing input data	Users were informed

3.3. At Wind subsystem (KNMI)

Date	Impacted products or services	Anomaly	Corrective and preventive measures
23 Jan	OSI-102-c, OSI-104-c	The ASCAT-C wind products have been unavailable on 22 Jan between 15:30 and 21:00 UTC sensing time due to an instrument anomaly.	NA on OSI SAF side

Date	Impacted products or services	Anomaly	Corrective and preventive measures
18 Feb	OSI-102-c, OSI-104-c	The ASCAT-C wind products have been unavailable or delayed between 17 February 8:00 and 18 February 7:00 UTC sensing time due to a ground segment anomaly.	NA on OSI SAF side
28 Feb	OSI-112-a, OSI-112-b	ScatSat-1 instrument anomaly. The winds have been unavailable since then, on 10 July ISRO confirmed that the anomaly is unrecoverable.	Wind products are discontinued.

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
19 January	Meteosat 0°, GOES-East and Meteosat IO SST, SSI, DLI	New geo processing chain became operational
29 June	All products on EUMETCast	The products data flow from MF to EUMETSAT was switched from the ftp protocol to the secure ftp (sftp) protocol.

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

Date	Impacted products or services	Events and modifications, maintenance activities
05 March	Web portal	User were informed about upgraded web portal
18 March	Production environment	The production environment for the HPC used at MET Norway was changed, with upgrade of the operative system. Users were informed.
02 June	Upgraded products	The sea ice edge and type products were upgraded. Users were given access to the upgraded products in advance, by dual distribution.

4.3. At Wind subsystem (KNMI)

NA

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

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), 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.

For the validation of the Ice Surface Temperature (IST), which is a part of the SST/IST High Latitude products, there are some significant limitations. The only conventional in situ observations are drifting buoys that are placed on the sea ice and automatic weather stations. These stations only observe air temperature or the temperature of the snow when they are covered by snow. So they do not directly measure the skin surface temperature that the satellite products estimate. A proper validation is therefore not possible on a routine basis. Occasionally, some in situ skin temperature data are available, and are be reported in the Half-yearly Operations reports.

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.

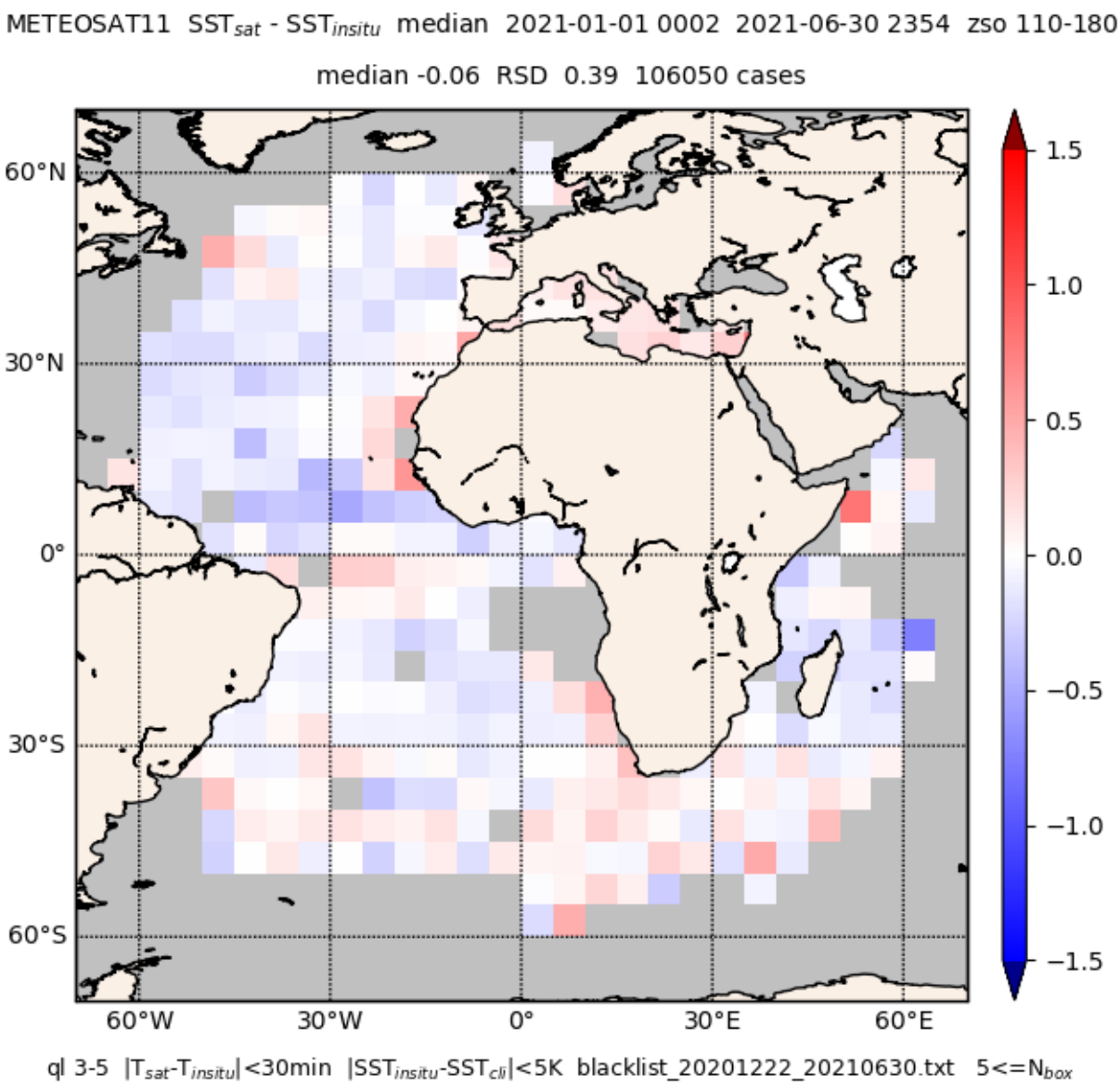


Figure 1: Meteosat night-time SST median difference with respect to buoys measurements for quality level 3,4,5

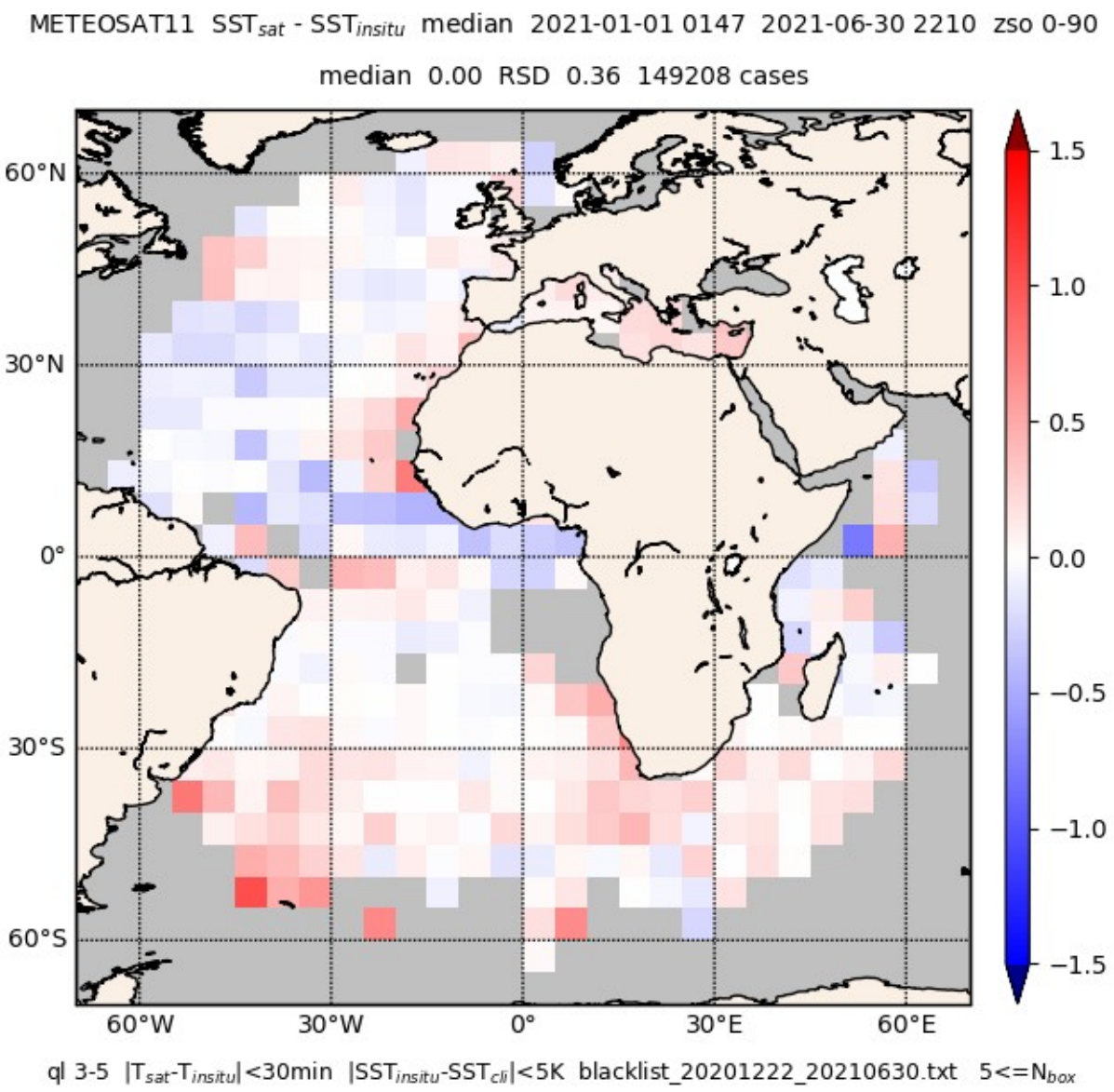


Figure 2: Meteosat day-time SST median difference with respect to buoys measurements for quality level 3,4,5

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

Meteosat night-time SST quality results over 1st 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
Jan. 2021	16137	-0.03	0.42	-0.01	0.39
Feb. 2021	16170	-0.08	0.44	-0.05	0.39
Mar. 2021	20481	-0.11	0.42	-0.09	0.38
Apr. 2021	17738	-0.14	0.46	-0.11	0.40
May 2021	19746	-0.08	0.45	-0.05	0.40
Jun. 2021	15778	-0.10	0.45	-0.07	0.41
Meteosat day-time SST quality results over 1st half 2021					
Jan. 2021	24930	0.03	0.41	0.05	0.35
Feb. 2021	21514	-0.01	0.41	0.01	0.34
Mar. 2021	25960	-0.05	0.41	-0.02	0.35
Apr. 2021	22947	-0.07	0.45	-0.03	0.37
May 2021	29073	-0.03	0.45	0.01	0.37
Jun. 2021	24784	-0.07	0.49	-0.03	0.42

Table 3: Meteosat SST quality results over 1st half 2021, for 3, 4, 5 quality indexes.

Comments: Overall statistics are good and 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.

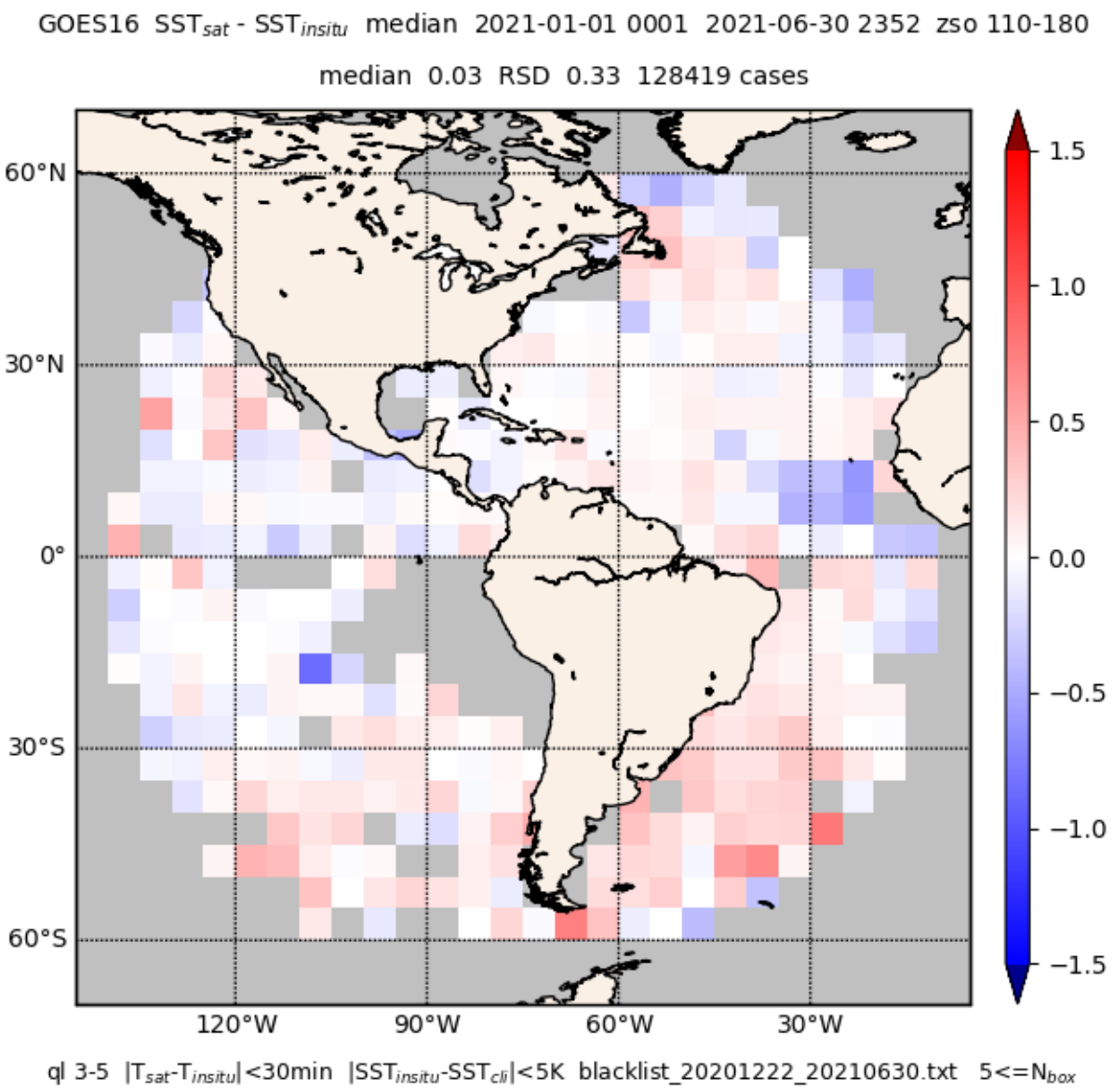


Figure 3: GOES-East night-time SST median difference with respect to buoys measurements for quality level 3,4,5

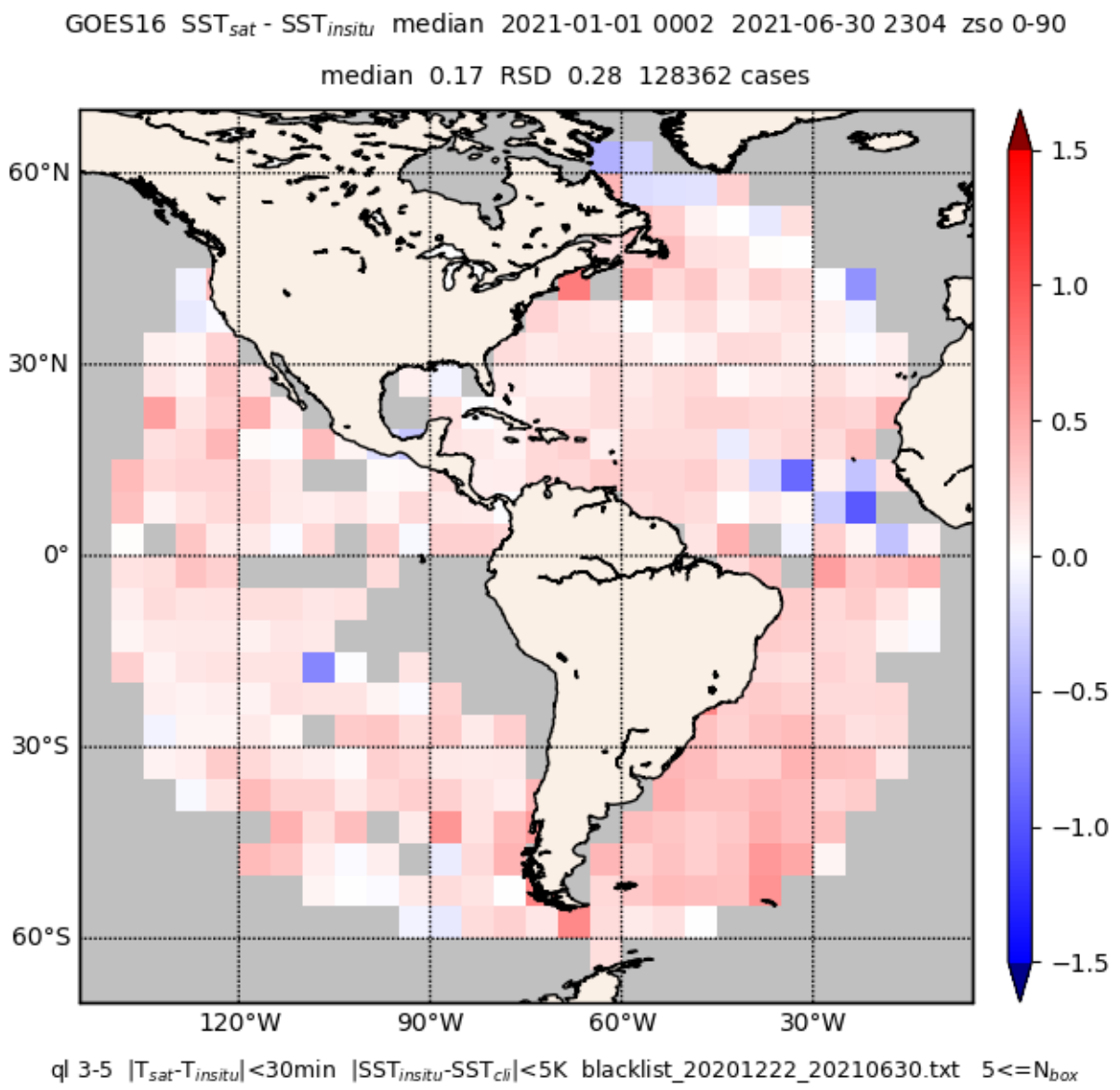


Figure 4: GOES-East day-time SST median difference with respect to buoys measurements for quality level 3,4,5

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

GOES-East night-time SST quality results 1st 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
Jan. 2021	20782	0.03	0.44	0.08	0.34
Feb. 2021	21102	0.04	0.36	0.08	0.31
Mar. 2021	25884	0.01	0.37	0.04	0.32
Apr. 2021	21371	-0.04	0.42	0.00	0.34
May 2021	21550	-0.05	0.39	-0.01	0.33
Jun. 2021	17730	-0.06	0.38	-0.01	0.33
GOES-East day-time SST quality results 1st half 2021					
Jan. 2021	20599	0.18	0.33	0.21	0.27
Feb. 2021	18549	0.22	0.30	0.23	0.24
Mar. 2021	24064	0.18	0.32	0.20	0.25
Apr. 2021	21166	0.11	0.37	0.14	0.29
May 2021	22936	0.09	0.38	0.12	0.30
Jun. 2021	21048	0.08	0.38	0.12	0.31

Table 4: GOES-East SST quality results over 1st half 2021, for 3, 4, 5 quality indexes

Comments: Overall statistics are good and 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.

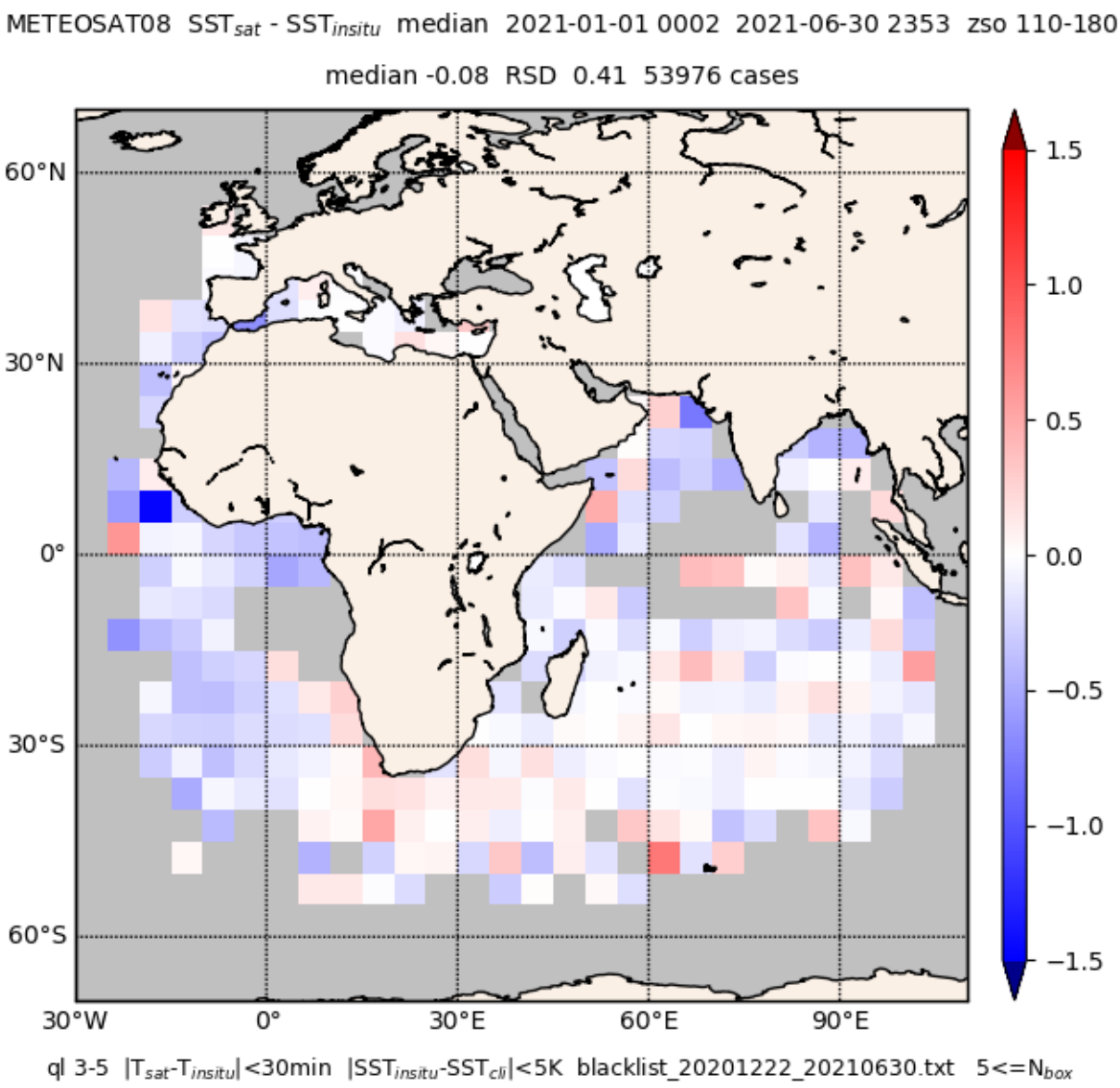


Figure 5: Meteosat Indian Ocean night-time SST median difference with respect to buoys measurements for quality level 3,4,5

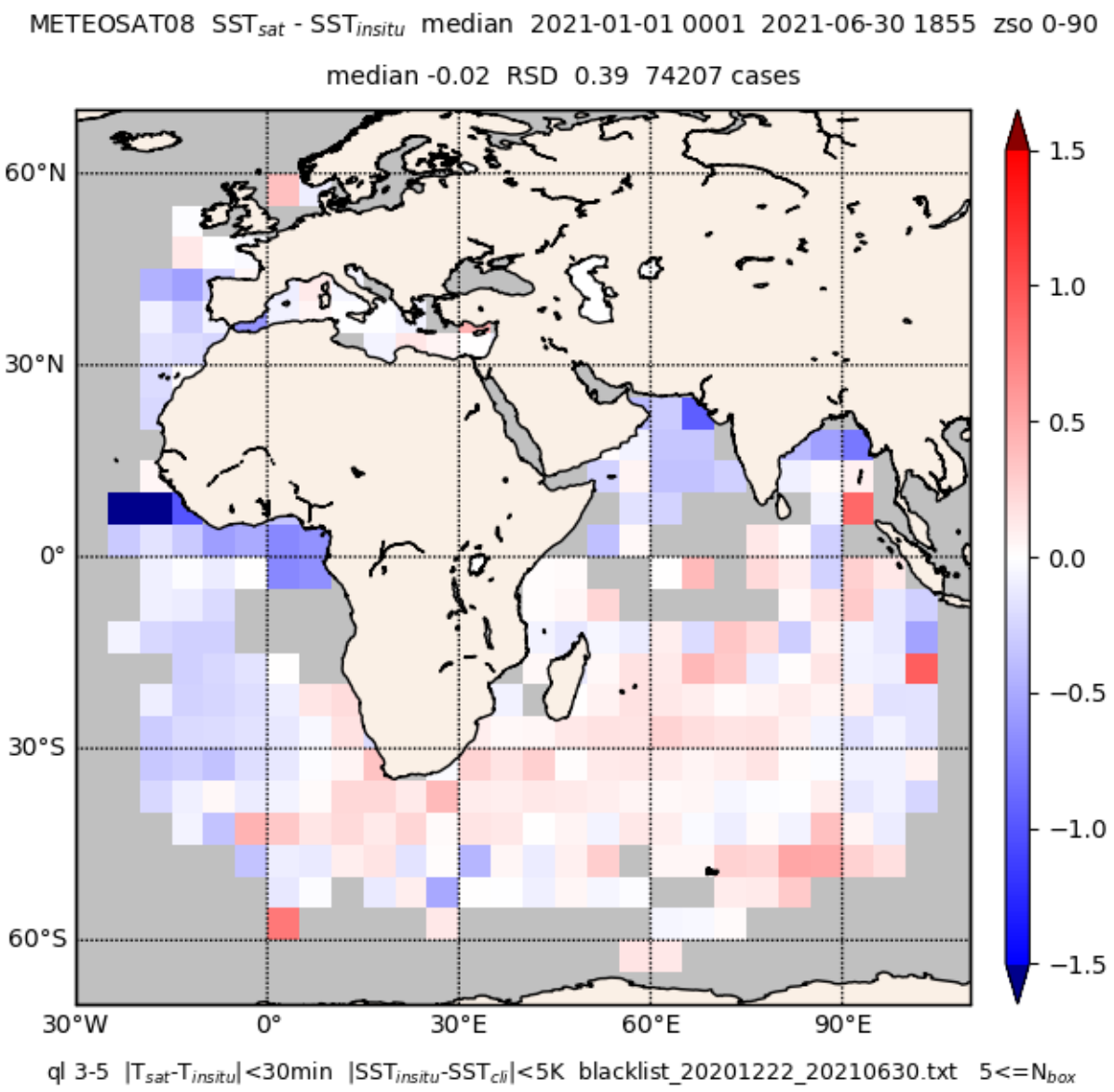


Figure 6: Meteosat Indian Ocean day-time SST median difference with respect to buoys measurements for quality level 3,4,5

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 1st 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
Jan. 2021	7374	-0.12	0.46	-0.08	0.43
Feb. 2021	8078	-0.14	0.45	-0.11	0.41
Mar. 2021	9690	-0.10	0.47	-0.09	0.42
Apr. 2021	9174	-0.10	0.44	-0.09	0.39
May 2021	10293	-0.10	0.45	-0.08	0.39
Jun. 2021	9367	-0.07	0.45	-0.05	0.41
Meteosat Indian Ocean day-time SST quality results over 1st half 2021					
Jan. 2021	15207	-0.07	0.45	-0.04	0.39
Feb. 2021	13220	-0.08	0.46	-0.05	0.39
Mar. 2021	13271	-0.00	0.46	0.01	0.39
Apr. 2021	11589	-0.05	0.46	-0.02	0.39
May 2021	11266	-0.06	0.49	-0.02	0.39
Jun. 2021	9654	-0.03	0.48	0.00	0.38

Table 5: Meteosat Indian Ocean SST quality results over 1st half 2021, for 3, 4, 5 quality indexes.

Comments: Overall statistics are good and 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 NOAA-20

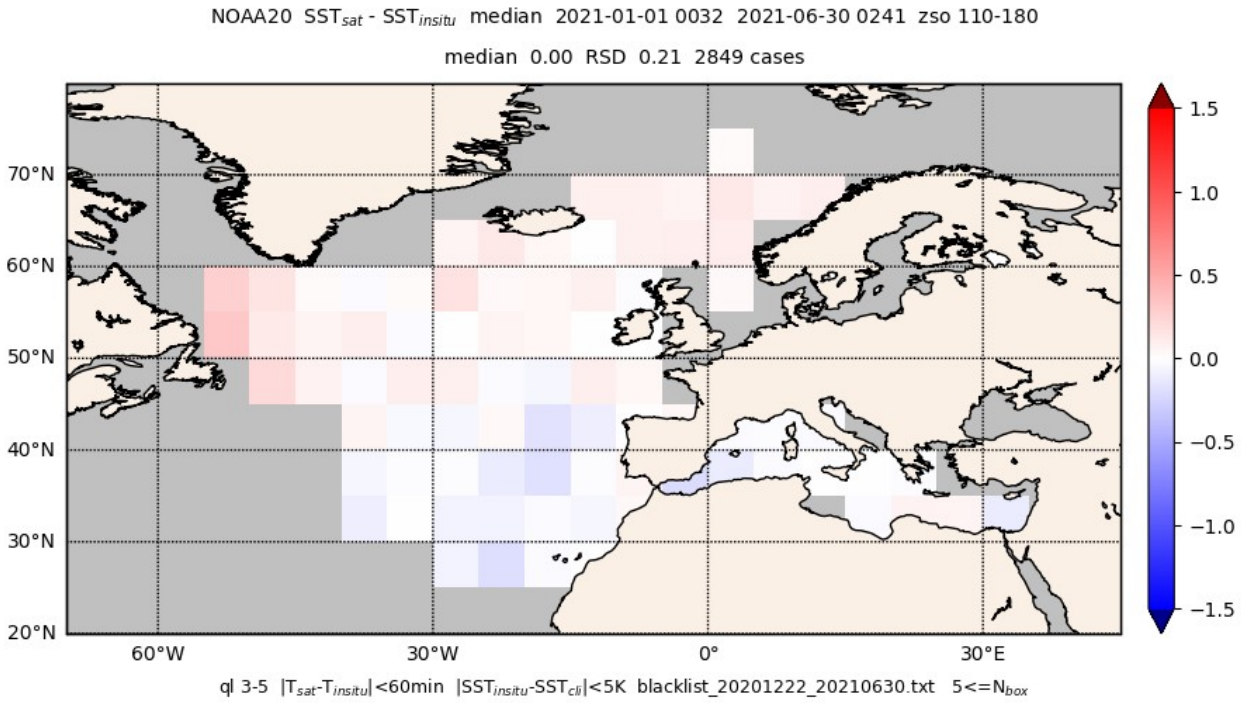


Figure 7: NOAA-20 NAR night-time SST median difference with respect to buoys measurements for quality level 3,4,5

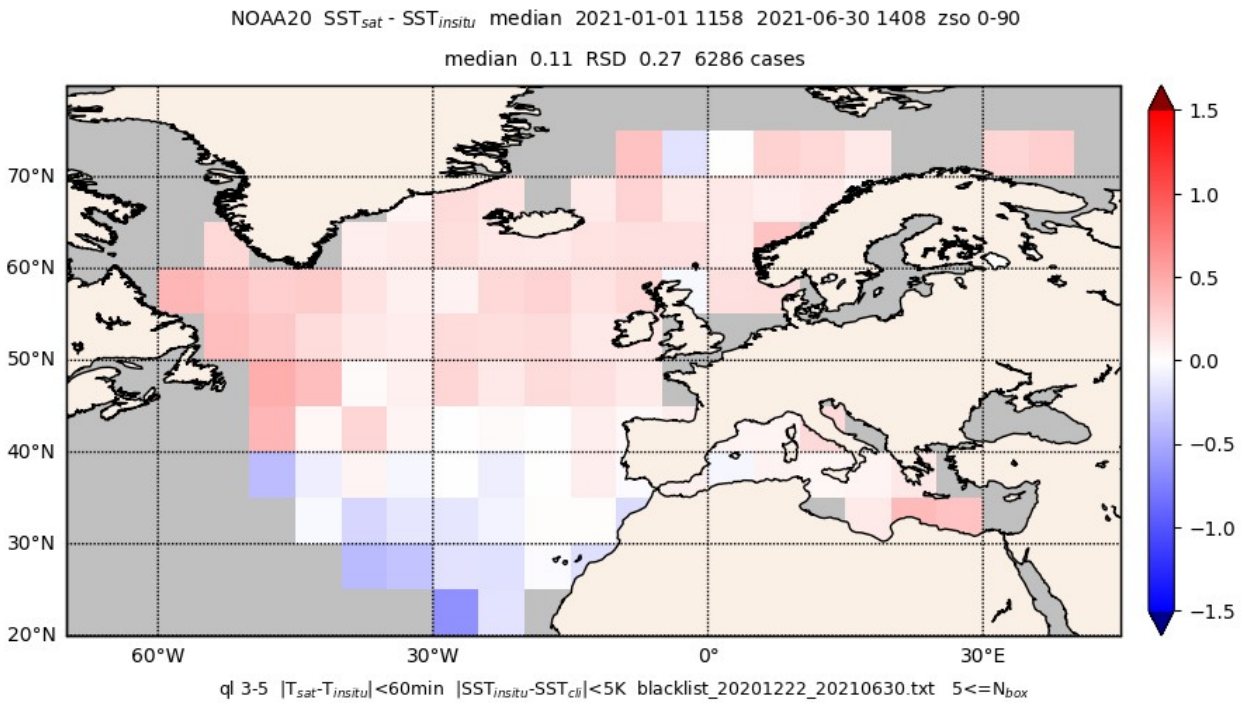


Figure 8: NOAA-20 NAR day-time SST median difference with respect to buoys measurements for quality level 3,4,5

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

NOAA-20 NAR night-time SST quality results over 1st 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
Jan. 2021	492	0.08	0.39	0.07	0.17
Feb. 2021	589	0.00	0.25	0.02	0.18
Mar. 2021	573	-0.05	0.27	-0.01	0.20
Apr. 2021	483	-0.04	0.38	-0.02	0.23
May 2021	428	-0.06	0.28	-0.05	0.27
Jun. 2021	284	-0.08	0.32	-0.04	0.25
NOAA-20 NAR day-time SST quality results over 1st half 2021					
Jan. 2021	426	0.17	0.35	0.18	0.24
Feb. 2021	631	0.10	0.35	0.12	0.25
Mar. 2021	808	0.04	0.35	0.06	0.26
Apr. 2021	1179	0.08	0.40	0.10	0.28
May 2021	1691	0.07	0.40	0.09	0.25
Jun. 2021	1551	0.09	0.47	0.14	0.32

Table 6: Quality results for NOAA-20 NAR SST over 1st half 2021, for 3, 4, 5 quality indexes

Comments: Overall statistics are good and 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.

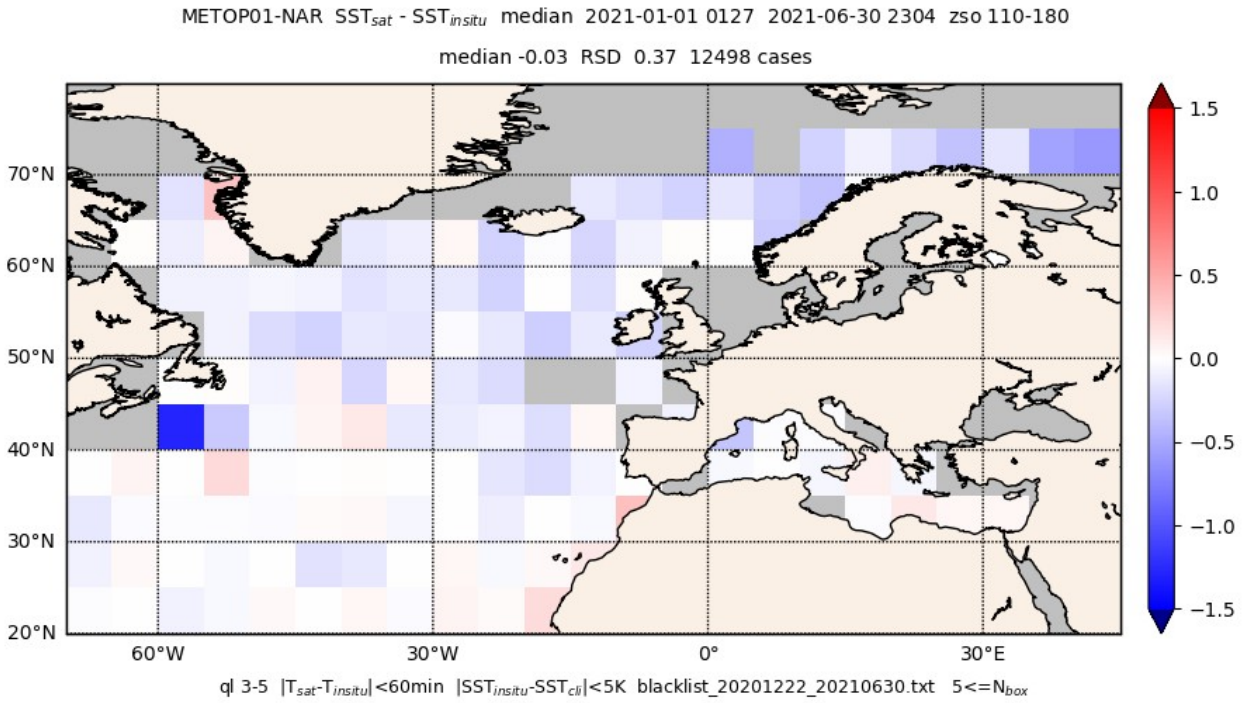


Figure 9: Metop-B NAR night-time SST median difference with respect to buoys measurements for quality level 3,4,5

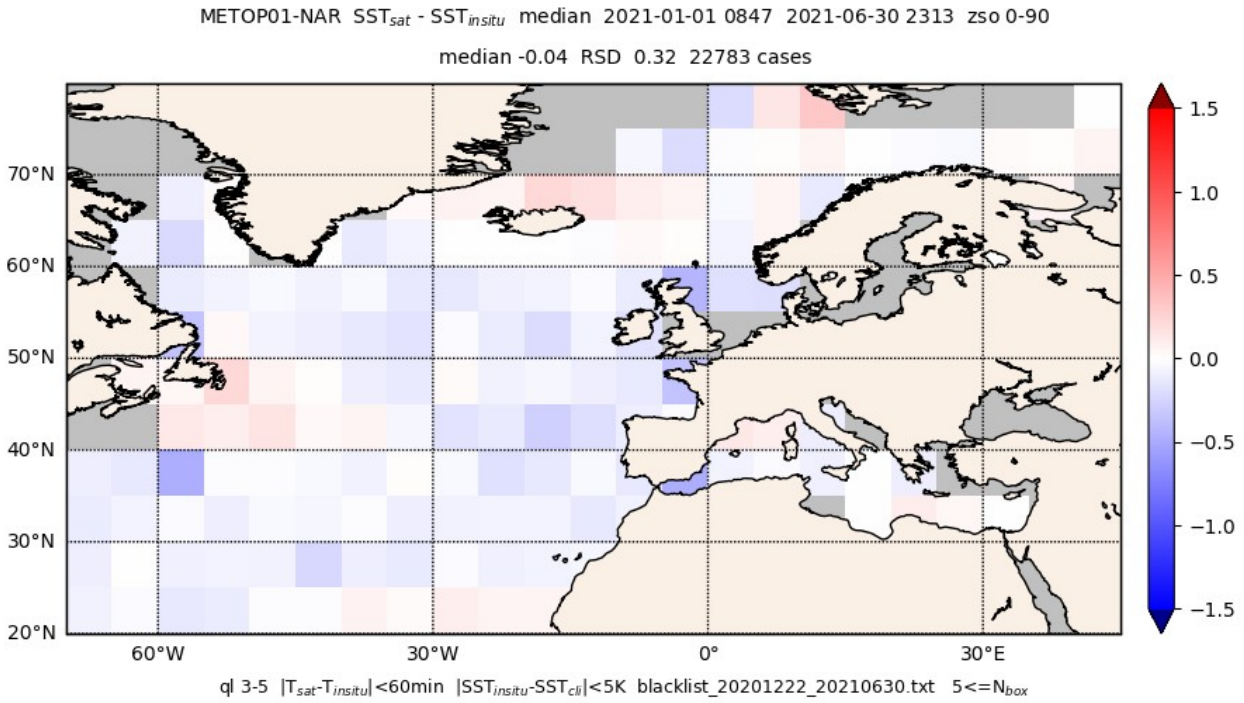


Figure 10: Metop-B NAR day-time SST median difference with respect to buoys measurements for quality level 3,4,5

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

Metop-B NAR night-time SST quality results over 1st 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
Jan. 2021	2822	-0.06	0.67	0.02	0.39
Feb. 2021	2419	-0.06	0.46	0.02	0.35
Mar. 2021	2287	-0.12	0.53	-0.06	0.36
Apr. 2021	1981	-0.17	0.56	-0.09	0.39
May 2021	1684	-0.15	0.47	-0.07	0.37
Jun. 2021	1305	-0.12	0.41	-0.05	0.32
Metop-B NAR day-time SST quality results over 1st half 2021					
Jan. 2021	2313	-0.01	0.44	0.04	0.32
Feb. 2021	2539	-0.03	0.41	0.01	0.30
Mar. 2021	3095	-0.08	0.45	-0.04	0.31
Apr. 2021	3812	-0.11	0.47	-0.06	0.33
May 2021	5492	-0.12	0.45	-0.06	0.33
Jun. 2021	5532	-0.11	0.53	-0.05	0.33

Table 7: Quality results for Metop-B NAR SST over 1st half 2021, for 3, 4, 5 quality indexes

Comments: Overall statistics are good and 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.

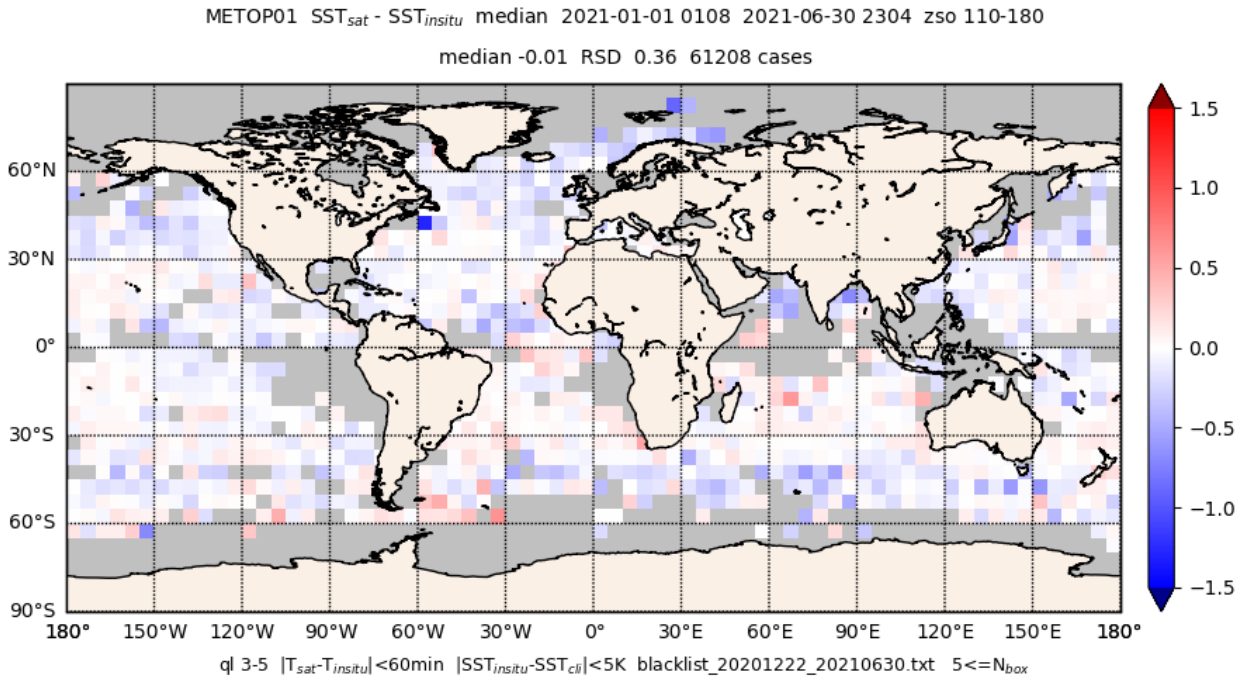


Figure 11: Metop-B night-time SST median difference with respect to buoys measurements for quality level 3,4,5

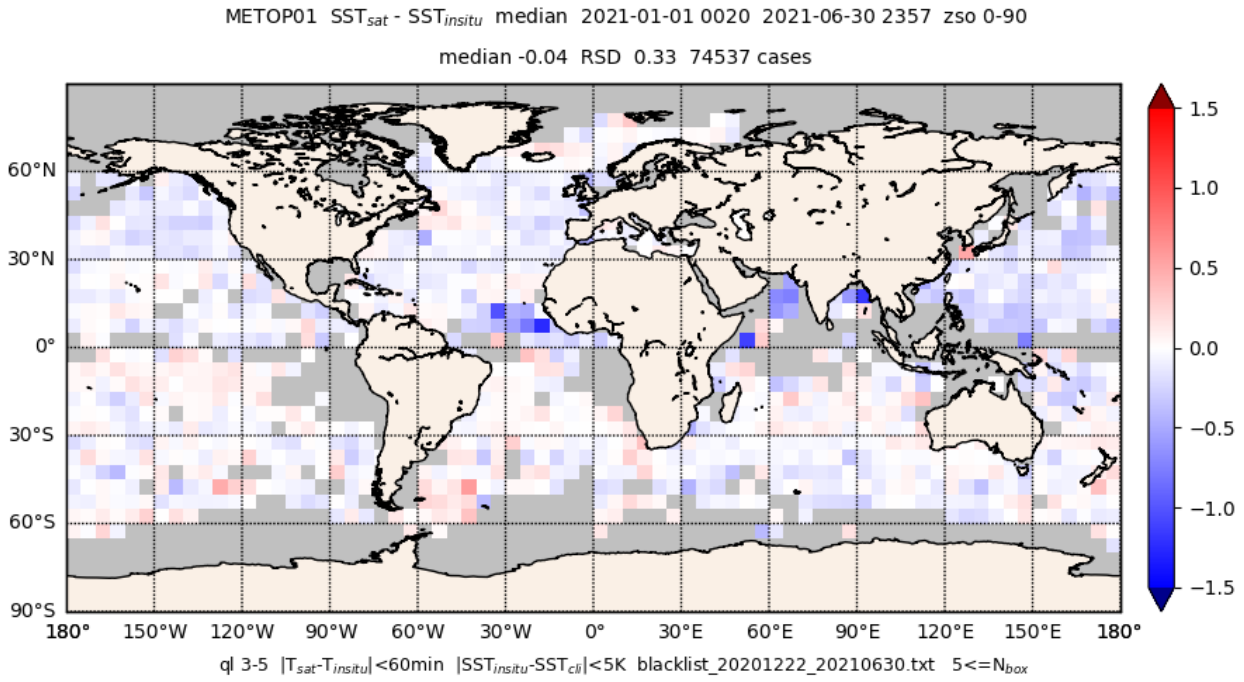


Figure 12: Metop-B day-time SST median difference with respect to buoys measurements for quality level 3,4,5

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

Global Metop-B night-time SST quality results over 1st 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
Jan. 2021	11199	-0.11	0.55	-0.02	0.37
Feb. 2021	9992	-0.10	0.52	-0.01	0.35
Mar. 2021	11491	-0.10	0.51	-0.01	0.36
Apr. 2021	10475	-0.11	0.51	-0.02	0.38
May 2021	9884	-0.10	0.49	-0.01	0.36
Jun. 2021	8167	-0.08	0.47	0.00	0.34
Global Metop-B day-time SST quality results over 1st half 2021					
Jan. 2021	11716	-0.09	0.46	-0.04	0.34
Feb. 2021	10444	-0.06	0.42	-0.02	0.32
Mar. 2021	12496	-0.07	0.42	-0.03	0.32
Apr. 2021	12499	-0.09	0.45	-0.04	0.34
May 2021	14118	-0.10	0.45	-0.04	0.33
Jun. 2021	13264	-0.10	0.51	-0.04	0.35
(*) 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 8: Quality results for global METOP SST over 1st half 2021, for 3,4,5 quality indexes

Comments: Overall statistics are good and within the requirement.

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

5.1.6.1. 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 OSI-205-a is a high latitude SST and global ice surface temperature (IST) and marginal ice zone surface temperature product.

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 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 110 degrees. In-situ observations and the centre of the OSI-205-a level-2 pixel must be within 3 km of each other and observation times must be within 15 minutes of the satellite crossing time.
Buoy data used for the SST validation is from the Copernicus Marine Environment Monitoring Service (In Situ TAC). SIMB3 buoy data from the Cryosphere Innovation data have been used for the IST validation.

IST validation against PROMICE Automatic Weather Station (AWS) air temperatures for the Greenland Ice sheet has been carried out as well. Since the quality controlled PROMICE data with calculated surface temperatures are usually released with a 6 month delay we apply the raw transmitted air temperature data from the stations instead. Error statistics between satellite IST and air temperatures are known to be worse than error statistics against in situ surface temperatures. Therefore we do not expect this validation to comply completely with the product requirements. From the next HYR reporting we expect to apply surface temperature estimates from PROMICE AWS.

The IST accuracy requirements are split into two parts in the Product Requirement Document: Namely, surface temperatures from IR radiometers, air temperatures from drifting buoys. The reason for the split is the higher certainty in IR radiometers, measuring the ice surface skin temperature, compared to the conventional buoy temperature measurements (also discussed in the ATBD for OSI-205-a).

The following tables and figures provide the OSI-205-a SST quality results over the reporting period.

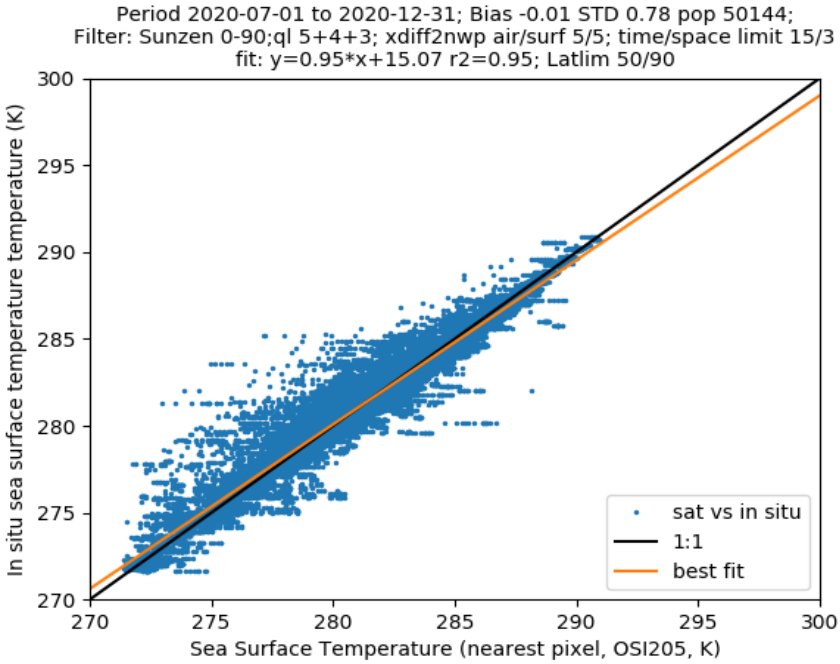


Figure 13: 2nd half 2020 OSI-205-a SST mean difference and bias with respect to conventional buoys measurements from the Copernicus In Situ DB. Only daytime data for the northern hemisphere are shown.

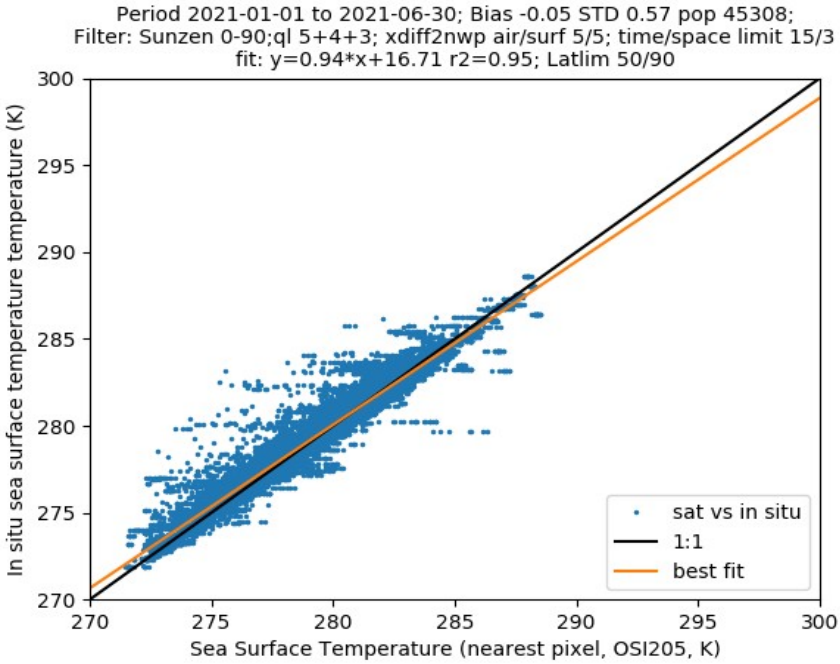


Figure 14: 1st half 2021 OSI-205-a SST mean difference and bias with respect to conventional buoys measurements from the Copernicus In Situ DB. Only daytime data for the northern hemisphere are shown.

OSI-205-a AVHRR SST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	NA	NA	NA	NA	NA
Aug. 2020	24	0.10	85.7	0.88	12.0
Sep. 2020	2167	-0.44	37.1	0.83	17.0
Oct. 2020	6791	-0.42	40.0	0.91	9.0
Nov. 2020	5512	-0.45	35.7	0.97	3.0
Dec. 2020	5435	-0.56	20.0	1.12	-12.0
2nd half 2020	*19929*	*-0.47*	*32.9*	*0.98*	*2.0*
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	NA	NA	NA	NA	NA
Jun. 2021	NA	NA	NA	NA	NA
1st half 2021	*9735*	*-0.62*	*11.4*	*0.93*	*7.0*
OSI-205-a AVHRR SST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	15066	0.08	88.6	0.95	5.0
Aug. 2020	11020	-0.001	99.9	0.85	15.0
Sep. 2020	11852	0.0004	99.9	0.55	45.0
Oct. 2020	7043	-0.09	87.1	0.54	46.0
Nov. 2020	3018	-0.17	75.7	0.62	38.0
Dec. 2020	2145	-0.26	62.9	0.81	19.0
2nd half 2020	*50144*	*-0.01*	*98.6*	*0.78*	*22.0*
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*
(*) 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 9: Quality results for OSI-205-a AVHRR SST, for the Northern Hemisphere, over Jul. 2020 to Jun. 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 January-June 2021, 32 buoys were disqualified from the validation data, since they are supposedly grounded at coast lines:

- GL_TS_DB_2101539 at the west coast of Alaska at the Gulf of Alaska
- GL_TS_DB_2101694 at coast of Alaska at Barents Sea
- GL_TS_DB_2101801 at coast of Russia at Barents Sea
- GL_TS_DB_2101803 at the coast of Russia at the Barents Sea

- GL_TS_DB_4101815 at the south coast of Iceland
- GL_TS_DB_4401569 at coasts of Norway and England
- GL_TS_DB_4401574 at the west coast of Canada
- GL_TS_DB_4401575 at west coast of England
- GL_TS_DB_4401847 at the coast of Alaska at Barents Sea
- GL_TS_DB_4401902 at west coast of Denmark
- GL_TS_DB_4601599 at coast of Alaska at Gulf of Alaska
- GL_TS_DB_4601600 at the coast of Alaska at the Gulf of Alaska
- GL_TS_DB_4601606 at the coast of Alaska at the Gulf of Alaska
- GL_TS_DB_4601797 at coast of Alaska at Barents Sea
- GL_TS_DB_4601800 at coasts of Canada and Alaska
- GL_TS_DB_4601805 at west coast of Canada
- GL_TS_DB_4701658 at coast in Northwest Passages
- GL_TS_DB_4802539 at north coast of Canada
- GL_TS_DB_6102773 at west coast of Norway
- GL_TS_DB_6203626 at coast of english island
- GL_TS_DB_6203760 at coast of Ireland and England
- GL_TS_DB_6301682 at north coast of Norway
- GL_TS_DB_6401837 at south-west coast of Iceland
- GL_TS_DB_6401838 at south coast of Iceland
- GL_TS_DB_6401851 at south coast of Iceland
- GL_TS_DB_6401855 at the south coast of Iceland
- GL_TS_DB_6401856 at west coast of Iceland
- GL_TS_DB_6401875 at south coast of Iceland
- GL_TS_DB_6402647 at south-west coast of Iceland
- GL_TS_DB_6402653 at south coast of Iceland
- GL_TS_DB_6402554 at coast of Faroe Islands
- GL_TS_DB_6402666 at the south coast of Iceland

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 with few observations, which still satisfies the threshold requirements of 1.5 K mean difference and standard deviation.

For the previous validation period, July-December 2020, 34 buoys were disqualified from the validation data, since they are supposedly grounded at coast lines:

- GL_TS_DB_4101652 at the south coast of Iceland
- GL_TS_DB_4101659 at the north coast of Norway
- GL_TS_DB_4101661 at the north coast of Norway
- GL_TS_DB_4101771 at the north coast of Iceland
- GL_TS_DB_4401565 at the south coast of Iceland
- GL_TS_DB_4401849 at the coast of Alaska, at the Beaufort Sea
- GL_TS_DB_4402556 at the south-west coast of Greenland
- GL_TS_DB_4402590 at the south-west coast of Greenland
- GL_TS_DB_4402633 at the south-west coast of Greenland
- GL_TS_DB_4601598 at the west coast of Alaska
- GL_TS_DB_4601607 at the north coast of Alaska, at the Beaufort Sea
- GL_TS_DB_4601683 at the west coast of Moresby Island
- GL_TS_DB_4601795 at the coast of Alaska, at the Beaufort Sea
- GL_TS_DB_4602503 at the coast of Novaya Zemlya, Russia
- GL_TS_DB_4801639 at the north coast of Canada
- GL_TS_DB_4801674 at the north coast of Alaska

- GL_TS_DB_4801716 at the north coast of Alaska, at the Beaufort Sea
- GL_TS_DB_4802504 at the coast of Baffin Bay
- GL_TS_DB_4802539 at the north coast of Canada
- GL_TS_DB_5301765 at the west coast of Norway
- GL_TS_DB_6202662 at the south-west coast of Greenland
- GL_TS_DB_6202665 at the south coast of Greenland
- GL_TS_DB_6202668 at the west coast of Norway
- GL_TS_DB_6202669 at the south coast of Greenland
- GL_TS_DB_6202675 at the north coast of Great Britain
- GL_TS_DB_6202683 at the north coast of Norway
- GL_TS_DB_6203551 at the north coast of Norway
- GL_TS_DB_6203587 at the north coast of Norway
- GL_TS_DB_6203715 at the North coast of Russia
- GL_TS_DB_6301508 at the north coast of Russia
- GL_TS_DB_6301536 at the north coast of Russia
- GL_TS_DB_6301682 at the north coast of Norway
- GL_TS_DB_6402542 at the south coast of Iceland
- GL_TS_DB_6402547 at the south coast of Greenland

Validation values for the second half year of 2020 are fully satisfactory and fulfil the requirements on mean error and standard deviation error. The only value not satisfying the target accuracy is the standard deviation for December night-time, which still satisfies the threshold requirement of 1.5 K. If only data with quality level 5 and 4 were to be considered, all values in the table would satisfy the target requirements.

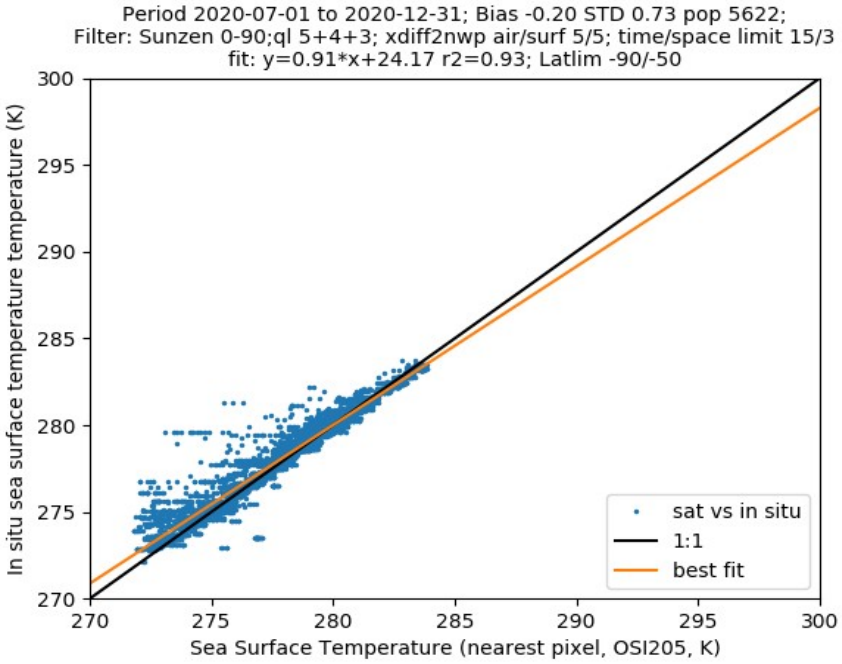


Figure 15: 2nd half 2020 OSI-205-a SST mean difference and bias with respect to conventional buoys measurements from the Copernicus In Situ DB. Only daytime data for the southern hemisphere are shown.

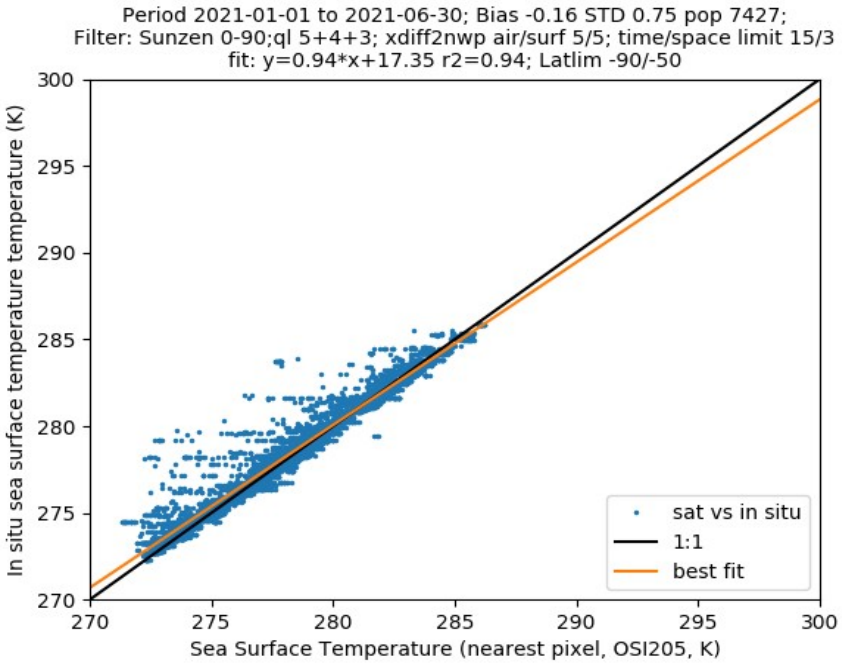


Figure 16: 1st half 2021 OSI-205-a SST mean difference and bias with respect to conventional buoys measurements from the Copernicus In Situ DB. Only daytime data for the southern hemisphere are shown.

OSI-205-a AVHRR SST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	1672	-0.85	-21.4	1.07	-7.0
Aug. 2020	1187	-0.65	7.1	1.00	0.0
Sep. 2020	1147	-0.47	32.9	0.95	5.0
Oct. 2020	924	-0.50	28.6	1.06	-6.0
Nov. 2020	110	-0.52	25.7	1.21	-21.0
Dec. 2020	NA	NA	NA	NA	NA
2nd half 2020	*5040*	*-0.64*	*8.6*	*1.04*	*-4.0*
Jan. 2021	NA	NA	NA	NA	NA
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*
OSI-205-a AVHRR SST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	858	-0.65	7.1	1.35	-35.0
Aug. 2020	796	-0.34	51.4	0.61	39.0
Sep. 2020	865	-0.15	78.6	0.53	47.0
Oct. 2020	1093	-0.10	85.7	0.47	53.0
Nov. 2020	651	-0.06	91.4	0.49	51.0
Dec. 2020	1359	-0.03	95.7	0.45	55.0
2nd half 2020	*5622*	*-0.20*	*71.4*	*0.73*	*27.0*
Jan. 2021	1371	0.00	100.0	0.41	59.0
Feb. 2021	1211	0.03	95.7	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*
(*) 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 10: Quality results for OSI-205-a AVHRR SST, for the Southern Hemisphere, over Jul. 2020 to Jun. 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 January-June 2021, 3 buoys were disqualified from the validation data, since they are supposedly grounded at coast lines:

- GL_TS_DB_3401550 at the south coast of Argentinia
- GL_TS_DB_3401559 at the south coast of Argentinia
- GL_TS_DB_5501577 at the south coast of Argentinia

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.

Validation values for the second half year of 2020 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.
It should also be noted that there are significant less observations for the Southern Hemisphere than for the Northern Hemisphere.

The following table and figures provide the OSI-205-a IST quality results over the reporting period.

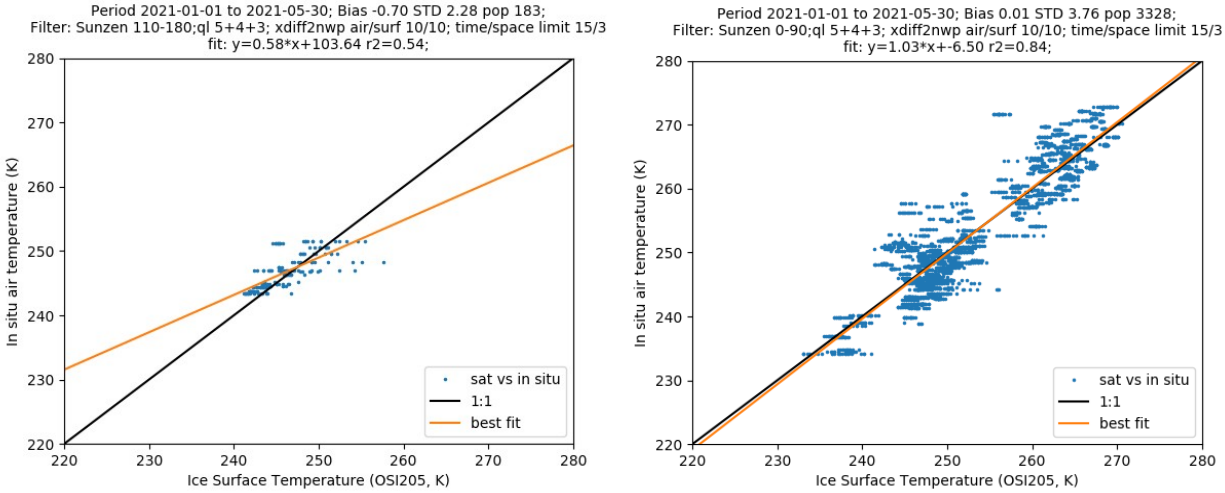


Figure 17: 1st half 2021 OSI-205-a monthly mean IST mean difference and bias with respect to conventional buoys measurements from the SIMB3 buoys (air temperature). Data with quality level 3, 4, 5 are shown. The graph on the left shows night-time data, while the plot on the right only shows day-time observations.

OSI-205-a IST quality results over 1st half 2021, night-time, air temperature, CRREL					
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	183	-0.70	80.0	2.28	24.0
Feb. 2021	NA	NA	NA	NA	NA
Mar. 2021	NA	NA	NA	NA	NA
Apr. 2021	NA	NA	NA	NA	NA
May 2021	NA	NA	NA	NA	NA
Jun. 2021	NA	NA	NA	NA	NA
OSI-205-a IST quality results over 1st half 2021, day-time, air temperature, CRREL					
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	NA	NA	NA	NA	NA
Feb. 2021	170	0.28	92.0	3.24	-8.0
Mar. 2021	1300	0.69	80.3	3.47	15.7
Apr. 2021	1227	-0.21	94.0	4.20	-40.0
May 2021	631	-1.04	70.3	3.21	-7.0
Jun. 2021	NA	NA	NA	NA	NA
(*) 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 Metop AVHRR IST over 1st half 2021, for quality levels 3, 4 and 5, by night and by day.

Comments:
For the validation against measured air temperature of SIMB3 buoys the target requirements are mostly satisfied. The exceptions, indicated by the negative margin values in the table above, satisfy the threshold requirements of ±4.5K for the mean difference and ±4.0K for the standard deviation, apart from the standard deviation of day-time April 2021.
The comparison of IST vs measured buoy air temperatures results in larger standard deviations, as expected.

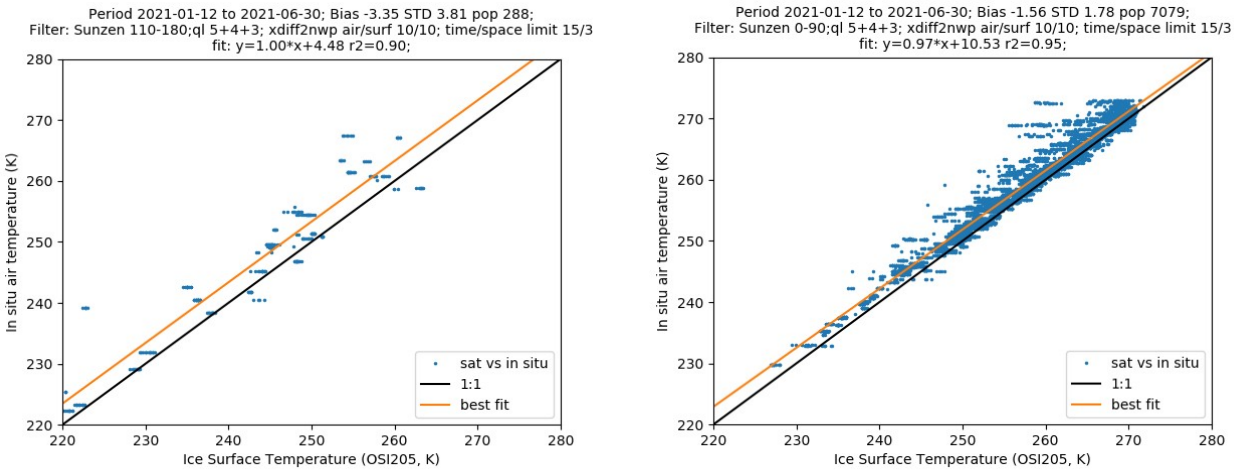


Figure 18: IST PROMICE air: 1st half 2021 OSI-205 monthly mean IST with respect to air measurements from PROMICE. The graph on the left shows night-time data with quality flags 5, 4 & 3, while the plot on the right only shows day-time observations

PROMICE data (only including "*_U" stations, located in the upper ablation and lower accumulation zone, around the equilibrium line and the EastGrip station) is generally colder than the observed air temperature, as it is expected.
We have included data from all PROMICE stations near the equilibrium line ("*_U") (ice cap rim) as well as the EastGrip (central Ice cap). Some of these stations are very close to the ice edge and hence some noise is expected.
At the moment directly transmitted (not quality controlled) PROMICE air temperatrure data is used, since the quality controlled data with calculated surface temperatures is not available yet.

OSI-205-a IST quality results over 1st half 2021, night-time, air 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 (**)
Jan. 2021	156	-3.07	-104.7	3.22	-61.0
Feb. 2021	132	-3.69	-146.0	4.39	-119.5
Mar 2021	NA	NA	NA	NA	NA
Apr. 2021	NA	NA	NA	NA	NA
May 2021	NA	NA	NA	NA	NA
Jun. 2021	NA	NA	NA	NA	NA
OSI-205-a IST quality results over 1st half 2021, day-time, air 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 (**)
Jan. 2021	NA	NA	NA	NA	NA
Feb. 2021	NA	NA	NA	NA	NA
Mar 2021	NA	NA	NA	NA	NA
Apr. 2021	1709	-2.33	-55.3	1.83	8.5
May 2021	3705	-1.41	6.0	1.53	23.5
Jun. 2021	1665	-1.12	25.3	1.98	1.0
(*) 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 12: Quality results for OSI-205-a Metop AVHRR IST over January to June 2021, for quality levels 3, 4 and 5, by night and by day. Compared to PROMICE measured air temperature

Comments:
The validation against the measured PROMICE air temperature performed not as good as previously reported; against quality controlled surface temperature data, as discussed above.
Still the threshold requirements (2.5 K mean diff & 3 K SD) are satisfied during day-time.
It should be noted that there only was a low number of measurements during night-time for this reported period.

5.1.6.2. 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. The validation of this IST product is based the drifting buoys on the sea ice. These buoys do not provide a good estimate of

the sea ice skin surface temperature, but is the only available data source for routine validation on sea ice in the Arctic Ocean. The problem with these buoys is that they sometimes are buried in snow and hence measure temperatures different to the surface skin temperature.

OSI-205-b NHL VIIRS SST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	4335	0.004	99.4	0.744	25.6
Aug. 2020	4118	-0.036	94.9	0.713	28.7
Sep. 2020	4230	-0.119	83	0.642	35.8
Oct. 2020	2887	-0.245	65	0.672	32.8
Nov. 2020	1333	-0.385	44.9	0.714	28.6
Dec. 2020	660	-0.351	49.9	0.722	27.8
Jan. 2021	2588	-0.438	37.5	0.985	1.5
Feb. 2021	1367	-0.323	53.8	0.896	10.4
Mar. 2021	1035	-0.515	26.4	0.980	2.0
Apr. 2021	713	-0.783	-11.8	1.025	-2.5
May 2021	282	-0.650	7.2	1.202	-20.2
Jun. 2021	477	-0.372	46.9	1.042	-4.2
OSI-205-b NHL VIIRS SST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	819	-0.147	79	0.899	10.1
Aug. 2020	2138	-0.206	70.6	0.907	9.3
Sep. 2020	3787	-0.282	59.7	0.922	7.8
Oct. 2020	2995	-0.303	56.7	0.913	8.7
Nov. 2020	2536	-0.393	43.9	0.945	5.5
Dec. 2020	2138	-0.372	46.9	0.996	0.4
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
(*) 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 13: Quality results for OSI-205-b NHL VIIRS SST, over Northern Atlantic and Arctic Ocean, over Jul. 2020 to Jun. 2021, for 3,4,5 quality indexes, by night and by day. Comparison with drifting buoys.

Comments:
The SST validation results are within target requirement for all months for daytime. For nighttime the mean difference results are within target requirement for all months except April (for which threshold requirement is met), and the standard deviation results are within target requirement for all months except April-June (for which the threshold requirement is met).
There are fewer than usual in observations than usual in April and May at daytime. This is due to a

processing problem that was fixed in end of May, as reported to users in service message #2275.

OSI-205-b NHL VIIRS IST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	0	-	-	-	-
Aug. 2020	0	-	-	-	-
Sep. 2020	9	0.028	99.2	2.795	6.8
Oct. 2020	189	0.145	95.9	4.728	-57.6
Nov. 2020	206	-2.779	20.6	4.707	-56.9
Dec. 2020	89	-6.82	-94.9	3.69	-23
Jan. 2021	138	-6.340	-81.1	2.572	14.3
Feb. 2021	33	-7.292	-108.4	2.611	13.0
Mar. 2021	8	-7.136	-103.9	1.587	47.1
Apr. 2021	0	-	-	-	-
May 2021	0	-	-	-	-
Jun. 2021	0	-	-	-	-
OSI-205-b NHL VIIRS IST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	2	-	-	-	-
Aug. 2020	1	-	-	-	-
Sep. 2020	25	-1.372	60.8	3.936	-31.2
Oct. 2020	2	-	-	-	-
Nov. 2020	0	-	-	-	-
Dec. 2020	0	-	-	-	-
Jan. 2021	0	-	-	-	-
Feb. 2021	0	-	-	-	-
Mar. 2021	1	-	-	-	-
Apr. 2021	142	-2.581	26.3	3.789	-26.3
May 2021	99	1.272	63.6	3.052	-1.7
Jun. 2021	4	-	-	-	-
(*) 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 14: Quality results for OSI-205-b NHL VIIRS IST, over Northern Atlantic and Arctic Ocean, over Jul. 2020 to Jun. 2021, for 3,4,5 quality indexes, by night and by day. Comparison with air temperature from buoys.

5.1.6.3. 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. The validation of this IST product is based the drifting buoys on the sea ice. These buoys do not provide a good estimate of the sea ice skin surface temperature, but is the only available data source for routine validation on sea ice in the Arctic Ocean. The problem with these buoys is that they sometimes are burried in snow and hence measure temperatures different to the surface skin temperature.

OSI-203-a NHL AVHRR SST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	478	0.037	94.7	1.04	-4.0
Aug. 2020	1518	0.063	91.1	0.918	8.2
Sep. 2020	4101	-0.311	55.6	0.778	22.2
Oct. 2020	4532	-0.459	34.4	0.782	21.8
Nov. 2020	3079	-0.484	30.9	0.711	28.9
Dec. 2020	2350	-0.585	16.4	0.866	13.4
Jan. 2021	2616	-0.652	6.8	0.828	17.2
Feb. 2021	1544	-0.612	12.6	0.796	20.4
Mar. 2021	1408	-0.745	-6.4	0.704	29.6
Apr. 2021	2547	-0.440	37.1	0.886	11.4
May 2021	1262	-0.298	57.5	0.867	13.3
Jun. 2021	350	0.044	93.7	1.049	-4.9
OSI-203-a NHL AVHRR SST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	4666	0.041	94.2	0.822	17.8
Aug. 2020	4788	0.004	99.5	0.777	22.3
Sep. 2020	6618	-0.002	99.7	0.544	45.6
Oct. 2020	5448	-0.135	80.7	0.555	44.5
Nov. 2020	2509	-0.196	72	0.543	45.7
Dec. 2020	1069	-0.242	65.5	0.663	33.7
Jan. 2021	1602	-0.306	56.2	0.624	37.6
Feb. 2021	1934	-0.334	52.3	0.675	32.5
Mar. 2021	2894	-0.281	59.9	0.579	42.1
Apr. 2021	9029	-0.159	77.2	0.471	52.9
May 2021	6237	-0.046	93.5	0.471	52.9
Jun. 2021	4420	-0.015	97.8	0.666	33.4
(*) 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-203-a NHL AVHRR SST over Northern Atlantic and Arctic Ocean for Jul. 2020 to Jun. 2021, for 3,4,5 quality indexes, by night and by day. Comparison with drifting buoys.

Comments:
For this period the validation results are all within the target requirement, except at nighttime where the mean difference for March and standard deviation for June are slightly outside target requirement.

OSI-203-a NHL AVHRR IST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	0	-	-	-	-
Aug. 2020	0	-	-	-	-
Sep. 2020	2	-	-	-	-
Oct. 2020	65	-2.777	20.7	4.928	-64.3
Nov. 2020	115	-3.194	8.8	4.989	-66.3
Dec. 2020	58	-5.571	-59.2	5.001	-66.7
Jan. 2021	91	-6.655	-90.1	2.854	4.9
Feb. 2021	12	-6.205	-77.3	2.772	7.6
Mar. 2021	7	-6.205	-163.4	0.438	85.4
Apr. 2021	0	-	-	-	-
May 2021	0	-	-	-	-
Jun. 2021	0	-	-	-	-
OSI-203-a NHL AVHRR IST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	5	-3.566	-1.9	1.235	58.8
Aug. 2020	1	-	-	-	-
Sep. 2020	29	-0.978	72	4.498	-49.9
Oct. 2020	3	-	-	-	-
Nov. 2020	0	-	-	-	-
Dec. 2020	0	-	-	-	-
Jan. 2021	0	-	-	-	-
Feb. 2021	0	-	-	-	-
Mar. 2021	0	-	-	-	-
Apr. 2021	57	-2.028	42.1	4.557	-51.9
May 2021	35	1.986	43.3	3.763	-25.4
Jun. 2021	6	-5.880	-68.0	0.667	77.8
(*) 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-203-a NHL AVHRR IST over Northern Atlantic and Arctic Ocean for Jul. 2020 to Jun. 2021, for 3,4,5 quality indexes, by night and by day. Comparison with air temperature from buoys.

Comments:
The validation results for this period shiow that the mean difference is usually within the target requirement at daytime, but not during nighttime (with too negative difference). For standard deviation the nighttime results are within the target requirement, while the daytime results show standard deviations within target requirement in June and above in April and May.

5.1.6.4. 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. The validation of this IST product is based the drifting buoys on the sea ice. These buoys do not provide a good estimate of the sea ice skin surface temperature, but is the only available data source for routine validation on sea ice in the Arctic Ocean. The problem with these buoys is that they sometimes are burried in snow and hence measure temperatures different to the surface skin temperature.

OSI-203-b NHL VIIRS SST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	1754	-0.359	48.7	1.129	-12.9
Aug. 2020	3248	-0.347	50.4	1.002	-0.2
Sep. 2020	5402	-0.347	50.5	0.915	8.5
Oct. 2020	5098	-0.374	46.6	0.873	12.7
Nov. 2020	3872	-0.421	39.9	0.872	12.8
Dec. 2020	3513	-0.431	38.5	0.938	6.2
Jan. 2021	3916	-0.450	35.7	0.885	11.5
Feb. 2021	2531	-0.392	44.0	0.894	10.6
Mar. 2021	2835	-0.524	25.2	0.890	11.0
Apr. 2021	3642	-1.305	-86.5	0.957	4.3
May 2021	588	-0.960	-37.1	1.264	-26.4
Jun. 2021	928	-0.424	39.4	1.106	-10.6
OSI-203-b NHL VIIRS SST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	4511	-0.047	93.2	0.708	29.2
Aug. 2020	4455	-0.029	95.9	0.676	32.4
Sep. 2020	6342	-0.119	83.0	0.537	46.3
Oct. 2020	5613	- 0.255	63.6	0.602	39.8
Nov. 2020	3182	-0.447	36.1	0.629	37.1
Dec. 2020	1640	-0.436	37.8	0.708	29.2
Jan. 2021	2471	-0.485	30.6	0.680	32.0
Feb. 2021	2352	-0.408	41.7	0.697	30.3
Mar. 2021	1489	-0.451	35.5	0.630	37.0
Apr. 2021	883	-0.301	56.9	0.489	51.1
May 2021	490	0.007	99.0	0.537	46.3
Jun. 2021	4284	-0.104	85.2	0.635	36.5
(*) 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 17: Quality results for OSI-203-b NHL VIIRS SST over Northern Atlantic and Arctic Ocean for Jul. 2020 to Jun. 2021, for 3,4,5 quality indexes, by night and by day. Comparison with drifting buoys.

Comments:
For this period the validation results are all within the target requirement, except for nighttime where the mean difference for April and May and standaard deviation for May and June are outside target requirement (but within threshold requirement).
There are fewer than usual in observations than usual in April and May at daytime. This is due to a problem with the input data from OSI-205-b, which was reported to users in service message #2275.

OSI-203-b NHL VIIRS IST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	0	-	-	-	-
Aug. 2020	0	-	-	-	-
Sep. 2020	17	-2.724	22.2	5.513	-83.8
Oct. 2020	101	-1.106	68.4	4.056	-35.2
Nov. 2020	121	-2.847	18.6	4.512	-50.4
Dec. 2020	53	- 4.604	-31.5	5.160	-72.0
Jan. 2021	19	-4.953	-41.5	3.770	-25.7
Feb. 2021	10	-8.665	-147.6	0.460	84.7
Mar. 2021	8	-7.654	-118.7	1.967	34.4
Apr. 2021	0	-	-	-	-
May 2021	0	-	-	-	-
Jun. 2021	0	-	-	-	-
OSI-203-b NHL VIIRS IST quality results over Jul. 2020 to Jun. 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 (**)
Jul. 2020	3	-	-	-	-
Aug. 2020	8	-2.021	42.2	3.667	-22.2
Sep. 2020	15	-1.450	58.6	3.774	-25.8
Oct. 2020	1	-	-	-	-
Nov. 2020	0	-	-	-	-
Dec. 2020	0	-	-	-	-
Jan. 2021	0	-	-	-	-
Feb. 2021	0	-	-	-	-
Mar. 2021	0	-	-	-	-
Apr. 2021	70	-2.740	21.7	4.157	-38.6
May 2021	57	1.191	66.0	3.114	-3.8
Jun. 2021	18	-1.305	62.7	0.748	75.1
(*) 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-b NHL VIIRS IST over Northern Atlantic and Arctic Ocean for Jul. 2020 to Jun. 2021, for 3,4,5 quality indexes, by night and by day

Comments:
The validation results for this period show that the mean difference is within the target requirement at daytime, but not during night-time (with too negative difference). For standard deviation the night-time results are within the target requirement except in January, while the daytime results

show standard deviations within target requirement in June and above in April and May.

5.1.7. 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.

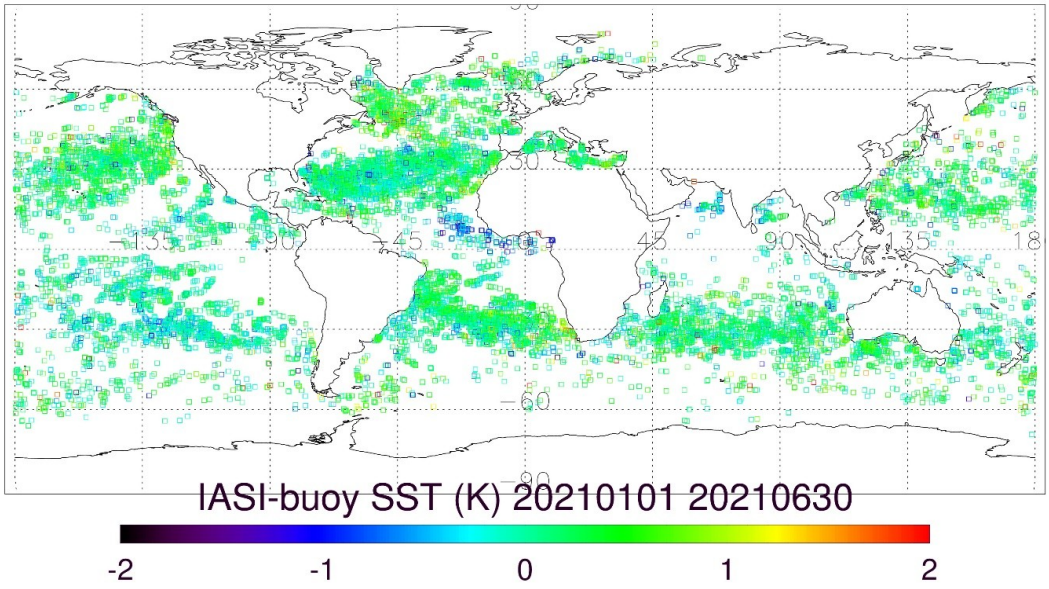


Figure 19: Mean Metop-B IASI night-time SST minus drifting buoy SST for Quality Levels 3, 4 and 5 from Jan. 2021 to Jun. 2021

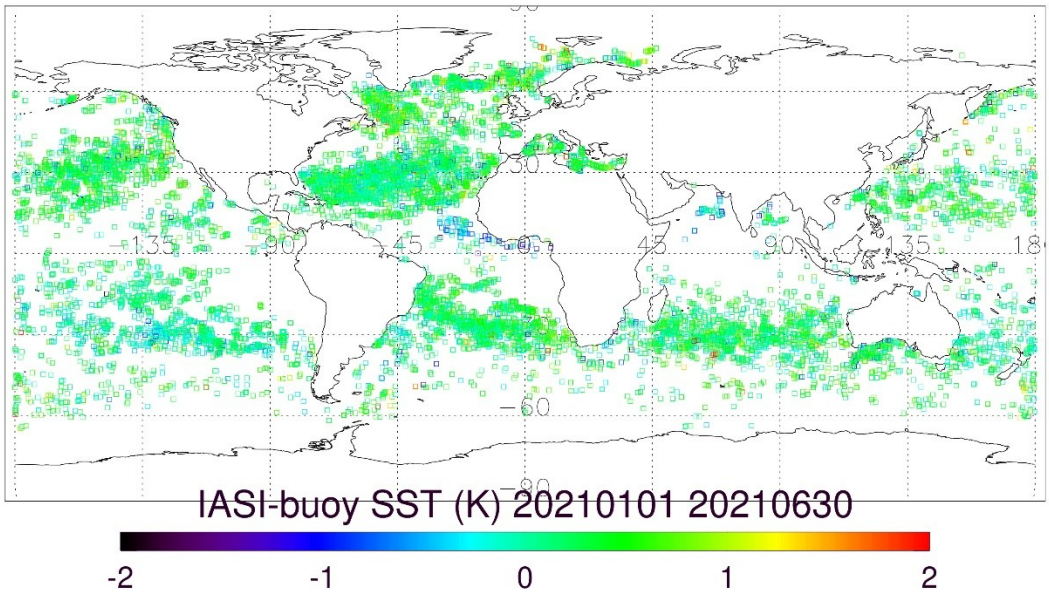


Figure 20: Mean Metop-B IASI day-time SST minus drifting buoy SST for Quality Levels 3, 4 and 5 from Jan. 2021 to Jun. 2021

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 1st 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 (**)
Jan. 2021	2773	0.17	66	0.49	39
Feb. 2021	2332	0.14	72	0.46	43
Mar. 2021	2827	0.10	80	0.45	44
Apr. 2021	2795	0.08	84	0.51	36
May 2021	2301	0.13	74	0.46	43
Jun. 2021	1883	0.10	80	0.46	43
Global Metop-B IASI day-time SST quality results over 1st half 2021					
Jan. 2021	2018	0.26	48	0.43	46
Feb. 2021	1866	0.26	48	0.42	48
Mar. 2021	2382	0.15	70	0.40	50
Apr. 2021	2246	0.17	66	0.46	43
May 2021	1925	0.20	60	0.43	46
Jun. 2021	1848	0.28	44	0.47	41
(*) 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 global Metop-B IASI SST over 1st half 2021, for Quality Levels 3, 4 and 5

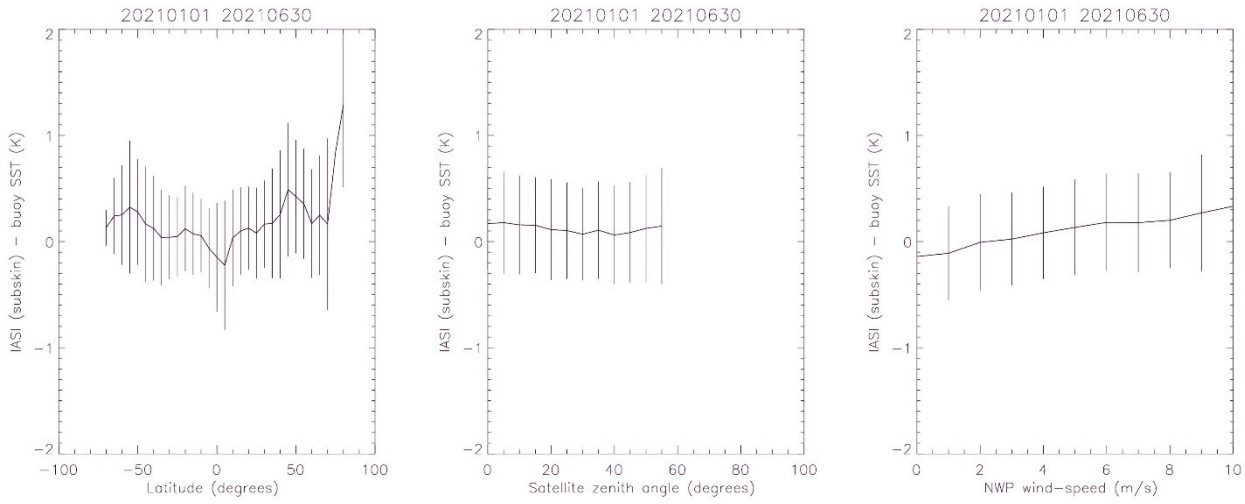


Figure 21: Mean Metop-B IASI night-time SST minus drifting buoy SST analyses for Quality Levels 3, 4 and 5, Jul. 2020 to Jun. 2021

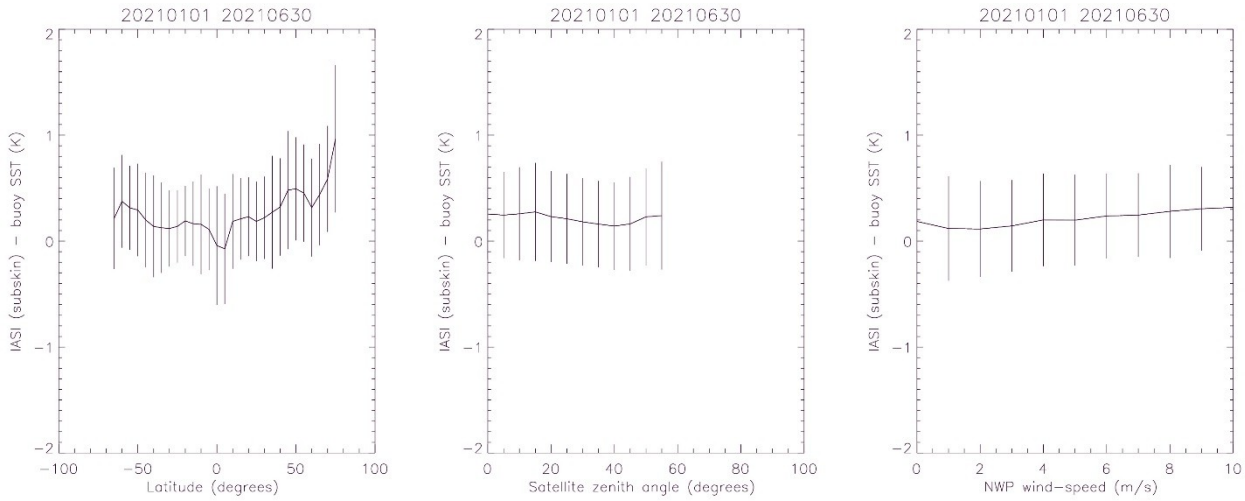


Figure 22: Mean Metop-B IASI day-time SST minus drifting buoy SST analyses for Quality Levels 3, 4 and 5, Jul. 2020 to Jun. 2021

Comments:
Over the six month reporting period the night-time mean IASI bias (for quality levels 3 and above) against drifting buoy SSTs is 0.12K with a standard deviation of 0.47K (n=14911); and the day-time mean bias is 0.22K, standard deviation 0.44K (n=12285). The monthly mean and whole time period results and within the target accuracy.

5.2. Radiative Fluxes quality

Following action OR14-Action-04, the quality of Meteosat 0° and GOES-East radiative fluxes products is now assessed separately.

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. to Jun. 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
(*) 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 20: GOES-East hourly DLI quality results from Jan. to Jun. 2021.

GOES-East daily DLI quality results from Jan. to Jun. 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
(*) 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 21: GOES-East daily DLI quality results from Jan. to Jun. 2021.

Comments: Overall statistics are good and 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. to Jun. 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
(*) 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 22: Meteosat 0° hourly DLI quality results from Jan. to Jun. 2021.

Meteosat 0° daily DLI quality results from Jan. to Jun. 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
(*) 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: Meteosat 0° daily DLI quality results from Jan. to Jun. 2021.

Comments: Overall statistics are good and 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. to Jun. 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

(*) 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 Indian Ocean hourly DLI quality results from Jan. to Jun. 2021.

Meteosat Indian Ocean daily DLI quality results from Jan. to Jun. 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

(*) 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 Indian Ocean daily DLI quality results from Jan. to Jun. 2021.

Comments: Overall statistics are good and 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 athttp://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 Jul. 2020 to Jun. 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 % (**)
Jul. 2020	68	330.32	-8.16	51.77	22.20	34.40
Aug. 2020	76	321.52	-4.46	72.62	20.70	36.49
Sep. 2020	62	309.68	-7.43	53.15	17.69	44.21
Oct. 2020	65	298.91	-6.15	59.66	16.77	45.01
Nov. 2020	65	286.27	-9.17	37.93	19.37	34.45
Dec. 2020	73	278.85	-11.62	20.01	15.68	46.01
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

(*) 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 26: AHL DLI quality results from Jul. 2020 to Jun. 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. to Jun. 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	1925	488.94	-15.14	69.04	79.00	46.14	-19.43	39.87
(*) 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 27: GOES-East hourly SSI quality results from Jan. to Jun. 2021.

GOES-East daily SSI quality results from Jan. to Jun. 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	45	190.93	-7.27	61.92	15.42	46.16	-8.86	17.14
(*) 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 28: GOES-East daily SSI quality results from Jan. to Jun. 2021.

Comments: Overall statistics are good and 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. to Jun. 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	4283	445.30	-11.90	73.28	63.45	52.50	-13.69	46.32
Jun. 2021	377	425.85	-30.13	29.25	65.62	48.64	-25.65	46.35
(*) 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: Meteosat 0° hourly SSI quality results from Jan. to Jun. 2021.

Meteosat 0° daily SSI quality results from Jan. to Jun. 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	360	224.05	-6.82	69.56	14.16	78.93	-6.13	13.60
Jun. 2021	29	236.19	-16.23	31.28	13.05	81.58	-19.88	10.82
(*) 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: Meteosat 0° daily SSI quality results from Jan. to Jun. 2021.

Comments: Overall statistics are good and 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. to Jun. 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	4279	446.85	-9.94	77.76	65.32	51.27	-10.84	48.67
Jun. 2021	370	418.97	-34.61	17.39	75.30	40.09	-26.57	55.89
(*) 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 Indian Ocean hourly SSI quality results from Jan. to Jun. 2021.

Meteosat Indian Ocean daily SSI quality results from Jan. to Jun. 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	360	225.14	-5.74	74.50	15.05	77.72	-4.90	14.97
Jun. 2021	29	234.42	-18.00	23.21	15.65	77.75	-15.87	12.82
(*) 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 Indian Ocean daily SSI quality results from Jan. to Jun. 2021.

Comments: Overall statistics are good and 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	In use, Arctic station with snow on ground much of the year. Strong shadow effect by mountains.
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	In use
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 33: Validation stations that are currently used for AHL radiative fluxes quality assessment.

The stations used in this validation 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 33. 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 Jul. 2020 to Jun. 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 % (**)
Jul. 2020	106	178.73	2.69	84.69	53.32	-0.97
Aug. 2020	107	150.60	1.82	87.79	33.93	23.98
Sep. 2020	99	72.39	-1.86	74.91	23.90	-7.29
Oct. 2020	59	38.18	-2.49	38.84	13.38	-9.65
Nov. 2020	34	20.35	-3.45	-44.93	4.72	33.85
Dec. 2020	10	8.20	-3.15	-177.17	6.58	-93.26
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

(*) 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 34: AHL SSI quality results from Jul. 2020 to Jun. 2021

Comments:
The validation for OSI-302-b shows that product is within or close to target accuracy requirement for most months. The mean difference 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. It is also similar for standard deviation, but with less margin to the target accuracy requirement.
There is also a noticeable negative mean difference in April and May (but within target accuracy), probably due to melting and varying snow conditions at the instrument sites, that makes the point observations less representative for the satellite pixel size.

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 35: 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.

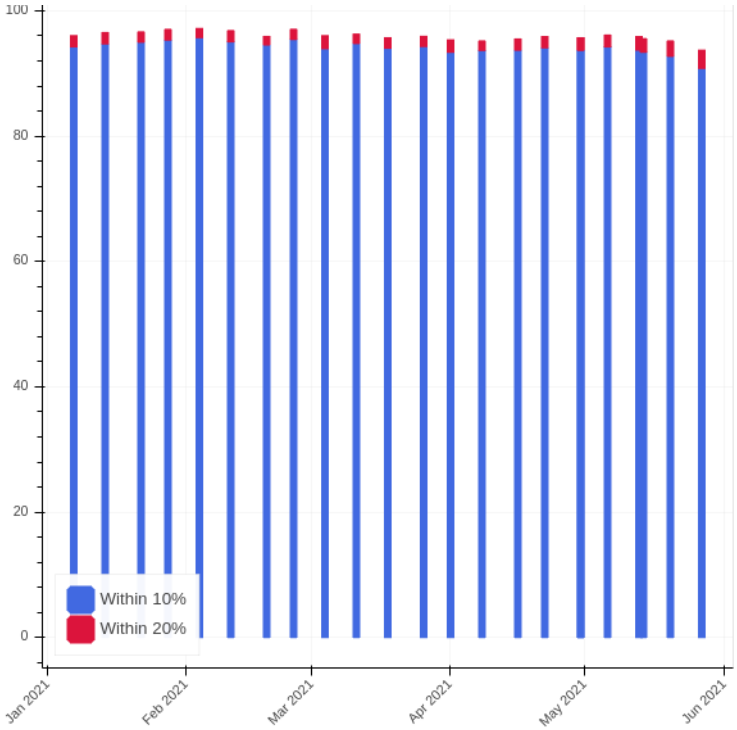


Figure 23: Comparison of ice concentrations from the NIC ice analysis and the OSI SAF concentration product. Northern hemisphere. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/- 10%, and likewise for +/-20%.

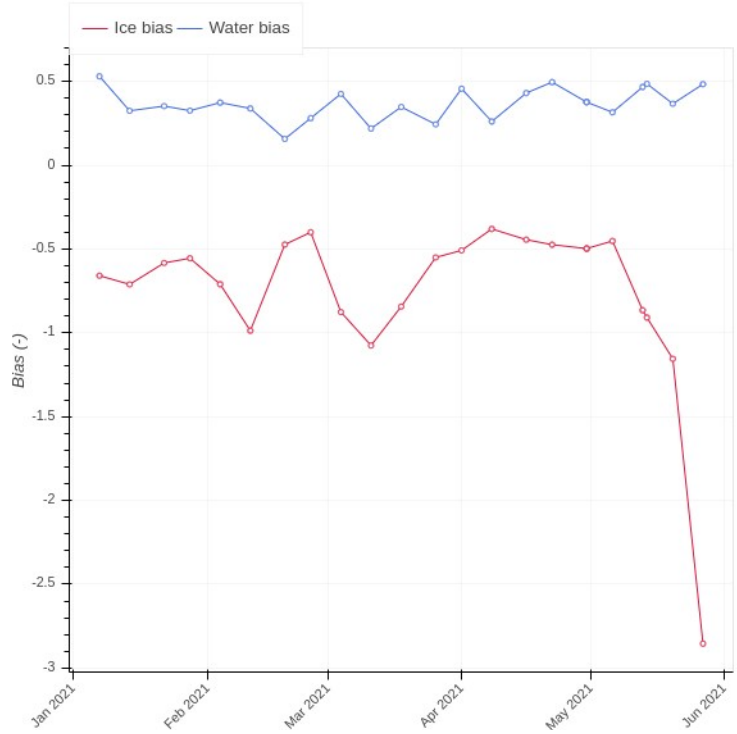


Figure 24: Difference between ice concentrations from the NIC ice analysis and OSI SAF concentration product for two categories: water and ice. When the difference is below zero, the OSI SAF sea ice concentration has a lower estimate than the ice analysis. Northern hemisphere.

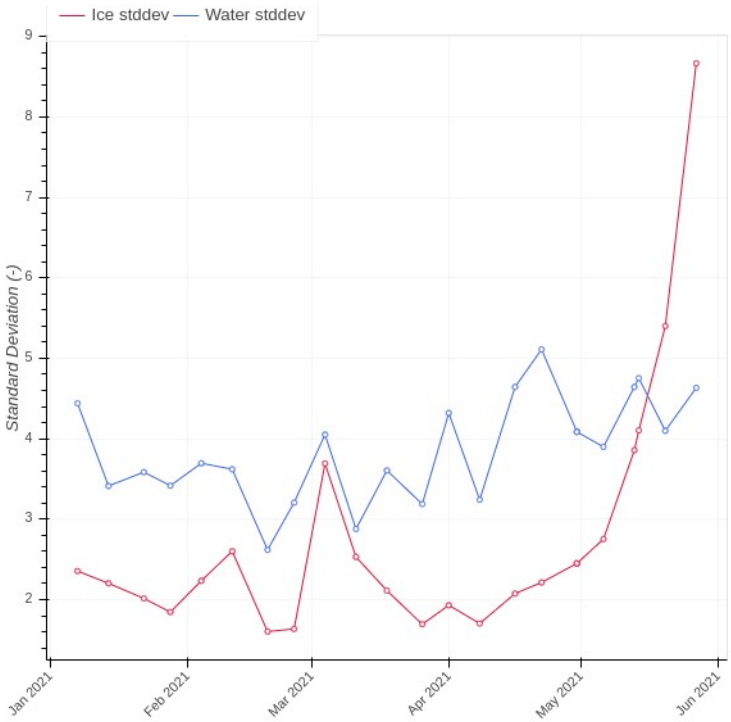


Figure 25: Standard deviation of the difference in ice concentrations from the NIC ice analysis and OSI SAF concentration product for two categories: water and ice. Northern hemisphere.

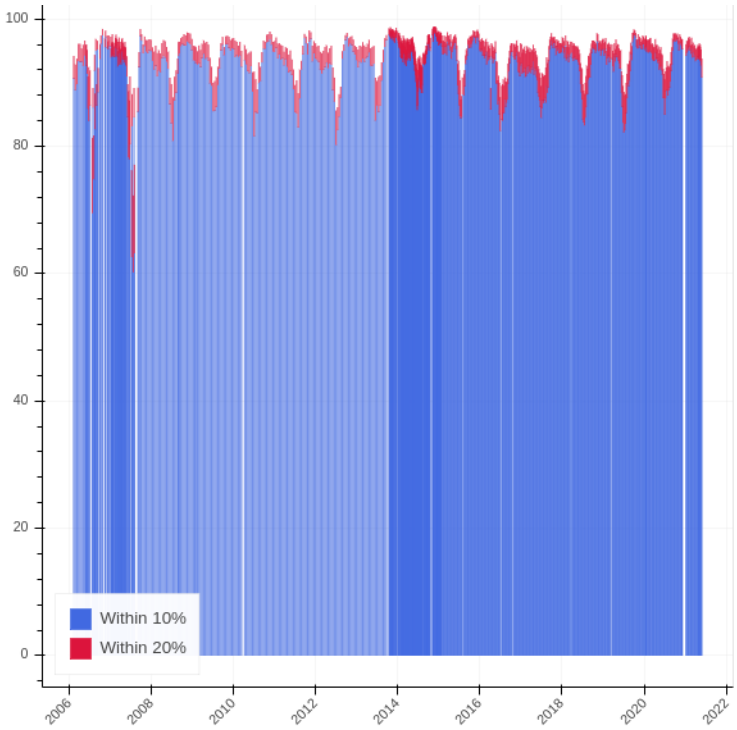


Figure 26: Multiyear variability. Comparison between ice concentrations from the NIC ice analysis and the OSI SAF concentration product. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/- 10%, and likewise for +/-20%. Northern hemisphere.

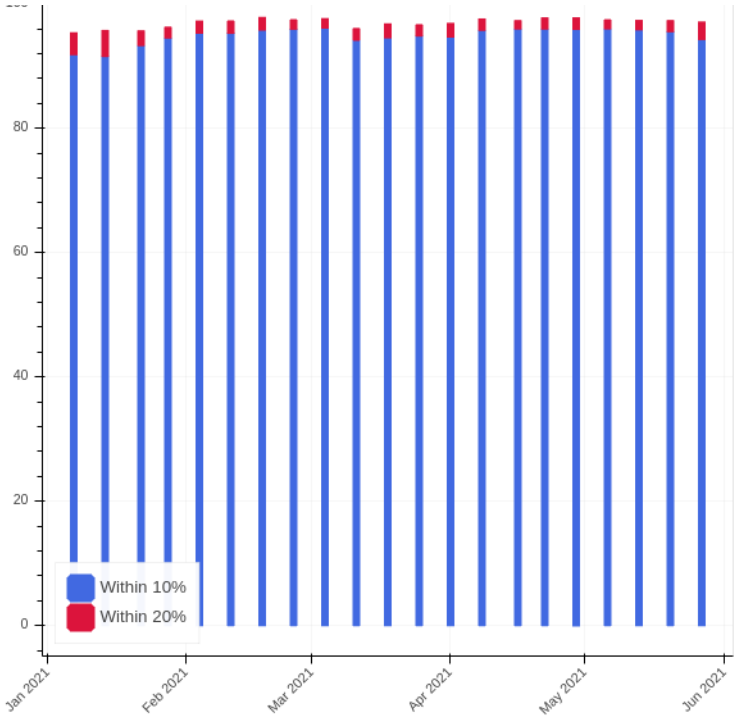


Figure 27: Comparison between ice concentrations from the NIC ice analysis and the OSI SAF concentration product. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/-10%, and likewise for +/-20%. Southern hemisph.

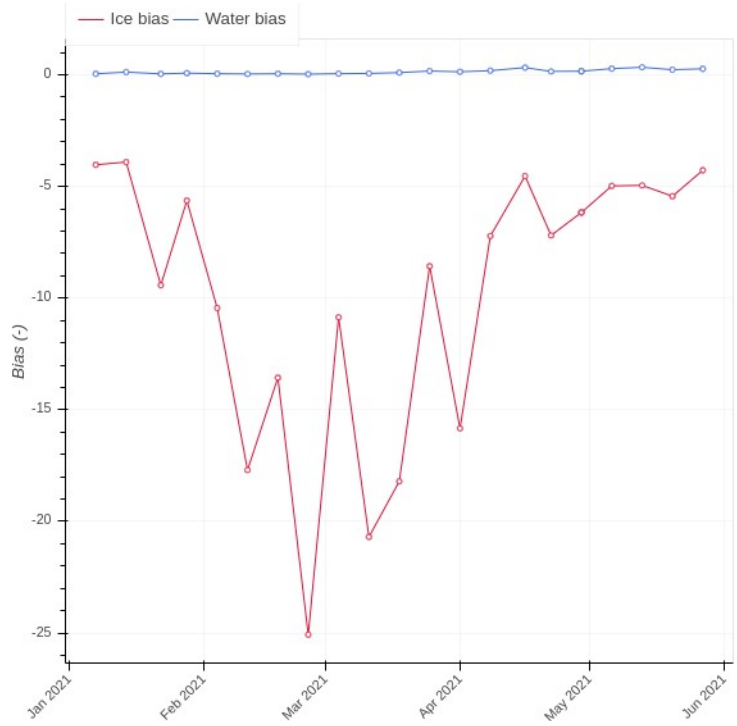


Figure 28: Difference between the ice concentrations from the NIC ice analysis and OSI SAF concentration product for two categories: water and ice. When the difference is below zero, the OSI SAF sea ice conc. has a lower estimate than the ice analysis. Southern hemisph.

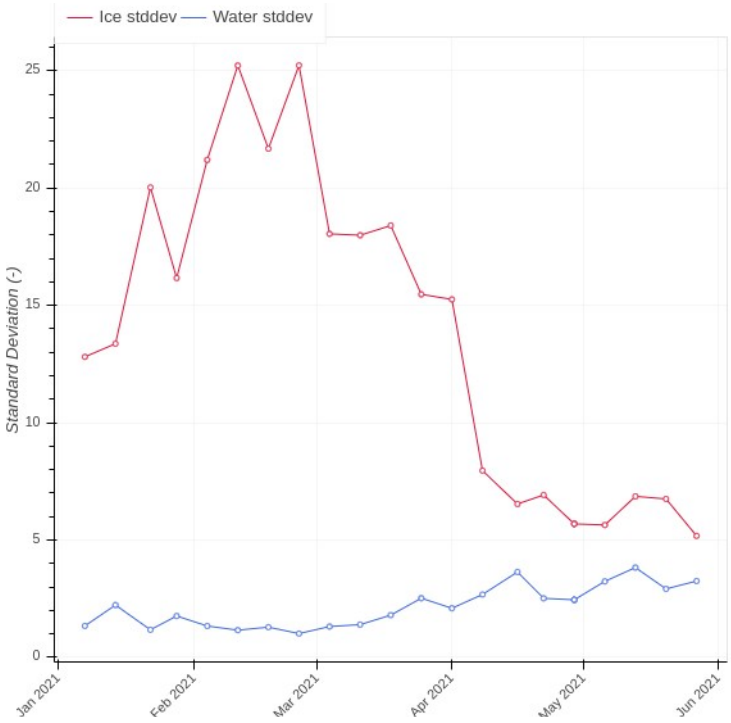


Figure 29: Standard deviation of the difference in ice concentrations from the NIC ice analysis and OSI SAF concentration product for two categories: water and ice. Southern hemisphere.

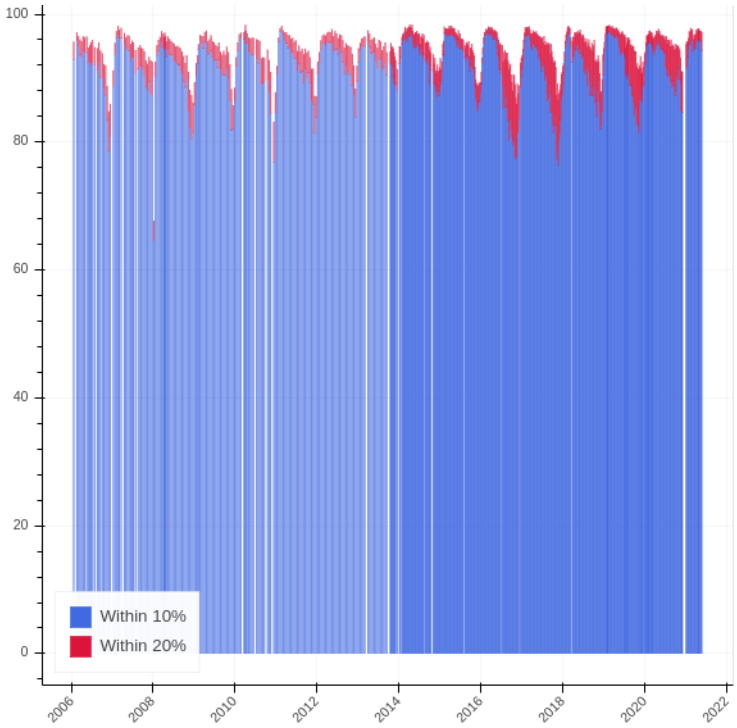


Figure 30: Multiyear variability. Comparison between ice concentrations from the NIC ice analysis and the OSI SAF concentration product. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/- 10%, and likewise for +/-20%. Southern hemisphere.

Concentration product					
Month	+/- 10% [%]	+/- 20% [%]	Mean difference [%]	SD [%]	Number of obs.
Jul. 2020	96.2	96.95	-1.69	6.87	494155
Aug. 2020	96.7	97.32	-1.35	6.79	554542
Sep. 2020	97.97	98.41	-0.8	4.83	612381
Oct. 2020	98.8	99.23	-0.45	3.15	547645
Nov. 2020	98.24	98.83	-0.67	3.92	464066
Dec. 2020	97.58	98.42	-0.93	4.82	419947
Jan. 2021	95.93	97.01	-1.55	6.22	356231
Feb. 2021	96.12	97.28	-1.5	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	-3.9	10.87	433125

Table 36: Monthly quality assessment results from comparing the OSI SAF sea ice concentration product to MET Norway ice service analysis for the Svalbard area. From Jul. 2020 to Jun. 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
Jan. 2021	75.55	24.45	0.0	0.0	0.0	0.0
Feb. 2021	77.83	22.17	0.0	0.0	0.0	0.0
Mar. 2021	76.36	23.64	0.0	0.0	0.0	0.0
Apr. 2021	80.99	19.01	0.0	0.0	0.0	0.0
May 2021	79.94	20.06	0.0	0.0	0.0	0.0
Jun. 2021	76.11	23.89	0.0	0.0	0.0	0.0

Table 37: Statistics for sea ice concentration confidence levels, Code 0-5, Northern Hemisphere, over 1st half 2021.

Month	Code=5	code=4	code=3	code=2	code=1	Unprocessed
Jan. 2021	88.03	11.97	0.0	0.0	0.0	0.0
Feb. 2021	91.3	8.7	0.0	0.0	0.0	0.0
Mar. 2021	89.1	10.9	0.0	0.0	0.0	0.0
Apr. 2021	85.34	14.66	0.0	0.0	0.0	0.0
May 2021	86.34	19.48	0.0	0.0	0.0	0.0
Jun. 2021	87.34	23.13	0.0	0.0	0.0	0.0

Table 38: Statistics for sea ice concentration confidence levels, Code 0-5, Southern Hemisphere, over 1st half 2021.

Comments:
Figure 25 and Figure 30 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	4.26	3.45
Southern Hemishpere	10.28	2.27

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.

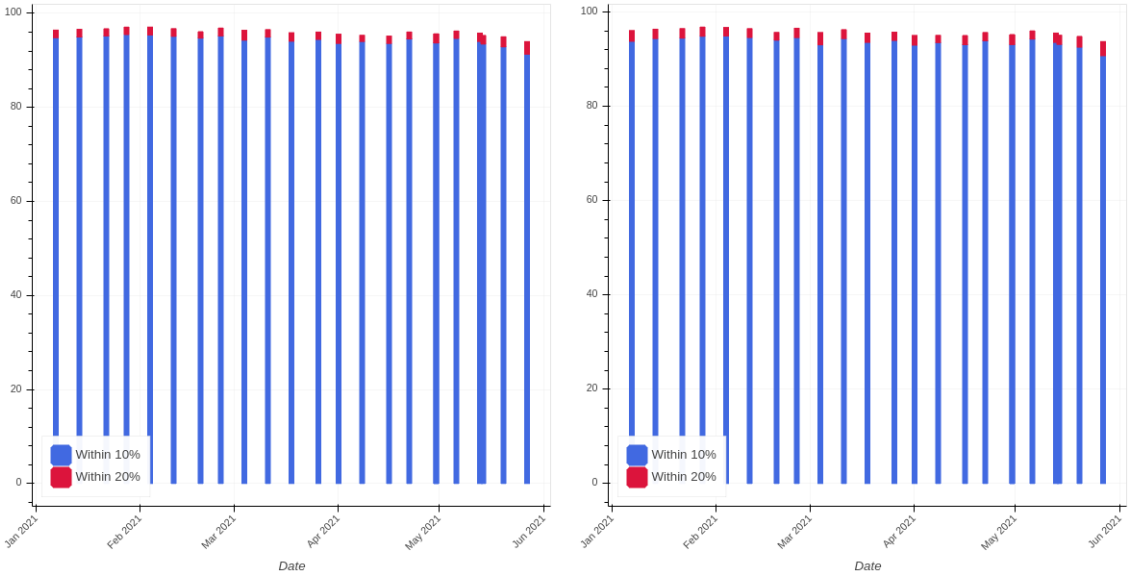


Figure 31: Comparison of ice concentrations from the NIC ice analysis and the OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right. Northern hemisphere. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/- 10%, and likewise for +/-20%

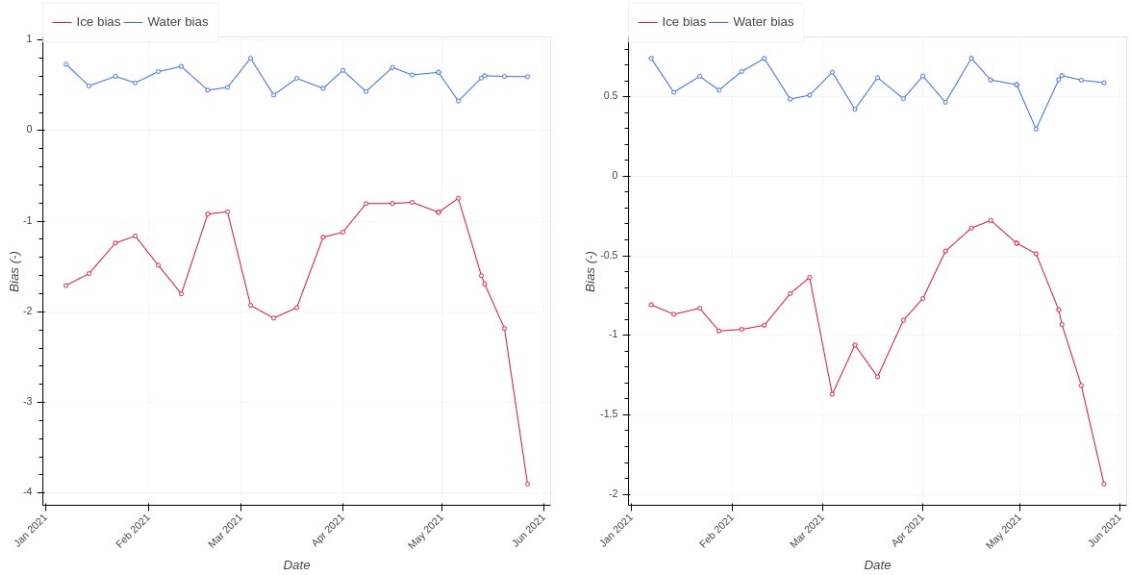


Figure 32: Difference between ice concentrations from the NIC ice analysis and OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right for two categories: water and ice. Northern Hemisphere

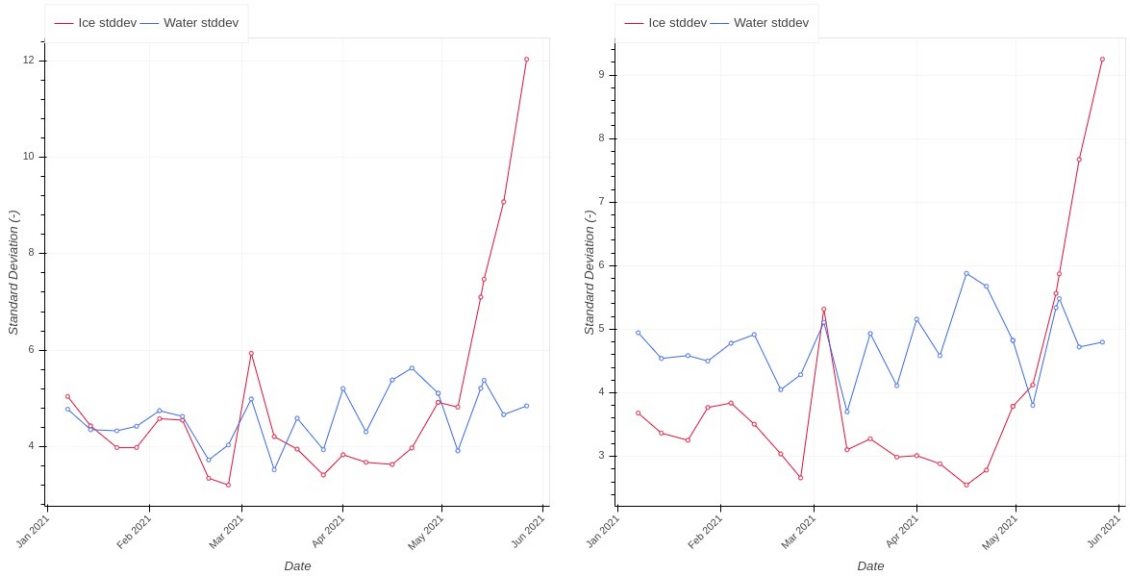


Figure 33: Standard deviation of the difference in ice concentrations from the NIC ice analysis and OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right for two categories: water and ice. Northern hemisphere.

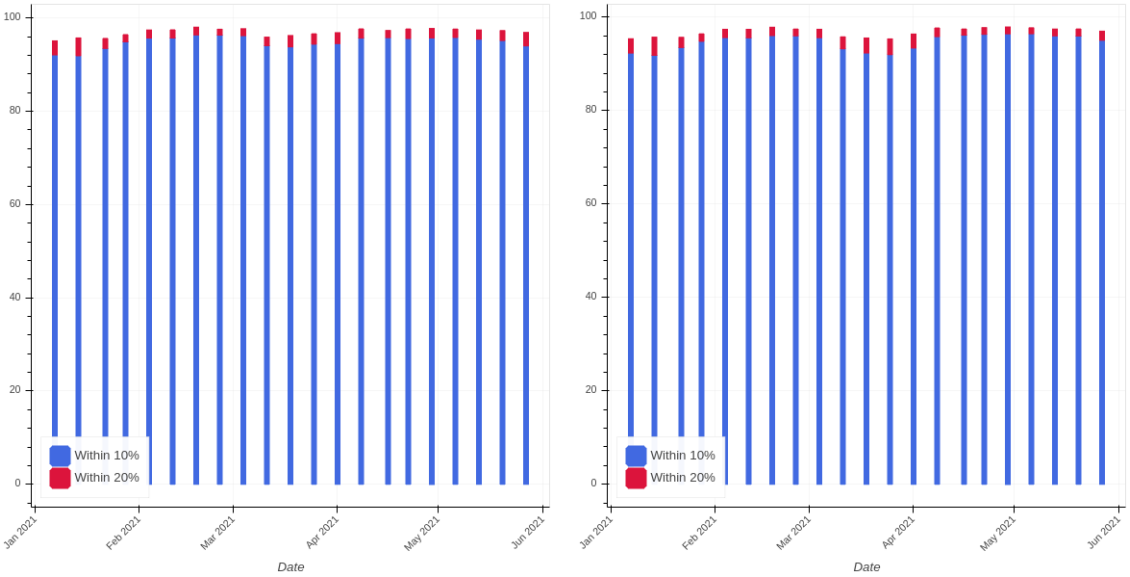


Figure 34: Comparison of ice concentrations from the NIC ice analysis and the OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right. Southern hemisphere. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/- 10%, and likewise for +/-20%

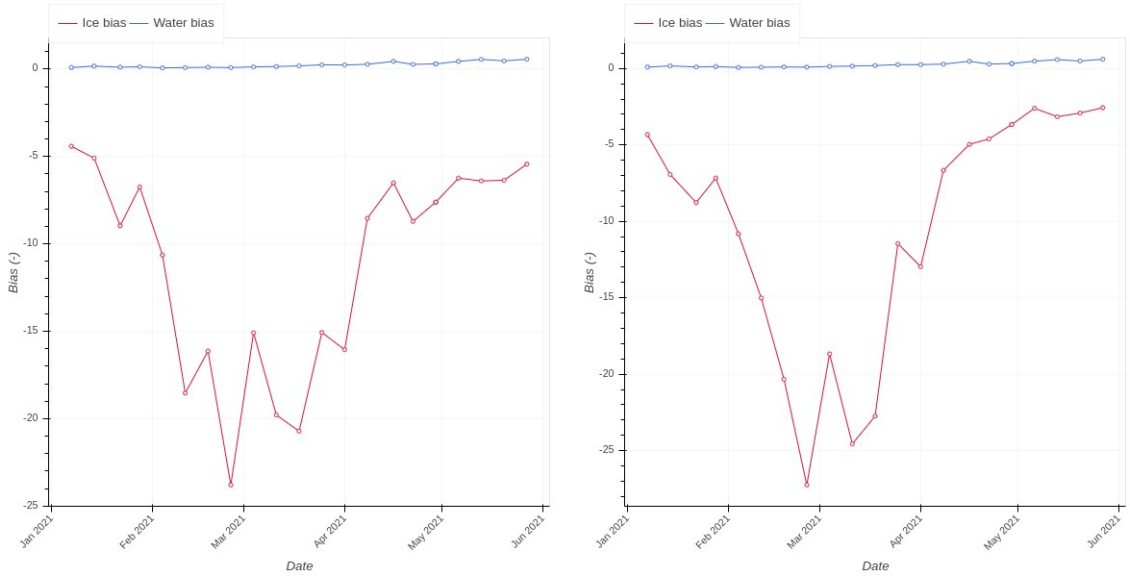


Figure 35: Difference between ice concentrations from the NIC ice analysis and OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right for two categories: water and ice. Southern Hemisphere

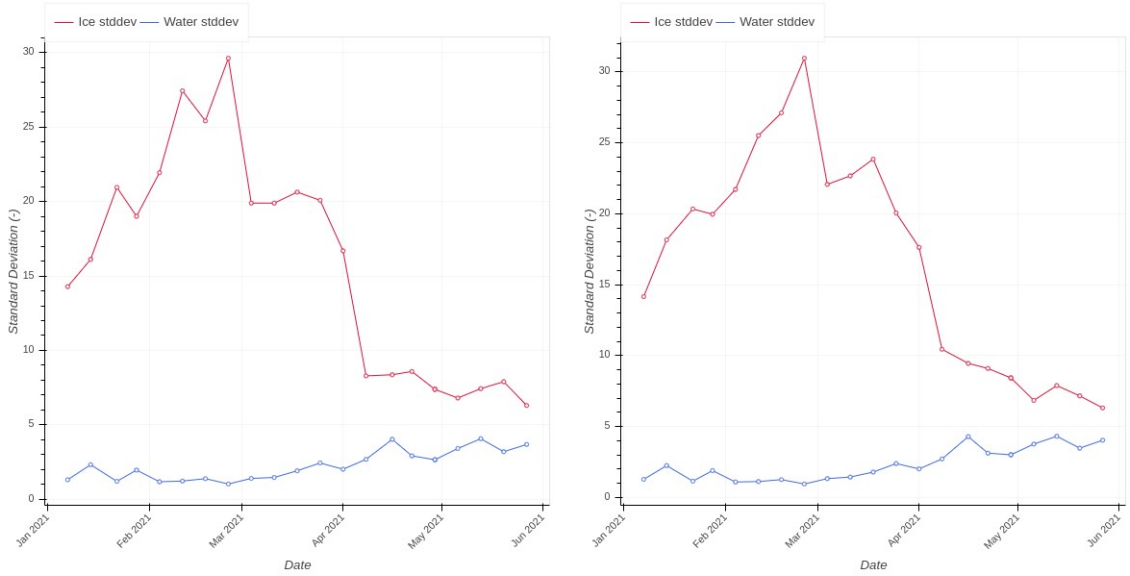


Figure 36: Standard deviation of the difference in ice concentrations from the NIC ice analysis and OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right for two categories: water and, ice. Southern hemisphere.

Comments:
Figure 33 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	6.19	4.69
	SH	11.88	2.54
TUD algorithm	NH	5.04	4.97
	SH	11.81	2.61

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

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

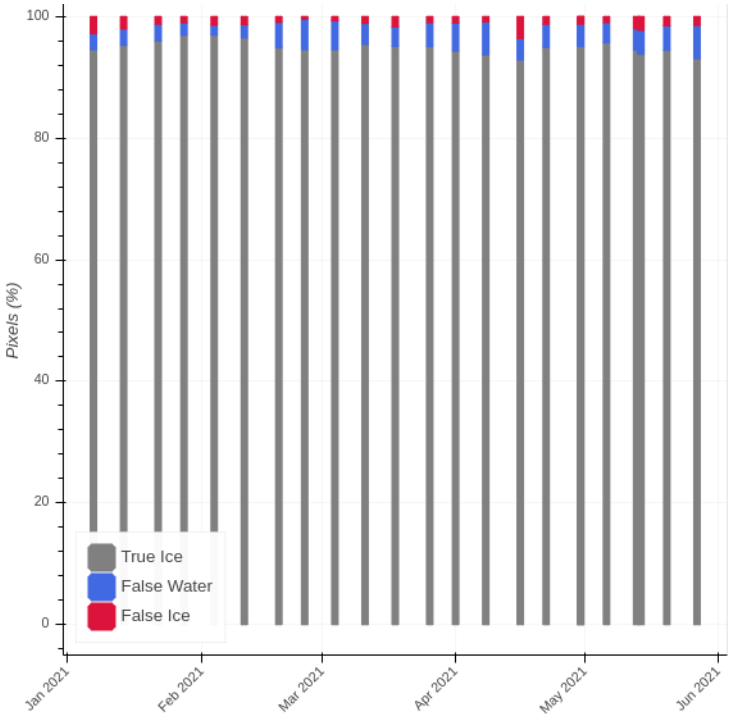


Figure 37: Comparison between the NIC ice analysis and the OSI SAF sea ice edge product. Northern hemisphere. 'False Water' means grid points where the OSI SAF product indicated water and the DMI ice analysis indicated ice and vice versa for the 'False Ice' category.

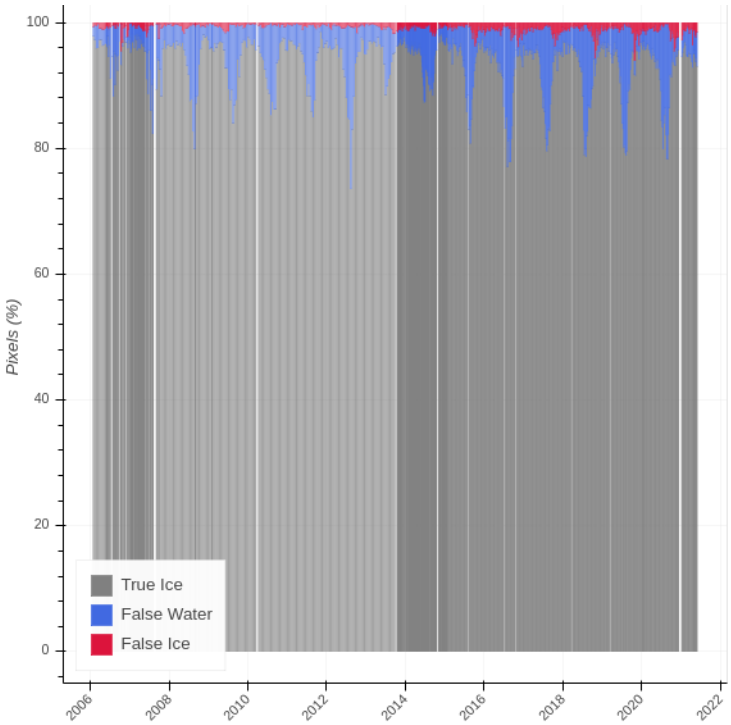


Figure 38: Multiyear variability. Comparison between the NIC ice analysis and the OSI SAF sea ice edge product. Northern hemisphere. 'False Water' means grid points where the OSI SAF product indicated water and the DMI ice analysis indicated ice and vice versa for the 'False Ice' category.

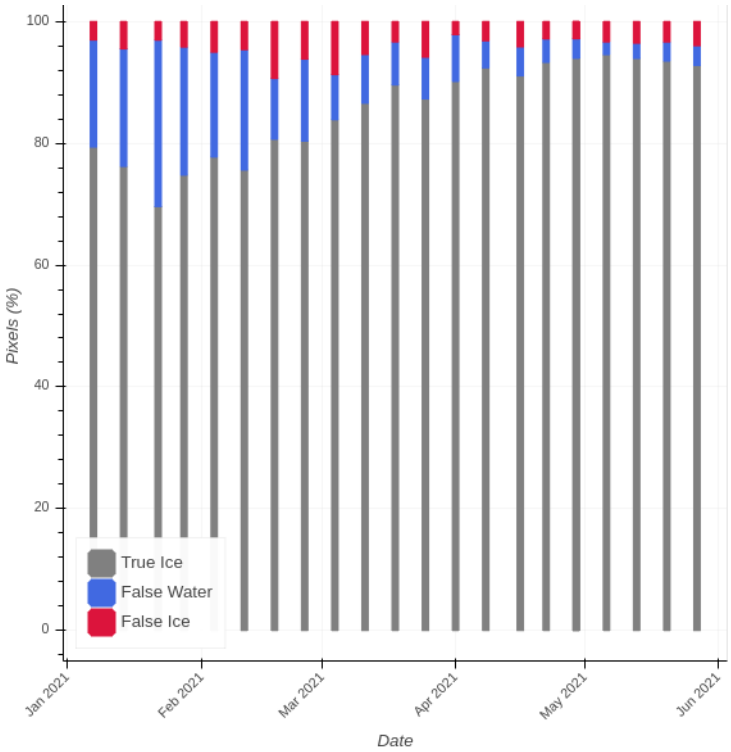


Figure 39: Comparison between the NIC ice analysis and the OSI SAF sea ice edge product. Southern hemisphere. 'False Water' means grid points where the OSI SAF product indicated water and the NIC ice analysis indicated ice and vice versa for the 'False Ice' category.

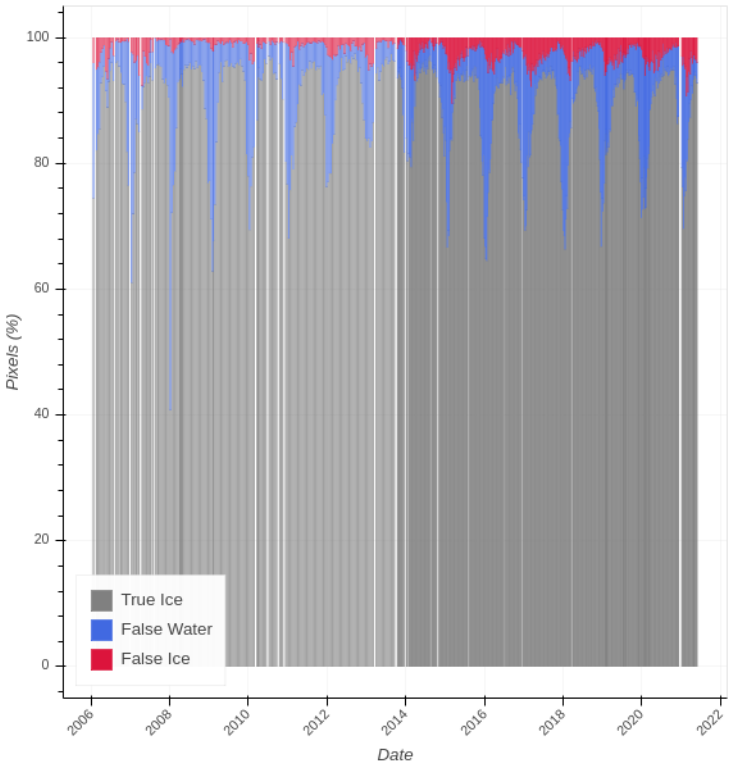


Figure 40: Multiyear variability. Comparison between the NIC ice analysis and the OSI SAF sea ice edge product. Southern hemisphere. 'False Water' means grid points where the OSI SAF product indicated water and the NIC ice analysis indicated ice and vice versa for the 'False Ice' category.

Month	Correct [%]	SAF lower [%]	SAF higher [%]	Mean edge diff [km]	Number of obs.
Jul. 2020	97.98	1.62	0.40	22.33	675793
Aug. 2020	97.32	2.51	0.17	22.46	671040
Sep. 2020	98.81	0.81	0.38	16.68	703249
Oct. 2020	99.21	0.19	0.59	8.16	685646
Nov. 2020	98.83	0.36	0.81	10.28	619955
Dec. 2020	98.33	0.63	1.04	10.62	640695
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

Table 39: Monthly quality assessment results from comparing OSI SAF sea ice products to MET Norway ice service analysis for the Svalbard area, from Jul. 2020 to Jun. 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.
Jul. 2020	-	-	-	-	-
Aug. 2020	-	-	-	-	-
Sep. 2020	-	-	-	-	-
Oct. 2020	98.49	1.24	0.27	24.22	2896
Nov. 2020	97.18	2.60	0.22	37.72	3210
Dec. 2020	93.01	6.28	0.71	61.45	6866
Jan. 2021	95.50	4.13	0.36	80.68	6303
Feb. 2021	97.56	2.18	0.26	65.24	3961
Mar. 2021	98.64	1.28	0.08	39.30	3173
Apr. 2021	98.84	0.84	0.32	22.83	2621
May 2021	-	-	-	-	-
Jun. 2021	-	-	-	-	-

Table 40: Monthly quality assessment results from comparing OSI SAF sea ice products to MET Norway ice service analysis for the Weddell Sea area, from Jul. 2020 to Jun. 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	Code=5	code=4	code=3	code=2	code=1	Unprocessed
Jan. 2021	75.76	11.37	8.49	3.63	0.75	53.84
Feb. 2021	76.72	8.62	9.25	4.51	0.91	53.86
Mar. 2021	75.65	7.96	10.33	5.01	1.05	53.81
Apr. 2021	79.06	10.69	5.84	3.46	0.94	53.64
May 2021	73.12	14	7.94	3.71	1.23	53.05
Jun. 2021	NA	NA	NA	NA	NA	NA

Table 41: Statistics for sea ice edge confidence levels, Code 0-5, Northern Hemisphere, over 1st half 2021.

Month	Code=5	code=4	code=3	code=2	code=1	Unprocessed
Jan. 2021	91.84	1.23	2.35	2.87	1.7	22.38
Feb. 2021	94.71	1.04	1.48	1.83	0.95	22.37
Mar. 2021	92.86	0.79	2.4	3.01	0.94	22.36
Apr. 2021	88.6	3.05	4.3	3.33	0.72	22.36
May 2021	83.62	6.33	6.04	3.39	0.62	22.4
Jun. 2021	NA	NA	NA	NA	NA	NA

Table 42: Statistics for sea ice edge confidence levels, Code 0-5, Southern Hemisphere, over 1st half 2021.

Comments:
In Table 39, 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 2020/2021 is 16.5 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-August when melting of snow and ice makes the product quality worse.

In Table 40, 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 47.3 km and **hereby exceeds the target accuracy requirement** of 45 km. The monthly differences are well below the yearly requirement all months except the 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-c) 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.
There was a transition from OSI-403-c to OSI-403-d for sea ice type on 03.06.2021, which also introduced sea ice type for Southern Hemisphere (not provided previously).

Month	SD wrt running mean [km²] OSI-403-c	Mean MYI coverage [km²] OSI-403-c
Jul. 2020	-	-
Aug. 2020	-	-
Sep. 2020	-	-
Oct. 2020	211,200	2,473,982
Nov. 2020	64,479	2,000,827
Dec. 2020	70,375	1,719,181
Jan. 2021	47,109	1,857,161
Feb. 2021	47,635	1,741,277
Mar. 2021	61,714	1,817,370
Apr. 2021	44,003	1,463,484
May 2021	-	-
Jun. 2021	-	-

Table 43: Monitoring of NH sea ice type quality by comparing the multi year coverage with the 11-days running mean, from Jul. 2020 to Jun. 2021.

Month	SD wrt running mean [km²] OSI-403-d	Mean MYI coverage [km²] OSI-403-d
Jul. 2020	-	-
Aug. 2020	-	-
Sep. 2020	-	-
Oct. 2020	-	-
Nov. 2020	-	-
Dec. 2020	-	-
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

Table 44: Monitoring of SH sea ice type (OSI-403-d) quality by comparing the multi year coverage with the 11-days running mean, from March. 2021 to Jun. 2021. The OSI-403-d was

operational since June, but March-May statistics are also shown for reference, since ice type was not provided for SH in OSI-403-c.

Month	Code=5	code=4	code=3	code=2	code=1	Unprocessed
Jan. 2021	88.75	2.52	7.75	0.86	0.13	53.84
Feb. 2021	88.66	1.45	8.95	0.82	0.12	53.86
Mar. 2021	88.23	1.32	9.42	0.88	0.15	53.81
Apr. 2021	89.07	1.84	7.93	0.95	0.2	53.64
May 2021	76.39	5.4	4.56	13.41	0.24	53.05
Jun. 2021	NA	NA	NA	NA	NA	NA

Table 45: Statistics for sea ice type confidence levels, Northern Hemisphere, over 1st half 2021.

Month	Code=5	code=4	code=3	code=2	code=1	Unprocessed
Jan. 2021	91.19	0.37	0.43	7.71	0.31	22.38
Feb. 2021	94.44	0.3	0.36	4.71	0.2	22.37
Mar. 2021	92.05	0.14	0.2	7.48	0.14	22.36
Apr. 2021	87.02	0.17	0.23	12.47	0.12	22.38
May 2021	80.39	0.19	0.27	19.05	0.1	22.4
Jun. 2021	NA	NA	NA	NA	NA	NA

Table 46: Statistics for sea ice type confidence levels, Southern Hemisphere, over 1st half 2021.

Comments:
Table 43 shows the sea-ice type monitoring for NH. Since the recent validation period, 2020 July – 2021 June, consists of both version OSI-403-c and OSI-403-d, with an overlap in March-April, values are given independently for each version (separated by "/"). The mid-column represents the monthly standard deviations of the daily MYI coverage variability. For both OSI-403-c and -d, all months have values well below the requirement of 100.000 km^2, except October 2020 where the variability was very high (>200.000 km^2). The high October value for OSI-403-c was discussed in previous HYR 2020-H2, and the upgraded product, OSI-403-d, includes a better routine to avoid this when first-year ice traning data is missing in October. A switch to static PDFs will be activated instead of trying to combine training data back in time. See also validation results in Figure 11-13 in SVR v3.0.

Table 44 shows the monitoring of the new sea-ice type product for SH (OSI-403-d) since the beginning of operationalisation in March 2021. All months have values well below the requirement of 100.000 km^2.

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 58 is the difference between the hemispheric OSI SAF product and the validation product.

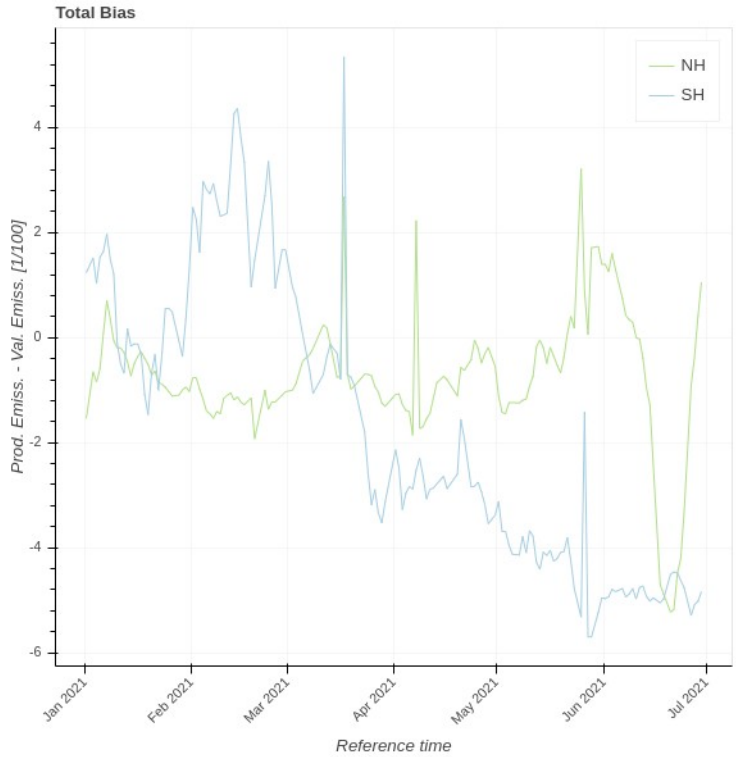


Figure 41: The mean hemispheric difference between the OSI SAF operational product and the validation product derived from NWP and SSMIS data. The y-axis unit is in hundreds (1/100)

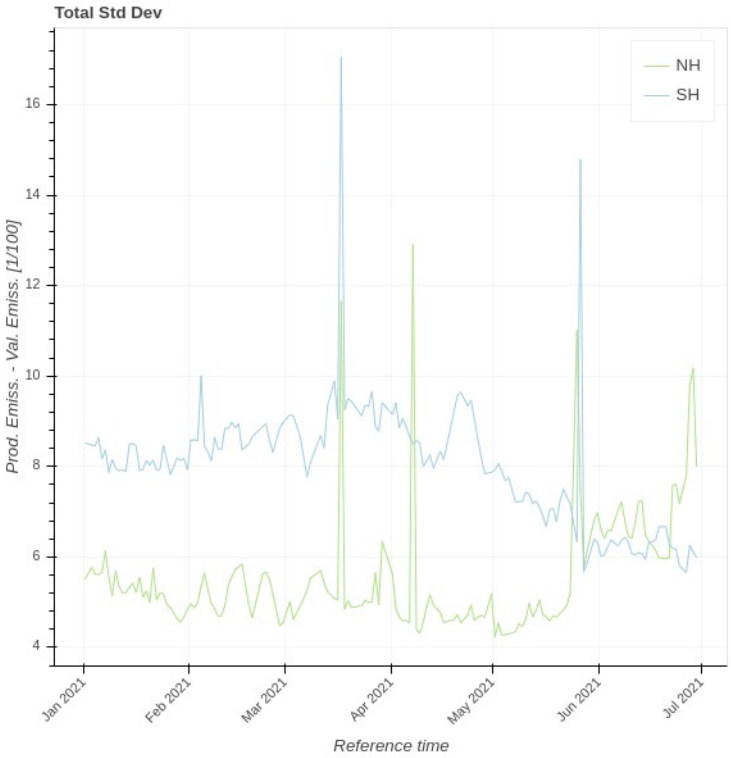


Figure 42: The standard deviation of the difference between the OSI SAF operational product and the validation product for the northern and southern hemispheres. The y-axis unit is in hundreds (1/100)

Comments:
The mean annual difference on the Northern Hemisphere is -0.01 and on the Southern Hemisphere it is -0.03. 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	-0.01	0.06	± 0.05	± 0.15
SH	-0.03	0.07	± 0.05	± 0.15

5.3.6. Low resolution sea ice drift (OSI-405-c) 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 generally buoys (e.g. the Ice Tethered Profilers) or ice camps (e.g. the Russian manned stations) that report their position at typically hourly intervals. Those trajectories are generally made available in near-real-time or at the end of the mission onto the ice. Position records are recorded either via the GPS (e.g. those of the ITPs) or the Argos Doppler-shift system (those of the iABP). GPS positions are very precise (< 50 m) while those obtained by Argos have worse accuracy (approx. 350 m for 'high quality' records) and are thus not used in our reporting.

A nearest-neighbor approach is implemented for the collocation, and any collocation pair whose distance between the product and the buoy is larger than 30 km or the mismatch at start time of the drift is more than 3 hours is discarded. The duration of the drifts must also match within 1 hour.

Reported statistics

Because of a denser atmosphere and surface melting, the OSI-405 accuracy is worse during the summer melt period (from 1st May to 30th September in the Arctic).

The Low Resolution Sea Ice Drift product comprises several single-sensor (e.g. SSMIS F18 or AMSR2 GW1 or ASCAT Metop-B) and a merged (or multi-sensor) products that are all processed and distributed on a daily basis. The quality assessment and monitoring results are thus presented for the multi-sensor product (multi-oi) and a selection of the single-sensor ones.

Most of the ice-drifting buoys are deployed and live in the Arctic Ocean. Only few Southern Hemisphere buoys are available. Hence most of the validation results below are for the NH maps, including monthly statistics. For SH, the number of buoys is insufficient, and we report only statistics over a full year (last 12 months). SH statistics are reported for completeness as the number of buoys is generally not enough to quantitatively assess the performance of OSI-405-c against the target requirements.

Quality assessment statistics

In the following tables, quality assessment statistics for the NH and SH products using multi-sensor (multi-oi) and SSMIS only (SSMIS-F17) are reported upon. In those tables, X(Y) are the X and Y components of the drift vectors. b() is the mean difference and σ() the standard deviation of the $\varepsilon(X) = X_{prod} - X_{ref}$. Columns α, β and ρ are respectively the slope and intercept of the regression line between Prod and Ref data pairs and the Pearson correlation coefficient. N is the number of collocation data pairs. Maps are also included that show the repartition of ice-drifter data for the given period.

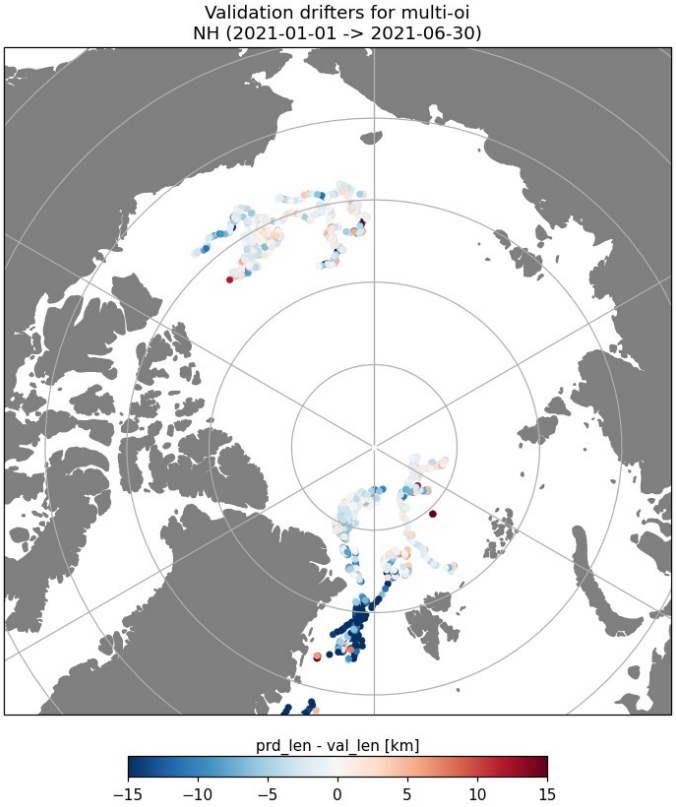


Figure 43: Location of GPS drifters for the quality assessment period (Jan. 2021 to Jun. 2021) in NH. The shade of each symbol represents the mean difference (prod-ref) in drift length (km over 2 days) for the multi-oi product.

Month	b(X) [km]	b(Y) [km]	σ(X) [km]	σ(Y) [km]	α	β[km]	ρ	N
Jul. 2020	-0,87	-3,8	6,47	9,14	0,59	-1,69	0,8	508
Aug. 2020	0,87	-0,23	5,98	6,77	0,73	0,02	0,85	280
Sep. 2020	-0,23	-1,07	5,89	4,99	0,84	0,53	0,93	344
Oct. 2020	-0,52	-0,36	4,64	5,32	0,85	0,3	0,9	501
Nov. 2020	-0,96	-1,23	5,98	8,11	0,81	-0,27	0,92	474
Dec. 2020	-1,4	-0,82	5,62	5,46	0,92	-1,09	0,94	419
Jan. 2021	-1,08	-1,23	4,69	7,96	0,83	-0,57	0,94	407
Feb. 2021	-0,45	-0,04	3,53	4,72	0,83	-0,2	0,94	315
Mar. 2021	-0,82	-1,49	3,11	4,92	0,88	-0,21	0,96	286
Apr. 2021	-0,39	-1,97	3,93	7,02	0,8	0,51	0,9	207
May 2021	-1,37	-3,23	7,12	7,62	0,67	-0,48	0,82	232
Jun. 2021	0,03	-2,74	7,93	8,07	0,73	0,65	0,84	171
Last 12 months	-0,67	-1,46	5,53	6,97	0,81	-0,34	0,91	4144

Table 47: Quality assessment results for the LRSID (multi-oi) product (NH) for Jul. 2020 to Jun. 2021.

Month	b(X) [km]	b(Y) [km]	σ(X) [km]	σ(Y) [km]	α	β[km]	ρ	N
Jul. 2020	--	--	--	--	--	--	--	0
Aug. 2020	--	--	--	--	--	--	--	0
Sep. 2020	--	--	--	--	--	--	--	0
Oct. 2020	-0,83	-0,19	5,07	5,63	0,89	0,03	0,89	402
Nov. 2020	-1,1	-1,31	6,49	6,98	0,87	-0,66	0,92	395
Dec. 2020	-1,31	-0,61	6,01	5,02	0,94	-0,96	0,94	390
Jan. 2021	-0,58	-0,43	4,64	6,18	0,88	-0,31	0,95	361
Feb. 2021	-0,23	-0,32	3,9	4,04	0,92	-0,24	0,94	253
Mar. 2021	-0,67	-0,87	3,56	4,05	0,92	-0,18	0,96	277
Apr. 2021	0,41	-1,52	3,69	6,15	0,87	0,35	0,92	169
May 2021	--	--	--	--	--	--	--	0
Jun. 2021	--	--	--	--	--	--	--	0
Last 12 months	-0,74	-0,7	5,12	5,62	0,9	-0,39	0,93	2247

Table 48: Quality assessment results for the LRSID (SSMIS-F18) product (NH) for Jul. 2020 to Jun. 2021.

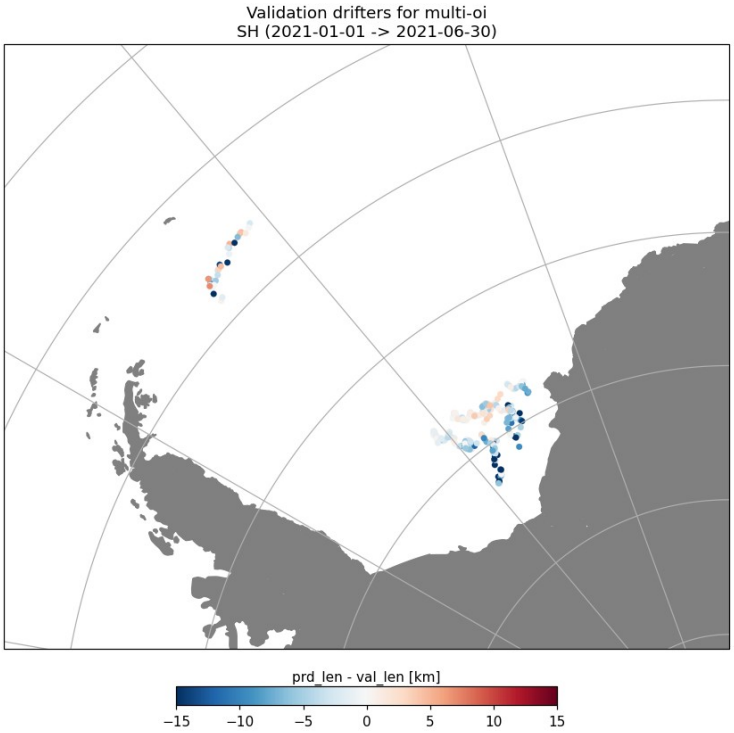


Figure 44: Location of GPS drifters for the quality assessment period (Jan. 2021 to Jun. 2021) in SH. The shade of each symbol represents the mean difference (prod-ref) in drift length (km over 2 days) for the multi-oi product.

Products	b(X) [km]	b(Y) [km]	σ(X) [km]	σ(Y) [km]	α	β[km]	ρ	N
multi-oi	0,38	0,39	5,14	6,98	0,78	-0,29	0,92	248
ssmis-f18	0,21	0,02	4,32	5,69	0,85	-0,33	0,92	183
amsr2-gw1	0,41	0,32	3,86	4,98	0,85	-0,08	0,94	185

Table 49: Quality assessment results for selected OSI-405-c products (SH) for the last 12 months (Jul. 2020 to Jun. 2021).

Comments:
The validation statistics reported in this HYR are somewhat larger than those in previous reports (e.g. NH RMSE over 12 months in the order of 6 km for multi-oi, vs below 4 km in earlier periods). We attribute these worse results to the over-sampling of the Fram Strait region. Indeed, the numerous buoys deployed around the Polarstern ship during the MOSAiC campaign have been slowly but steadily exiting the Arctic Ocean through the Fram Strait, a region with high sea-ice dynamics that the OSI-405-c is known not to capture well. Figure 43 clearly shows a cluster of these large mismatches (dark blues) in the Fram Strait region. Excluding the Fram Strait region results in removing ~400 matchups (out of 4144) over 12 months, and reducing the RMSE to ~4.5 km (multi-oi NH).

The RMSEs in the SH are nominal. We note that the Covid-19 has greatly reduced the number of buoys deployed in the Southern Hemisphere sea ice and that the current validation holds on a small number of buoys (Figure 44). We thank the Alfred Wegener Institute (AWI) for their sustained efforts in released sea-ice buoys in the Weddell Sea.

5.3.7. Medium resolution sea ice drift (OSI-407) 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 50 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 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.

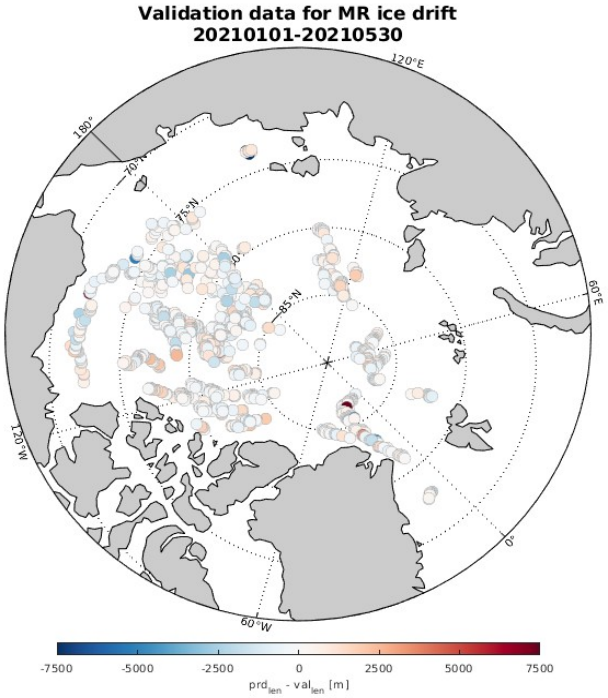


Figure 45: Location of GPS drifters for the quality assessment period (1st half 2021). The shade of each symbol represents the difference (prod-def) in drift length in meters

Month	b(X) [m]	b(Y) [m]	σ(X) [m]	σ(Y) [m]	α	β [m]	ρ	N
Jul. 2020	340	-15	795	656	0.95	200.6	0.978	1182
Aug. 2020	-117	175	686	1504	0.92	154.6	0.940	214
Sep. 2020	NA	NA	NA	NA	NA	NA	NA	NA
Oct. 2020	49	225	755	824	0.98	142.1	0.993	776
Nov. 2020	345	-112	981	1252	1.02	64.5	0.988	1618
Dec. 2020	103	1	1107	1049	0.97	61	0.988	9876
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
Last 12 months	122	-15	1020	1088	0.98	-55	0.984	29948

Table 50: MR sea ice drift product (OSI-407) performance, Jul. 2020 to Jun. 2021

Comments:
Note that the matchups for the statistics above are also shown in the latest scatter plot shown above.
Since an unusual behaviour was found in the satellite matchups for the 6th April, this date has been disqualified from the validation procedure this time around. As the buoy-satellite difference seems to be the same across all matchups with a systematic difference of ca. 10 km, a shift in the 3-minute segments of the satellite data might have occurred and will be further investigated.

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 previous second half year period of 2020, match-ups were found with 78 individual buoys during this period, after carrying out the automated nearest-neighbour approach.
After further quality control 5 buoys were disqualified, and the remaining 73 were used for the statistics shown in the table above.
The following buoys were disqualified because they are supposedly grounded (based on visual inspection of the buoy locations):
2501667, 4402661, 4800769, 4802508, 4802510

For the first half year period of 2021 match-ups were found with 108 individual buoys during this period, after carrying out the automated nearest-neighbour approach.
Note that none of the available buoy data for June 2021 qualified for the validation procedure.
After further quality control 53 buoys were disqualified, and the remaining 55 were used for the statistics shown in the table above.
The following buoys were disqualified because they are supposedly grounded or located too far to the south to be drifting in ice (based on visual inspection of the buoy locations):
2501538, 2501667, 2501716, 4101653, 4101655, 4101657, 4101659, 4101662, 4401751, 4401899, 4402527, 4402528, 4402533, 4402536, 4602502, 4602503, 4701658, 4701659, 4701660, 4800769, 4801639, 4801654, 4801690, 4802503, 4802504, 4802508, 4802539, 6202623, 6202634, 6202635, 6202637, 6202661, 6202665, 6202666, 6203551, 6203563, 6203587, 6203719, 6301511, 6301544, 6301682, 6401574, 6401575, 6401578, 6401581, 6402544, 6402545, 6402548, 6402549, 6402550, 6402552, 4801687, 4801688

5.4. Global Wind quality (OSI-102 series, OSI-104 series, OSI-112 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 July 2019 to June 2021. Before computing the statistics, 0.2 m/s is added to the ECMWF winds in order to convert the real model winds into neutral winds. As of 25 September 2018, the products contain stress-equivalent ECMWF model background winds instead of real 10m winds and the 0.2 m/s correction is not applied any more. The scatterometer winds are also stress-equivalent winds.

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/.

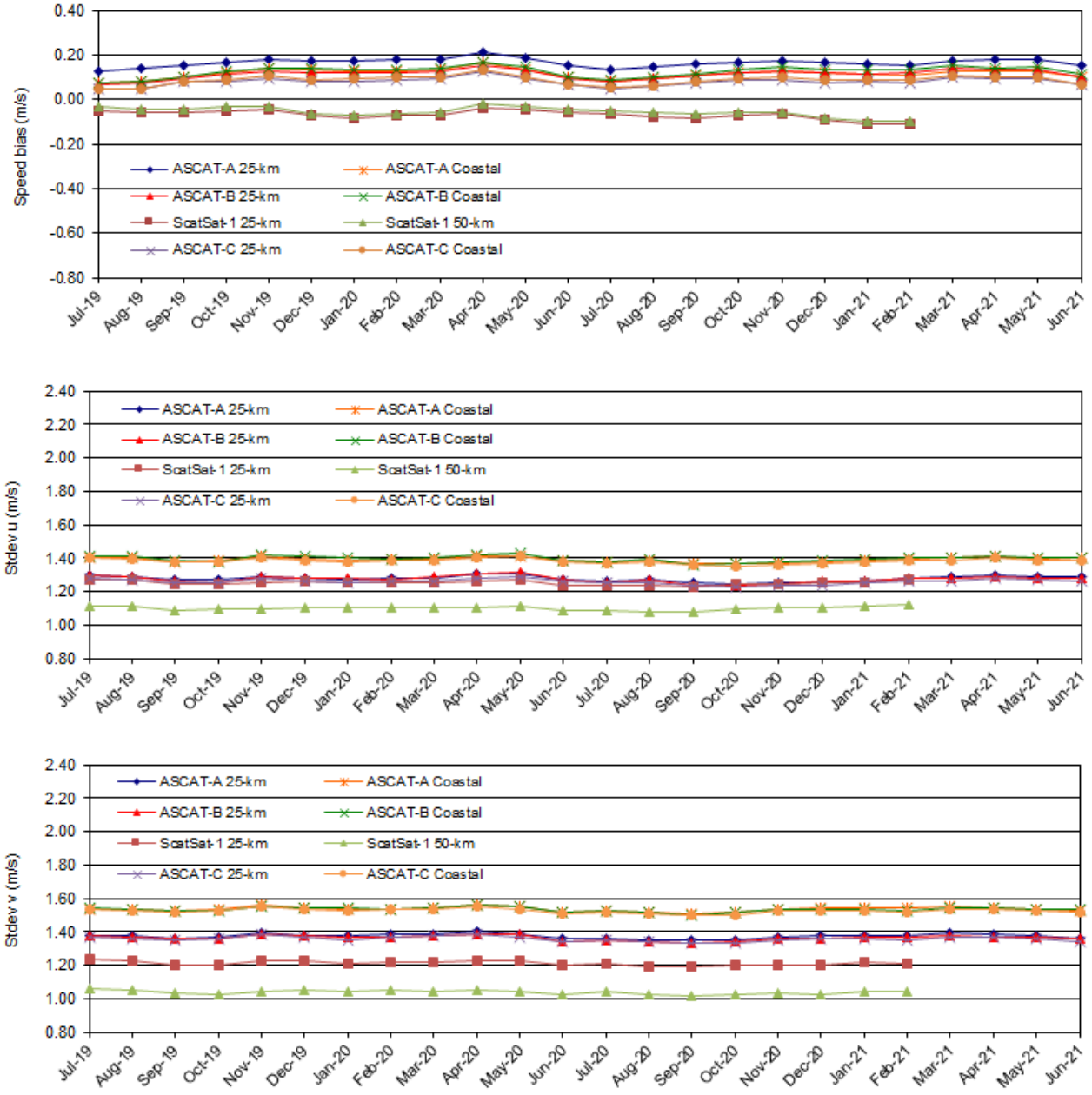


Figure 46: Comparison of scatterometer winds against ECMWF NWP forecast winds (monthly averages). For each product, the wind speed mean difference (scatterometer minus ECMWF, top), wind u component standard deviation (middle) and wind v component standard deviation (bottom) are shown.

5.4.2. Comparison with buoys

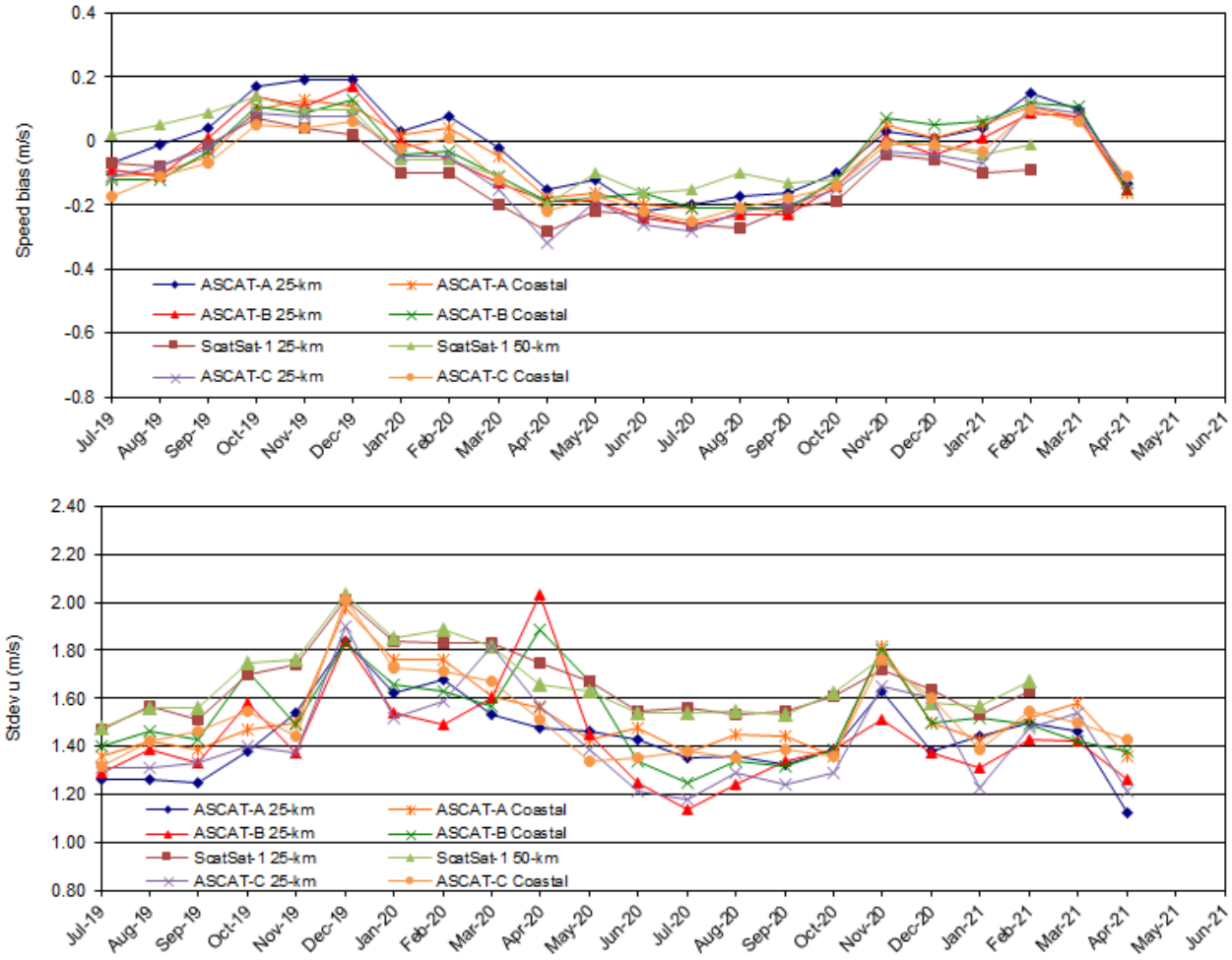
We compare the scatterometer winds with wind data from moored buoys on a monthly basis. The buoy data of approximately 150 buoys spread over the oceans (most of them in the tropical oceans and near Europe and North America) are retrieved from the ECMWF MARS archive and collocated with scatterometer winds. 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 July 2019 to April 2021. The last month 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.



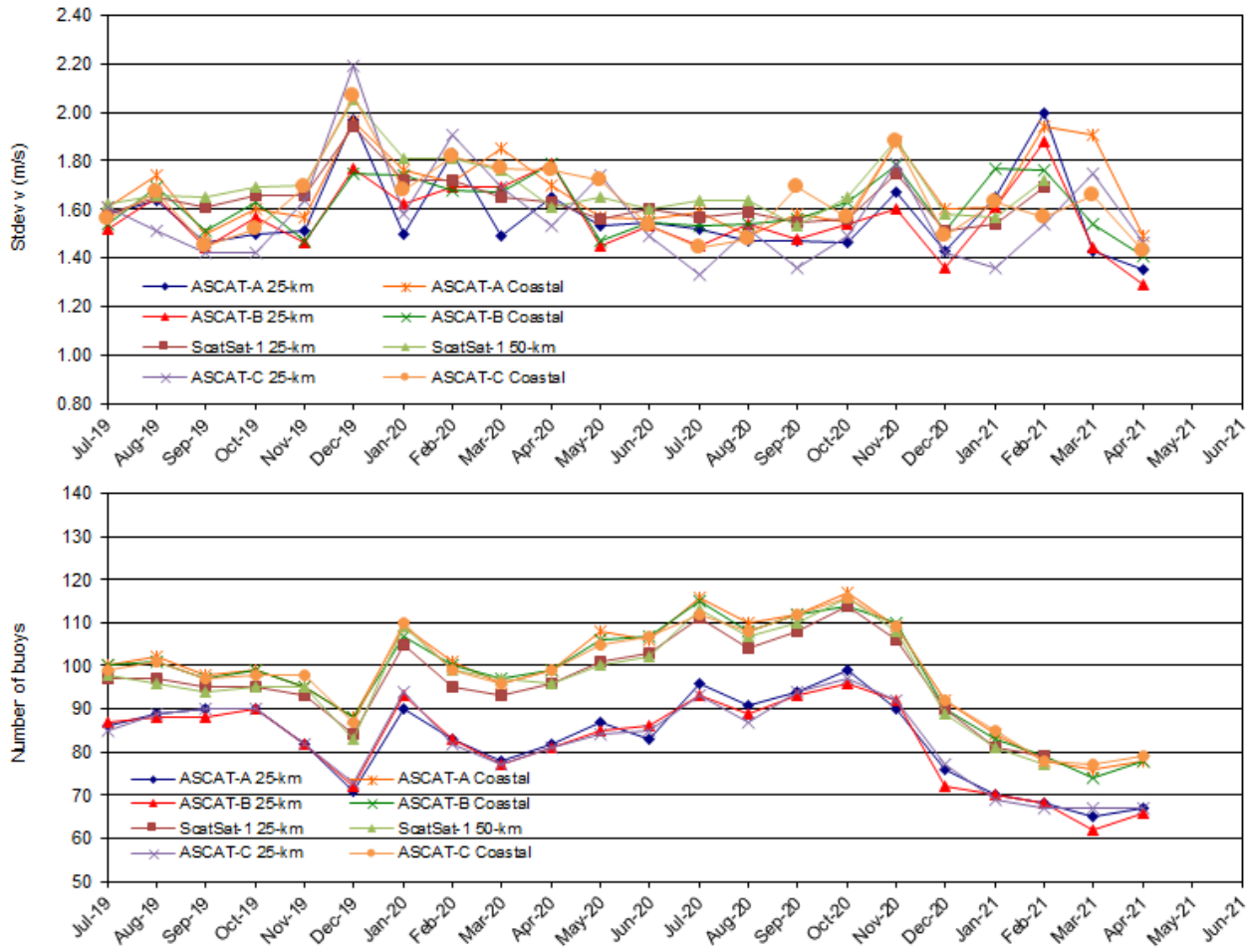


Figure 47: Comparison of scatterometer winds against buoy winds (monthly averages). For each product, the wind speed mean difference (scatterometer minus buoy, top), wind u component standard deviation (2nd plot) and wind v component standard deviation (3rd plot) are shown. Also the number of buoys available 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 SS1, http://osi-saf.eumetsat.int/lml/, managed by MF/CMS,
- a web site for SS2, http://osisaf.met.no/, managed by MET Norway,
- a web site for SS3, http://www.knmi.nl/scatterometer/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 central OSI SAF web site and help desk

6.1.1.1. Statistics on the registered users

Statistics on the central Web site use		
Month	Registered users	Pages
Jan. 2021	2001	1348
Feb. 2021	2026	1398
Mar. 2021	2020	1357
Apr. 2021	2051	1713
May 2021	2073	NA
Jun. 2021	2103	1593

Table 51: Statistics on central OSI SAF web site use over 1st half 2021.

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

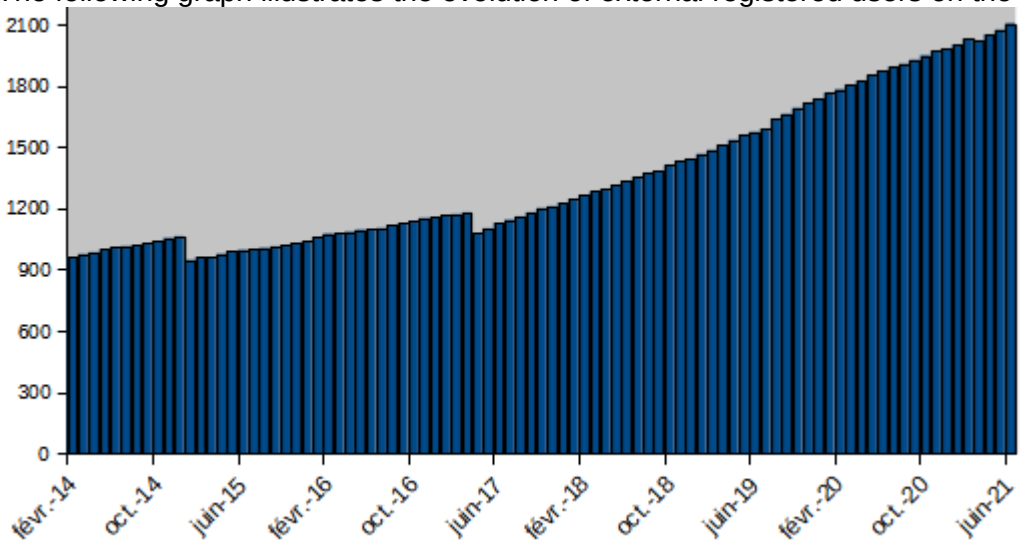


Figure 48: Evolution of external registered users on the central Web Site from April 2014 to Jun. 2021.

Comments:
The number of registered users is progressing continuously.

The following table lists the institutions or companies the new registered users (over 1st half 2021) are from.

Country	Institution, establishment or company
Algeria	école polytechniques d'architecture et d'urbanisme APAU Alger
Armenia	Department of Meteorology
Austria	University of Vienna
brazil	Federal University of Viçosa
Brazil	Universidade de são paulo
Brazil	Echoenergia
Canada	World Wildlife Fund Canada
China	Wuhan university
China	Ocean University of China
China	Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences
China	Dalian Maritime University
China	Nanjing University
China	Qingdao observatory
China	China University of Mining and Technology
China	China University of Geo-science
China	Ocean University of China
China	Tongji university
China	National Satellite Ocean Application Service
China	China Meteorological Administration
China	Xiamen University
China	China University of Petroleum
China	Wuhan university
China	Sun Yat-sen University
Croatia	Croatian Meteorological and Hydrological Service
Denmark	Danish Meteorological Institute
Denmark	Danish Technical University
Denmark	Technical University of Denmark, Risø
Estonia	Tallinn University of Technology
France	Collecte localisation Satellites
France	Service Hydrographique et Océanographique de la Marine
France	Météo-France
France	Collecte localisation Satellites
France	Laboratoire d'Océanologie et de Géosciences
France	Institut français de recherche pour l'exploitation de la mer
Germany	European Organisation for the Exploitation of Meteorological Satellites
Germany	Deutscher Wetterdienst
Germany	Alfred Wegener Institute for Polar and Marine Research
Germany	Karlsruhe Institue for Technology
Greece	National Observatory of Athens
Hong Kong	Hong Kong University of Science and Technology
India	Indian Institute of Technology Bhubaneswar
India	Andhra University
Indonesia	Politeknik Negeri Batam

Country	Institution, establishment or company
Indonesia	Sepuluh Nopember Institute of Technology
Italy	Università di Milano-Bicocca
Italy	University of Napoli Parthenope
Italy	Agenzia Nazionale per le nuove tecnologie,l'energia e lo sviluppo economico sostenibile
Italy	Università degli Studi di Modena e Reggio Emilia
Italy	Università di Trieste
Japan	Weathernews
Japan	Japan Meteorological Agency
Japan	Japan Agency for Marine-Earth Science and Technology
Korea Republic	GI E&S
Korea Republic	Ulsan National Institute of Science and Technology (UNIST)
Korea Republic	Korea Meteorological Administration
Korea Republic	Seoul National University
Malta	University of Malta
Mauritius	Association pour le Développement Durable
Morocco	University Hassan II of Casablanca
Netherlands	HKV Lijn in water
New Zealand	The University of Auckland
Norway	Norwegian Meteorological Institute
Norway	UiT The Arctic University of Norway
Norway	Norwegian Institute of Bioeconomy Research
Philippines	University of the Philippines
Portugal	Universidade de Lisboa
Romania	National Meteorological Administration
Russian Federation	Shirshov Institute of Oceanology RAS
Russian Federation	Arctic and Antarctic Research Institute
Russian Federation	Saint Petersburg University
Russian Federation	Bureau Hyperborea Ltd
Russian Federation	Russian State Hydrometeorological Universit
Spain	Instituto Español de Oceanografia
Sweden	EA Offshore Ice AB
Sweden	Uppsala University
Sweden	Swedish Meteorological and Hydrological Institute
Switzerland	ETH Zürich
United Kingdom	University of Plymouth
United Kingdom	University of Reading
United Kingdom	University College London
United Kingdom	University of Oxford
United States	Oregon State University
United States	Woods Hole Oceanographic Institution
United States	Visual Crossing Corporation
United States	Jet Propulsion Laboratory
United States	The Capella Research Group
United States	National Oceanic and Atmospheric Administration
United States	Scripps Institution of Oceanography

Table 52: List of institutes of the new registered users over 1st half 2021 on the central web site

Moreover 40 new individual users, i.e. persons independent from any institute, establishment or company, registered on the period.

6.1.1.2. Statistics on the use of the OSI SAF central Web site

Usage of the OSI SAF central Web Site by country (top 10) over 1st half 2021 (pages views)						
Countries	Jan. 2021	Feb. 2021	Mar. 2021	Apr. 2021	May 2021	Jun. 2021
USA	558	608	710	659	313	649
China	206	125	356	301	78	211
UK	100	142	172	138	69	148
France	116	111	141	114	57	120
Russia	21	14	55	63	18	51
Spain	31	18	49	35	28	54
Sud Corea	34	26	44	58	12	29
Italy	25	24	48	38	14	32
Germany	13	36	51	38	12	30
Japan	18	32	34	37	17	36
Others/Commercial	53	70	55	30	13	39

Table 53: Usage of the OSI SAF central Web Site by country (top 10) over 1st half 2021

6.1.1.3. Status of User requests made via the OSI SAF and EUMETSAT Help desks

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

The total number of OSI SAF helpdesk inquiries at the LML subsystem in this half year was 9. 8 requests were acknowledged or answered within three working days (one request was answered after 4 days during the Christmas period). 4 were categorized as ‘info’, 0 as ‘archive’, 5 as ‘unavailable’ and 0 as ‘anomaly’.

The total number of OSI SAF helpdesk inquiries at the HL subsystem in this half year was 19. 18 requests were acknowledged or answered within three working days. 13 were categorized as ‘info’, 1 as ‘archive’, 4 as ‘unavailable’ and 1 as ‘anomaly’.

The total number of OSI SAF helpdesk inquiries at scat@knmi in this half year was 26. 26 requests were acknowledged or answered within three working days. 17 were categorized as ‘info’, 4 as ‘archive’ and 5 as ‘unavailable’ (referring to ScatSat-1 outages).

6.1.2. Statistics on the OSI SAF Sea Ice Web portal

The following graph illustrates the evolution of page views on the OSI SAF High Latitude portal (http://osisaf-hl.met.no). The statistics for March-May 2021 is missing because the logs were lost

during a service upgrade.

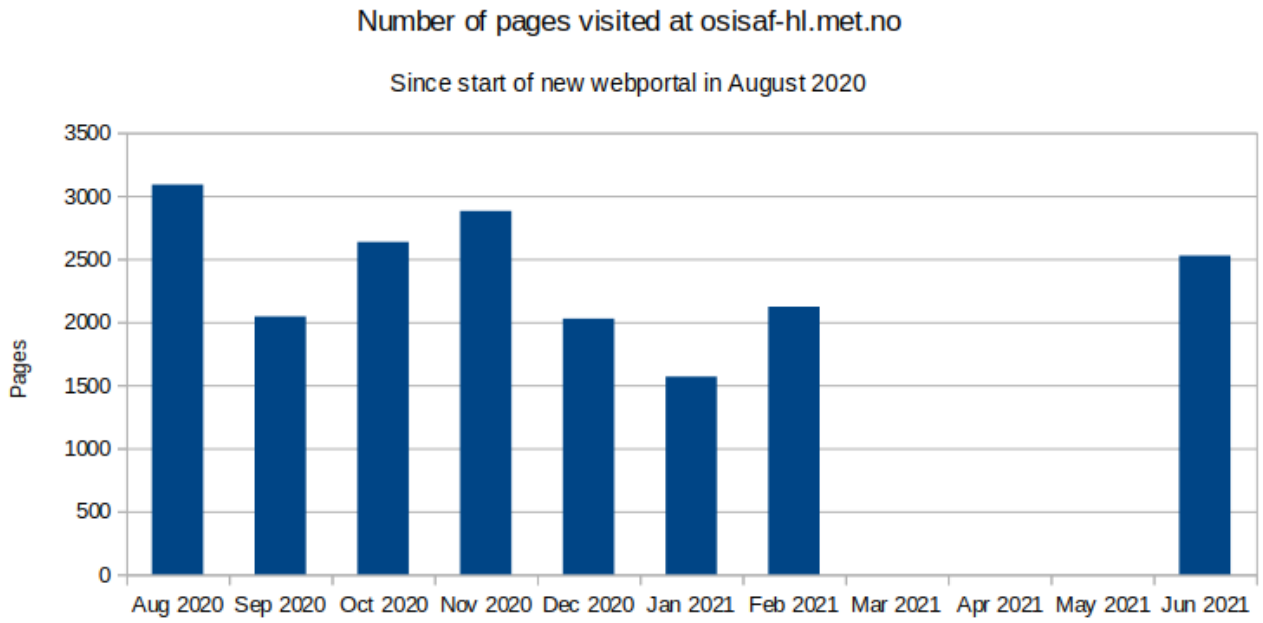


Figure 49: Evolution of page views on the HL OSI SAF Sea Ice portal from January 2014 to Jun. 2021 (http://osisaf-hl.met.no)

6.1.3. Statistics on the OSI SAF KNMI scatterometer web page

The following graph illustrates the evolution of page views on the KNMI scatterometer web pages, which are partly devoted to the OSI SAF wind products, from August 2005 to Jun. 2021. Only external sessions (from outside KNMI) are counted.

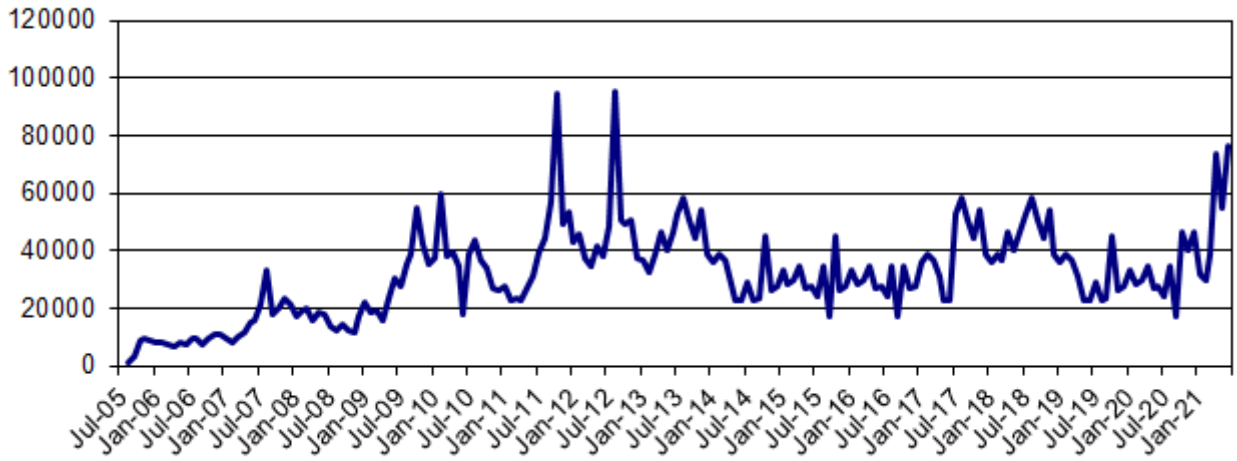


Figure 50: Number of page views on KNMI scatterometer website per month

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

Entity	Shortened name	Country
University of New Hampshire / Ocean Process Analysis Laboratory		USA
Seoul National University		Korea
ETH Zurich		Switzerland
University of Milano-Bicocca		Italy
Ocean University of China		China
Centre for Marine and Environmental Research Universidade do Algarve	CIMA	Portugal
Department of Environment, Forestry and Fisheries		South Africa

Table 54: List of newly registered wind users at KNMI

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.

		Jan. 2021		Feb. 2021		Mar. 2021		Apr. 2021		May 2021		Jun. 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	2027/443	275	2362	247	4217	1254	3030	332	2369/68/ 310	547	3480/96/ 248	218
OSI-202 series	NAR SST	453	1163	462	429	398/1/2	15119	4,098	781	507	1151	729	1059
OSI-204 series	MGR SST	228063/2 12	41470	210313/5 01	36999	273398/4 54	70310	127871/2 21/5	55260	131945/3 8956/5	34171	115738/3 6619/4	31921
OSI-206 series	Meteosat SST	17905	3545	7705	2513	8946	9884	19245	18711	7921	50279	16297	4237
OSI-207 series	GOES-East SST	1853	1	1382/0/2	5	1505	5011	1398	39	3654	26	1166/1	29
OSI-IO-SST	Meteosat-8 SST	29878	1322	59346	1125	29162	5012	19397	1947	19973	924	18251	874
OSI-208 series	IASI SST	32444	7597	29651	5825	36590	31650	26220/1	2412	34050/2/ 2	52	26100/1	60
OSI-250	Meteosat SST Data record	8232	x	8390/1	x	0/1/3	x	0	x	0	x	0	x
OSI-303 series	Meteosat DLI	90578	x	81794	x	99935	x	104734	x	156963/1	x	79940	x
OSI-304 series	Meteosat SSI	90578	x	81794	x	99935	x	104734	x	156963/1	x	79940	x
OSI-305 series	GOES-East DLI	5465	x	3529	x	11924	x	48913	x	68543	x	3139	x
OSI-306 series	GOES-East SSI	5465	x	3529	x	11924	x	48913	x	68543	x	3139	x
OSI-IO-DLI	Meteosat-8 DLI	3423	x	2115	x	2349	x	2183	x	10915	x	1820	x
OSI-IO-SSI	Meteosat-8 SSI	3423	x	2115	x	2349	x	2183	x	10915	x	1820	x

Table 55: Number of OSI SAF products downloaded from Ifremer FTP server and PO.DAAC server over 1st 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		Jan. 2021	Feb. 2021	Mar. 2021	Apr. 2021	May 2021	Jun. 2021
OSI-401 series	Global Sea Ice Concentration (SSMIS)	59365	53056	54264	98032	65444	144285
OSI-402 series	Global Sea Ice Edge	6866	6026	9645	6699	6316	57377
OSI-403 series	Global Sea Ice Type	80303	27339	9800	11889	13142	31345
OSI-404 series	Global Sea Ice Emissivity	140	52	64	124	74	5320
OSI-405 series	Low resolution Sea Ice Drift	10403	19068	17796	29388	36665	8713
OSI-407 series	Medium resolution Sea Ice Drift	2962	114	1199	6587	150	266
OSI-408 series	Global Sea Ice Concentration (AMSR-2)	5354	1891	3140	3604	1944	12187
OSI-409	Ice Concentration Data Record v1.2	38639	1413	2615	1638	343	3397
OSI-430	Ice Concentration ICDR v1.2	2700	611	65	0	0	60
OSI-430-b	Ice Concentration ICDR v2.0	9169	20301	23305	13281	9371	29474
OSI-450	Ice Concentration Data Record v2.0	104399	129194	130347	45807	79392	144733
OSI-203 series	NHL L3 SST/IST	139	114	1036	731	653	541
OSI-205 series	L2 SST/IST	91208	399	30633	68145	2941	1529
OSI-301+OSI-302 series	AHL DLI and SSI	48	28	18864	64	36	33

Table 56: Number of OSI SAF products downloaded from OSI SAF HL FTP server over 1st half 2021

Redistribution by CMEMS and C3S		Jan. 2021		Feb. 2021		Mar. 2021		Apr. 2021		May 2021		Jun. 2021	
		CMEMS	C3S	CMEMS	C3S	CMEMS	C3S	CMEMS	C3S	CMEMS	C3S	CMEMS	C3S
OSI-401 series	Global Sea Ice Concentration (SSMIS)	43209		30488		33681		38985		45690		41198	
OSI-402 series	Global Sea Ice Edge	42486		31168		30099		38494		41044		37124	
OSI-403 series	Global Sea Ice Type	42372		32022		33423		40159		45717		40813	
OSI-405 series	Low resolution Sea Ice Drift	38020		30120		30351		36015		41132		35789	
OSI-409	Ice Concentration Data Record v1.2												
OSI-430	Ice Concentration ICDR v1.2												
OSI-430-b	Ice Concentration ICDR v2.0	216	18296	1218	8500	1717	14307	1401	19120	746	6175	1262	6264
OSI-450	Ice Concentration Data Record v2.0	295	57822	1243	20606	2821	97304	4066	161327	4174	12399	4097	7307

Table 57: Number of OSI SAF products redistributed by CMEMS (downloads/product/day) and C3S (number of files) over 1st 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.

		Jan. 2021		Feb. 2021		Mar. 2021		Apr. 2021		May 2021		Jun. 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 25 km	15 per file (BUFR), 20 per file (NetCDF)	73595	15 per file (BUFR), 20 per file (NetCDF)	71972	15 per file (BUFR), 20 per file (NetCDF)	99927	13 per file (BUFR), 22 per file (NetCDF)	58057	13 per file (BUFR), 22 per file (NetCDF)	59502	13 per file (BUFR), 22 per file (NetCDF)	663136
OSI-102-b	ASCAT-B 25 km	54 per file (BUFR), 18 per file (NetCDF)	74337	54 per file (BUFR), 18 per file (NetCDF)	76596	54 per file (BUFR), 18 per file (NetCDF)	106865	56 per file (BUFR), 18 per file (NetCDF)	54519	56 per file (BUFR), 18 per file (NetCDF)	61117	56 per file (BUFR), 18 per file (NetCDF)	132491
OSI-102-c	ASCAT-C 25 km	18 per file (BUFR), 9 per file (NetCDF)	36302	18 per file (BUFR), 9 per file (NetCDF)	37742	18 per file (BUFR), 9 per file (NetCDF)	49927	18 per file (BUFR), 10 per file (NetCDF)	31687	18 per file (BUFR), 10 per file (NetCDF)	38344	18 per file (BUFR), 10 per file (NetCDF)	64889
OSI-104	ASCAT-A Coastal	44 per file (BUFR), 20 per file (NetCDF)	61184	44 per file (BUFR), 20 per file (NetCDF)	5418	44 per file (BUFR), 20 per file (NetCDF)	34848	43 per file (BUFR), 22 per file (NetCDF)	141905	43 per file (BUFR), 22 per file (NetCDF)	12863	43 per file (BUFR), 22 per file (NetCDF)	46231
OSI-104-b	ASCAT-B Coastal	46 per file (BUFR), 18 per file (NetCDF)	85768	46 per file (BUFR), 18 per file (NetCDF)	5381	46 per file (BUFR), 18 per file (NetCDF)	92940	46 per file (BUFR), 18 per file (NetCDF)	75470	46 per file (BUFR), 18 per file (NetCDF)	12245	46 per file (BUFR), 18 per file (NetCDF)	12173
OSI-104-c	ASCAT-C Coastal	13 per file (BUFR), 9 per file (NetCDF)	9970	13 per file (BUFR), 9 per file (NetCDF)	1455	13 per file (BUFR), 9 per file (NetCDF)	19107	11 per file (BUFR), 10 per file (NetCDF)	1974	11 per file (BUFR), 10 per file (NetCDF)	10459	11 per file (BUFR), 10 per file (NetCDF)	5280
OSI-112-a	ScatSat-1 25 km wind vectors	55 per file (BUFR), 9 per file (NetCDF)	N/A	55 per file (BUFR), 9 per file (NetCDF)	N/A		N/A		N/A		N/A		N/A
OSI-112-b	ScatSat-1 50 km wind vectors	55 per file (BUFR), 9 per file (NetCDF)	N/A	55 per file (BUFR), 9 per file (NetCDF)	N/A		N/A		N/A		N/A		N/A

Table 58: Number of OSI SAF products downloaded from KNMI FTP server and PO.DAAC server over 1st 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 11 January 2021.

Albania	5	Greece	18	Poland	12
Algeria	9	Guinea	2	Portugal	7
Angola	3	Guinea-Bissau	3	Qatar	3
Austria	23	Hong Kong	1	Romania	10
Azerbaijan	3	Hungary	9	Russian Federation	8
Bahrain	1	Iceland	2	Rwanda	6
Belgium	10	India	3	San Marino	1
Benin	4	Iran, Islamic Republic Of	33	Sao Tome And Principe	2
Bosnia And Herzegovina	1	Iraq	2	Saudi Arabia	3
Botswana	6	Ireland	7	Senegal	9
Brazil	6	Isle Of Man	1	Serbia	2
Bulgaria	6	Israel	6	Seychelles	3
Burkina Faso	4	Italy	299	Sierra Leone	2
Burundi	2	Jordan	2	Slovakia	8
Cameroon	6	Kazakhstan	6	Slovenia	1
Canada	1	Kenya	14	Somalia	1
Cape Verde	2	Korea, Republic Of	1	South Africa	17
Central African Republic	2	Kuwait	3	South Sudan	1
Chad	4	Kyrgyzstan	1	Spain	53
China	3	Latvia	1	Sudan	4
Comoros	2	Lebanon	3	Sweden	5
Congo	3	Lesotho	4	Switzerland	17
Congo, the Democratic	5	Liberia	3	Syrian Arab Republic	2
Cote D'Ivoire	6	Libyan Arab Jamahiriya	1	Tajikistan	1
Croatia	2	Lithuania	2	Tanzania, United Republic	6
Cyprus	1	Luxembourg	1	Togo	4
Czech Republic	22	Madagascar	6	Tunisia	4
Denmark	7	Malawi	4	Turkey	8
Djibouti	2	Mali	3	Turkmenistan	1
Egypt	6	Malta	2	Uganda	4
Equatorial Guinea	2	Mauritania	5	Ukraine	3
Eritrea	2	Mauritius	8	United Arab Emirates	5
Estonia	3	Morocco	10	United Kingdom	140
Eswatini	4	Mozambique	5	United States	4
Ethiopia	9	Namibia	6	Uzbekistan	1
Finland	6	Netherlands	29	Viet Nam	1
France	66	Niger	8	Yemen	2
Gabon	3	Nigeria	6	Zambia	4
Gambia	3	North Macedonia	1	Zimbabwe	4
Georgia	1	Norway	4		
Germany	118	Oman	4		
Ghana	10	Pakistan	1		

Table 59: Overall number of EUMETCast users by country on the 11 January 2021.

6.3.2. Users and retrievals from EUMETSAT Data Center

Orders Summary over the 1st 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 **1st half 2021**.

Product id	Item	Volume in MB	Number of files
OSI-410	F-16_OSICOL2_TST	4	2
	F-17_OSICOL2_TST	4	2
	F-18_OSICOL2_TST	4	2
OSI-404	F-18_OSIEMGB_OPE	9098	1448
Houly OSI-305-b/OSI-306-b	GOES-16_OHDLISSI_OPE	77087	8827
OSI-207-b	GOES-16_OSIHSSTN_OPE	916	96
OSI-408	GW-1_OSICOAMSRGB_OPE	15012	2212
OSI-410	GW-1_OSICOL2_TST	9	3
OSI-102-b	M01_OAS025_OPE	31160	18355
OSI-104-b	M01_OASWC12_OPE	662718	49848
OSI-407-a	M01_OMRSIDRN_OPE	6650	3042
OSI-201-b	M01_OSSTGLBN_OPE	945	26
OSI-203-a	M01_OSSTIST3A_OPE	7276	1292
OSI-202-c	M01_OSSTNARN_OPE	2604	120
OSI-102	M02_OAS025_OPE	31160	18355
OSI-104	M02_OASWC12_OPE	705938	52907
OSI-407-a	M02_OMRSIDRN_OPE	6650	156
OSI-201	M02_OSSTGLB_OPE	160	8
OSI-202	M02_OSSTNAR_OPE	340	32
OSI-102-c	M03_OAS025_OPE	18514	5227
OSI-104-c	M03_OASWC12_OPE	328584	11259
OSI-210	MMG_OSSTLML_OPE	1	1
OSI-401-b	MML_OSICOGBN_OPE	714	210
OSI-405	MML_OSIDRGB_OPE	1075	5740
OSI-402-c	MML_OSIEDGBN_OPE	540	64
OSI-403	MML_OSITYGB_OPE	315	4129
OSI-403-c	MML_OSITYGBN_OPE	790	2696
	MMS_OSSTMAP_OPE	2	1
Daily OSI-303/OSI-304	MSG2_ODDLISSI_OPE	46287	84
Hourly OSI-303/OSI-304	MSG2_OHDLISSI_OPE		328

Product id	Item	Volume in MB	Number of files
OSI-206	MSG2_OSIHSST_OPE		8780
OSI-206	MSG2_OSIHSSTN_OPE	12897	28
Daily OSI-303/OSI-304	MSG3_ODDLISSI_OPE	52251	937
Hourly OSI-303/OSI-304	MSG3_OHDLISSI_OPE		1
Daily OSI-304	MSG3_OSIDSSI_OPE	12	1
OSI-206	MSG3_OSIHSSTN_OPE	5472	481
Daily OSI-303-a/OSI-304-a	MSG4_ODDLISSI_OPE	57772	4726
Houly OSI-303-a/OSI-304-a	MSG4_OHDLISSI_OPE	78646	17673
OSI-206-a	MSG4_OSIHSSTN_OPE	24204	1991
Old OSI-202	N17_OSSTMNOR_OPE	2	7
OSI-202-c	N20_OSSTNARN_OPE	1944	114
OSI-112-a	SCATSAT1_OSSW025_OPE	80268	13412
OSI-112-b	SCATSAT1_OSSW050_OPE	2412	402

Table 60: Volume of data downloaded (in MB) by products from EDC over 1st half 2021.

Ingestion Summary over the 1st 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	Jan. 2021	Feb. 2021	Mar. 2021	Apr. 2021	May 2021	Jun. 2021
OSI-404	Global Sea Ice Emissivity (DMSP-F18)	100	92.8	100	100	100	100
OSI-305-b	Daily Downward Longwave Irradiance (GOES-16)	100	100	100	100	100	100
OSI-306-b	Daily Surface Solar Irradiance (GOES-16)						
OSI-305-b	Hourly Downward Longwave Irradiance (GOES-16)	99.3	99.8	99.5	100	99.8	100
OSI-306-b	Hourly Surface Solar Irradiance (GOES-16)						
OSI-207-b	Hourly Sea Surface Temperature (GOES-16)	99.3	100	99.7	99.5	100	100
OSI-408	Sea Ice Concentration (AMSR-2)	100	100	100	100	100	100
OSI-102-b	ASCAT 25km Wind (Metop-B)	99.5	96.6	100	100	100	100
OSI-104-b	ASCAT 12.5km Coastal Wind (Metop-B)	99.5	96.6	100	100	100	100
OSI-102	ASCAT 25km Wind (Metop-A)	100	96.3	100	100	100	99.7
OSI-104	ASCAT 12.5km Coastal Wind (Metop-A)	99.7	96.3	100	100	100	100
OSI-102-c	ASCAT 25 km Wind (Metop-C)	98.8	96.1	100	100	99.7	96.8

Product id.	Product name	Jan. 2021	Feb. 2021	Mar. 2021	Apr. 2021	May 2021	Jun. 2021
OSI-104-c	ASCAT 12.5 km Coastal Wind (Metop-C)	98.8	94.6	100	100	100	96.8
OSI-201-b	Global Sea Surface Temperature (Metop-B)	100	100	100	100	100	100
OSI-202-b	NAR Sea Surface Temperature (Metop-B)	96.7	100	100	100	100	100
OSI-202-c	NAR Sea Surface Temperature (NOAA-20)	0	100	100	100	100	100
OSI-407-a	Sea Ice Drift (Multi Mission)	100	100	100	98.3	100	96.6
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	95.1	100	100
OSI-203-b	SST/IST L3 (NPP)	100	100	100	100	100	100
OSI-401-b	Global Sea Ice Concentration (Multi Mission)	100	96.4	100	100	100	100
OSI-405-c	Global Low Resolution Sea Ice Drift	100	100	100	100	100	96.6
OSI-402-c	Global Sea Ice Edge (Multi Mission)	100	100	100	100	100	100
OSI-403-c	Global Sea Ice Type (Multi Mission)	100	100	100	100	100	100
OSI-301-b	Atlantic High Latitude Downward Longwave Irradiance	100	100	100	100	100	100
OSI-302-b	Atlantic High Latitude Surface Solar Irradiance						
OSI-303-a	Daily Downward Longwave Irradiance (MSG)	100	100	100	100	100	100
OSI-304-a	Daily Surface Solar Irradiance (MSG)						
OSI-303-a	Hourly Downward Longwave Irradiance (MSG)	99.7	99.5	99.8	100	100	100
OSI-304-a	Hourly Surface Solar Irradiance (MSG)						
OSI-206-a	Hourly Sea Surface Temperature (MSG)	99.8	99.8	99.8	99.8	99.8	100
OSI-112-a	ScatSat-1 25 km wind vectors	100	100	0	0	0	0
OSI-112-b	ScatSat-1 50 km Wind vectors	100	100	0	0	0	0

Table 61: Percentage of received OSI SAF products in EDC in 1st half 2021

7. Training

EUMETSAT User Preparation - Scatterometer (SCA) Webinar on 20 and 21 may with contributions from Ad Stoffelen and Steinar Eastwood.

8. Recent publications

Wang, Z., J. Zou, A. Stoffelen, W. Lin, A. Verhoef, X Li, Y. He, Y. Zhang, and M. Lin, Scatterometer Sea Surface Wind Product Validation for HY-2C, IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 2021, doi: 10.1109/JSTARS.2021.3087742.