EUMETSAT OSI SAF
OCEAN AND SEA ICE

Samsung

Half-Yearly Operations Report

2nd half 2020

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1. Introduction

1.1. Scope of the document

The present report covers from 1st of July to 31 December 2020.

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 1.0, 30 May 2017

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-b, OSI-204-b, 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-a, 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-a, OSI-306-a, 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-c, OSI-403-c
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	Jul. 2020	Aug. 2020	Sep. 2020	Oct. 2020	Nov. 2020	Dec. 2020
OSI-102	ASCAT-A 25 km wind	99.7	100	99.9	100	100	100
OSI-102-b	ASCAT-B 25 km wind	99.8	100	100	99.9	100	100
OSI-102-c	ASCAT-C 25 km wind	99.8	99.9	100	99.9	100	100
OSI-104	ASCAT-A Coastal wind	99.2	99.6	99.5	99.6	99.7	99.8
OSI-104-b	ASCAT-B Coastal wind	99,8	99.9	100	99.9	100	100
OSI-104-c	ASCAT-C Coastal wind	99.7	99.8	99.9	100	99.9	99.9
OSI-112-a	ScatSat-1 25 km wind vectors	62.4	73.9	65.9	71.0	84.5	88.1
OSI-112-b	ScatSat-1 50 km wind vectors	62.3	74.1	66.2	70.9	84.7	88.1
OSI-201-b	GBL SST	100	100	100	87.1	100	100
OSI-202-b	NAR SST	100	98.4	100	87.1	100	100
OSI-203-a	NHL SST/IST (L3)	100	100	96.7	100	100	100
OSI-203-b	NHL SST/IST (L3)	100	100	100	100	100	100
OSI-204-b	MGR SST	99.4	98.7	99.8	86.2	99.8	99.0
OSI-205-a	SST/IST (L2)	100	100	100	100	100	99.9
OSI-205-b	SST/IST (L2)	100	100	100	98.6	100	100
OSI-206-a	Meteosat SST	100	98.8	100	89.6	100	100
OSI-207-a	GOES-East SST	99.7	99.1	100	87.0	100	100
OSI-208-b	IASI SST	100	98.8	99.9	87.0	99.8	99.5
OSI-301	AHL DLI	100	100	100	100	100	100
OSI-302	AHL SSI	100	100	100	100	100	100
OSI-303-a	Meteosat DLI - hourly	100	98.5	100	86.7	99.9	99.9
	Meteosat DLI - daily	100	100	100	87.1	100	100
OSI-304-a	Meteosat SSI - hourly	100	98.5	100	86.7	99.9	99.9
	Meteosat SSI - daily	100	100	100	87.1	100	100
OSI-305-a	GOES-East DLI - hourly	99.6	98.5	100	86.4	99.9	100
	GOES-East DLI - daily	96.8	100	100	87.1	100	100
OSI-306-a	GOES-East SSI - hourly	99.6	98.5	100	86.4	99.9	100
	GOES-East SSI - daily	96.8	100	100	87.1	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	100	98.3	99.2	100	100
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	100	100	100	100

Table 1: Percentage of OSI SAF products available on the OSI SAF FTP servers within the specified time over 2nd half 2020.

Comment:
Due to a planned upgrade operation of the OSI SAF LML FTP server from Tuesday 13 to Thursday 15 October 2020, the OSI SAF products (OSI-201/202/204/206/207/208 and OSI-303 to 306 series) have not been available on this server during this period, which has impacted their performance level in October.

2.2. Availability via EUMETCast

Ref.	Product	Jul. 2020	Aug. 2020	Sep. 2020	Oct. 2020	Nov. 2020	Dec. 2020
OSI-102	ASCAT-A 25 km wind	99.7	100	99.9	100	100	100
OSI-102-b	ASCAT-B 25 km wind	99.8	100	100	99.9	100	100
OSI-102-c	ASCAT-C 25 km wind	99.8	99.9	100	99.9	100	100
OSI-104	ASCAT-A Coastal wind	99.2	99.6	99.5	99.6	99.7	99.8
OSI-104-b	ASCAT-B Coastal wind	99,8	99.9	100	99.9	100	100
OSI-104-c	ASCAT-C Coastal wind	99.7	99.8	99.9	100	99.9	99.9
OSI-112-a	ScatSat-1 25 km wind vectors	62.4	73.9	65.9	71.0	84.5	88.1
OSI-112-b	ScatSat-1 50 km wind vectors	62.3	74.1	66.2	70.9	84.7	88.1
OSI-201-b	GBL SST	100	96.8	100	100	100	100
OSI-202-b	NAR SST	100	100	100	99.2	100	100
OSI-203-a	NHL SST/IST (L3)	100	100	95	98.4	100	100
OSI-203-b	NHL SST/IST (L3)	100	100	100	100	100	100
OSI-204-b	MGR SST	99.7	98.6	99.8	99.7	99.8	99.8
OSI-205-a	SST/IST (L2)	99.5	100	100	100	100	100
OSI-205-b	SST/IST (L2)	97.0	98.9	99.5	98.4	98.4	99.1
OSI-206-a	Meteosat SST	99.9	98.4	100	100	100	100
OSI-207-a	GOES-East SST	99.5	98.8	100	99.9	100	100
OSI-208-b	IASI SST	100	98.8	99.9	100	100	100
OSI-301	AHL DLI	100	100	100	100	100	100
OSI-302	AHL SSI	100	100	100	100	100	100
OSI-303-a	Meteosat DLI - hourly	99.7	98.5	99.7	99.7	100	100
	Meteosat DLI - daily	100	100	100	100	100	100
OSI-304-a	Meteosat SSI - hourly	99.7	98.5	99.7	99.7	100	100
	Meteosat SSI - daily	100	100	100	100	100	100
OSI-305-a	GOES-East DLI - hourly	99.5	98.7	99.7	99.7	100	100
	GOES-East DLI - daily	96.8	100	100	100	100	100
OSI-306-a	GOES-East SSI - hourly	99.5	98.7	99.7	99.7	100	100
	GOES-East SSI - daily	96.8	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	100	100	100	100	100
OSI-403-c	Global Sea Ice Type	96.8	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	99.2	100	98.3	99.2	99.2	100
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 2nd half 2020.

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.

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
20-25 August	All LML products	Network issues at Météo-France, impacting the distribution to EUMETSAT and Ifremer, whose cause is attribuable to the internet network provider.	None
13-15 October	All LML products	Unavailability of the products during the planned upgrade of the OSI SAF LML FTP server.	Information to users that the latest OSI SAF products could be retreived from the backup LML FTP server (ftp://eftp2.ifremer.fr) in the same directories and with the same credentials as for eftp1.ifremer.fr.

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

Date	Impacted products or services	Anomaly	Corrective and preventive measures
30 September	OSI-203-a	Product delayed on FTP and EUMETCast. users informed in service message #2127	
3 October	HL FTP server	HL FTP server outage, users informed in service message #2130 and 2131	

3.3. At Wind subsystem (KNMI)

NA

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
September	LML SST products	A new version of the SST validation at LML has been developed and implemented (ASCII files replaced by netCDF, validation is more consistent, robust statistics were added)
13-15 October	OSI SAF LML FTP server	Upgrade of the OSI SAF LML FTP server, the backup server was still available during the operation
19 November	North Atlantic Regional SST OSI-202-b OSI-202-c	The updated product OSI-202-c, including NOAA-20, became operational. The old product OSI-202-b (with NPP) was discontinued.
26 November	Full resolution Metop SST metagranules based on Metop-C OSI-204-c	The product OSI-204-c, based on Metop-C data became operational (distributed only on the LML FTP server). No change on the OSI-204-b, based on Metop-B, still distributed on LML FTP server, EUMETCast and EDC until Metop-C becomes the prime Metop satellite.
11 December	GEO products	New chain to process the new generation of geostationary satellites (GOES and in the future MTG). New products available in parallel for one month.

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

Date	Impacted products or services	Events and modifications, maintenance activities
19 August	OSI-408	From 19 August to 30 October 2020 the AMSR Sea Ice Concentration OSI-408 was of reduced quality due to way the dynamical tie-points were calculated when there is very little ice. This has been updated.
11 September	OSI-402-c	A small change was done to the OSI SAF Sea Ice Edge product (OSI-402-c), as it was necessary to change the auxiliary data. Small positive impact on the product quality. Users were informed in service message #2116.
25 November	OSI-420	Release of sea ice index product OSI-420 as demonstrational product, service message #2160

4.3. At Wind subsystem (KNMI)

NA

4.4. Release of software and new data records & ICDR

The ASCAT Wind Data Processor (AWDP) v3.3 was released on 31 July 2020. This minor release of the ASCAT and ERS scatterometer wind data processor includes backscatter calibration tables for Metop-C ASCAT. AWDP is now also capable to read the new format version 13 ASCAT full resolution level 1b data containing enhanced land contamination information. The GRIB API module which is not maintained anymore by ECMWF is replaced by ecCodes.

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-a, 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 on the Northern Hemisphere. 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. Still, comparison results are presented in this report, but the results must be read with this in mind. Occasionally, some in situ skin temperature data are available, and will be reported here. No in situ data are available for the Southern hemisphere and hence the IST for SH cannot be validated.

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

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

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

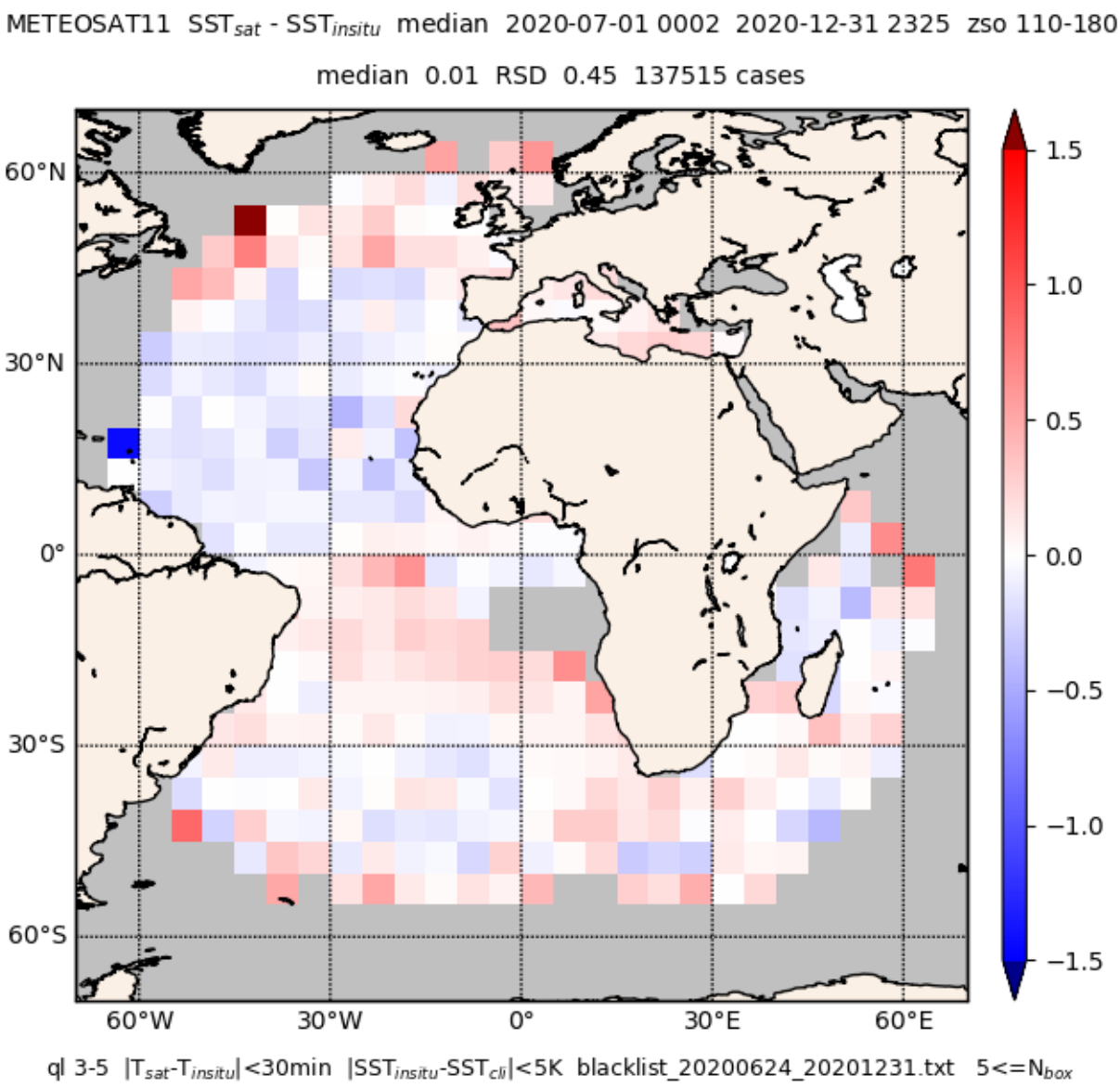


Figure 1: Meteosat night-time SST median difference with respect to buoys measurements for quality level 3,4,5

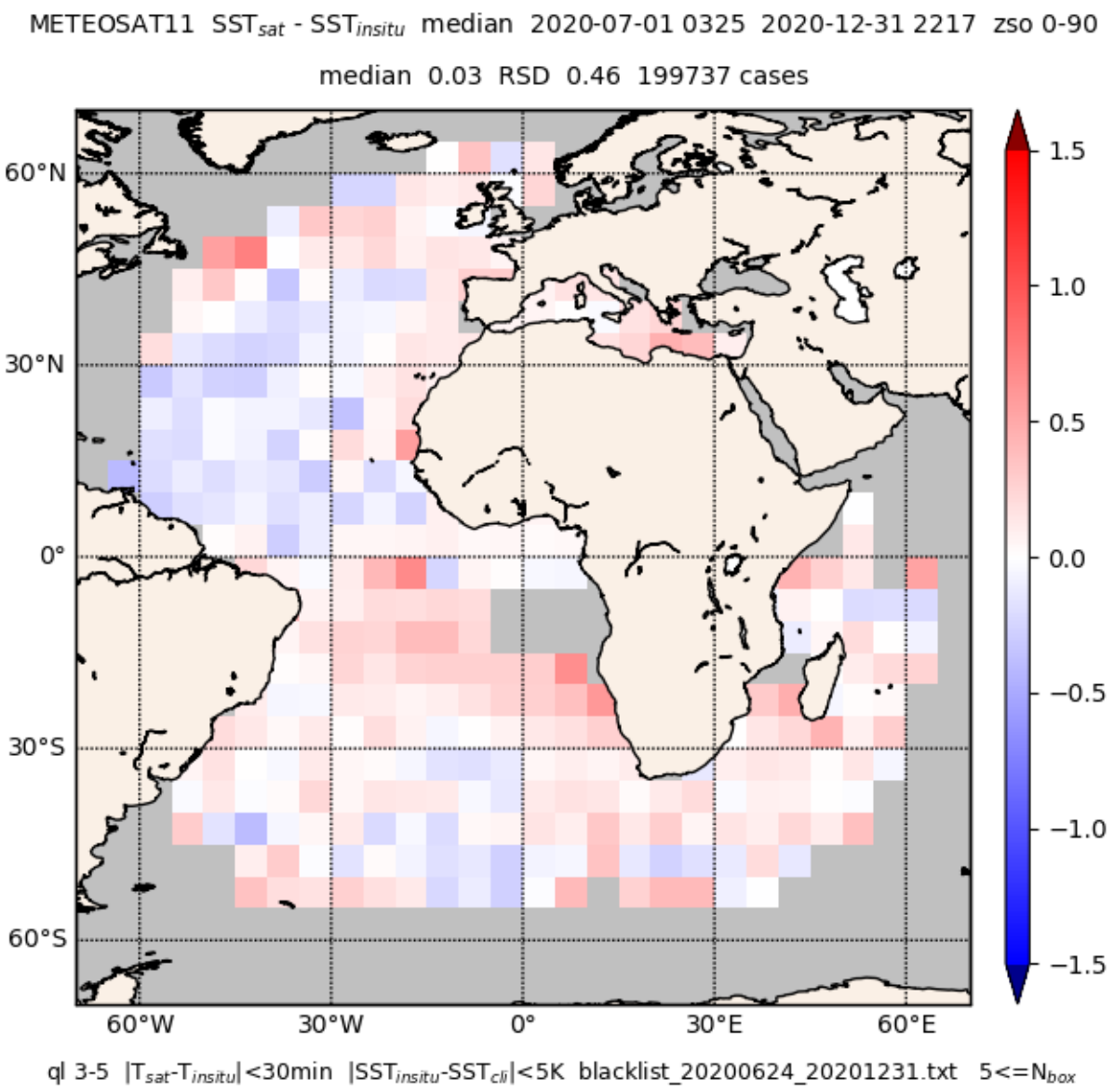


Figure 2: Meteosat day-time SST median difference with respect to buoys measurements for quality level 3,4,5

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

Meteosat night-time SST quality results over 2nd half 2020					
Month	Number of cases	Mean diff. in K (req.: ± 0.5 K)	SD in K (req.: ± 1 K)	Median in K	RSD in K
Jul. 2020	21657	-0.03	0.54	0.03	0.50
Aug. 2020	25942	-0.10	0.55	-0.04	0.49
Sep. 2020	23213	-0.03	0.54	0.02	0.47
Oct. 2020	23029	-0.04	0.51	-0.02	0.45
Nov. 2020	21848	0.00	0.50	0.03	0.42
Dec. 2020	21826	0.00	0.52	0.02	0.44
Meteosat day-time SST quality results over 2nd half 2020					
Jul. 2020	36007	-0.06	0.60	0.02	0.54
Aug. 2020	39495	-0.09	0.63	0.00	0.53
Sep. 2020	32868	-0.01	0.55	0.04	0.45
Oct. 2020	29571	0.00	0.52	0.03	0.44
Nov. 2020	29053	0.05	0.47	0.07	0.39
Dec. 2020	32743	0.02	0.48	0.04	0.40

Table 3: Meteosat SST quality results over 2nd half 2020, for 3, 4, 5 quality indexes.

Comments:
Overall statistics are good and within the requirement.

5.1.2. GOES-East SST (OSI-207-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%GOES-E%20SST_monthly%20map_monthly_Night%20time.

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

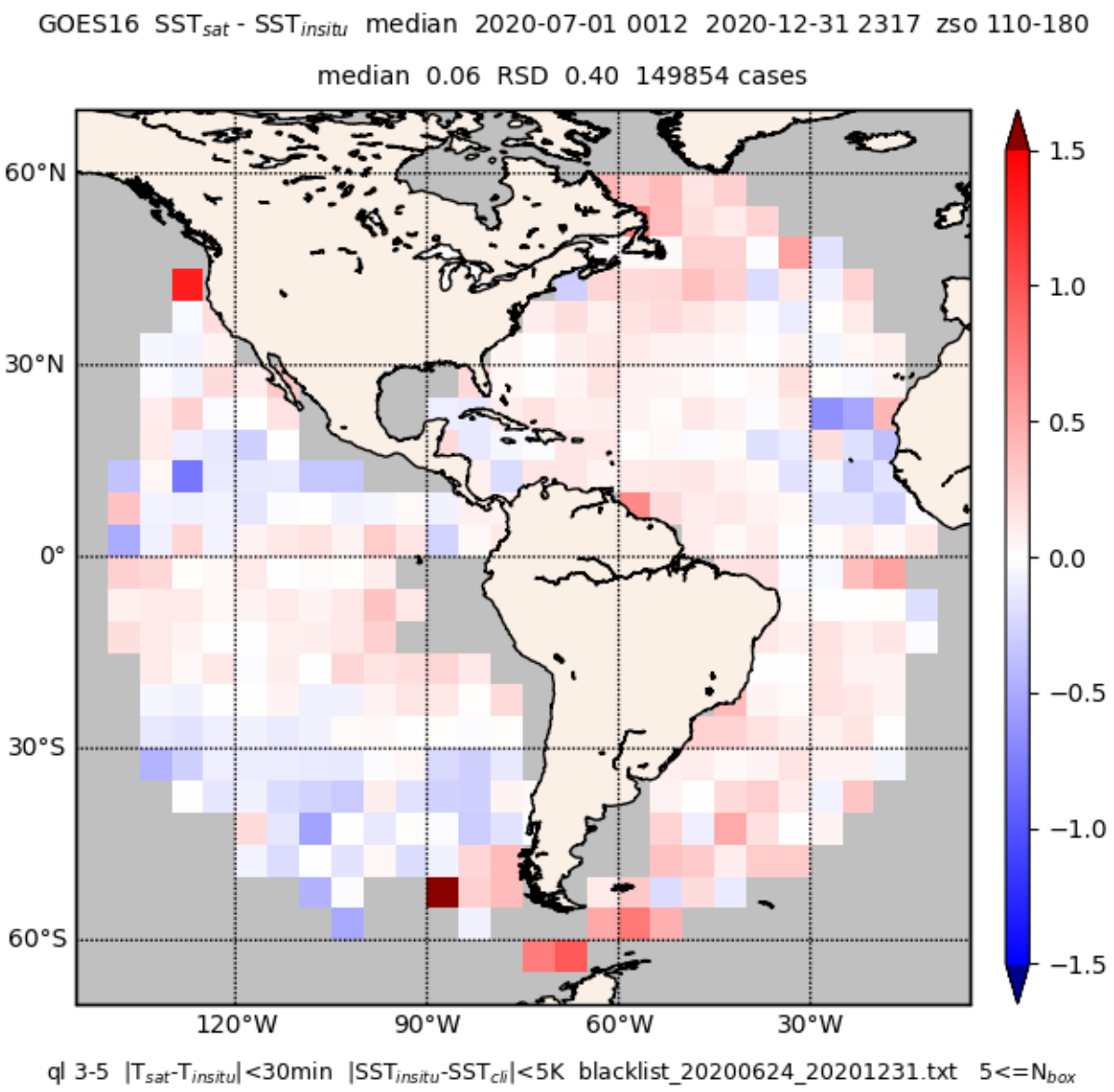


Figure 3: GOES-East night-time SST median difference with respect to buoys measurements for quality level 3,4,5

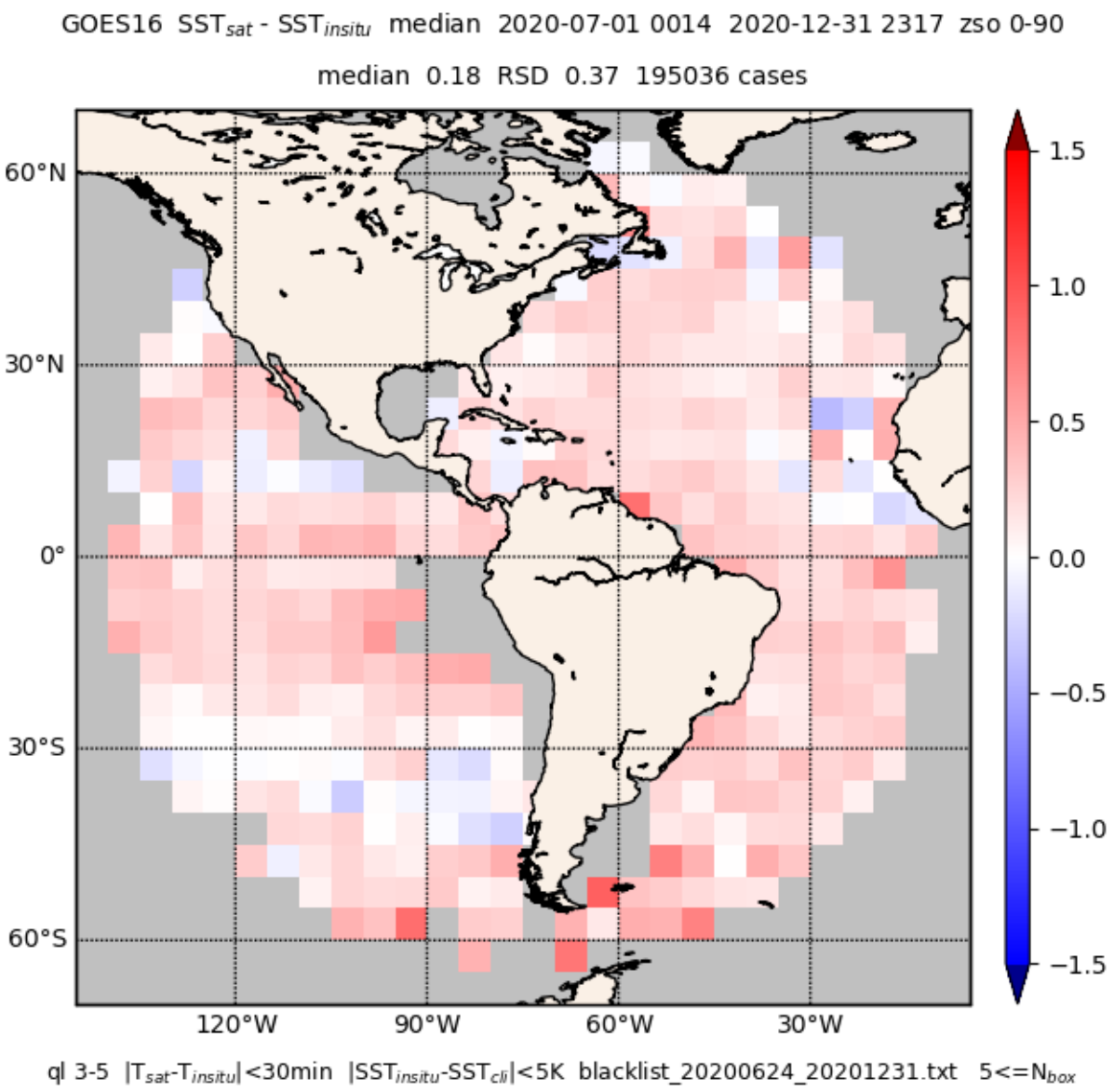


Figure 4: GOES-East day-time SST median difference with respect to buoys measurements for quality level 3,4,5

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

GOES-East night-time SST quality results 2nd half 2020					
Month	Number of cases	Mean diff. in K (req.: ± 0.5 K)	SD in K (req.: ± 1 K)	Median in K	RSD in K
Jul. 2020	19327	-0.04	0.54	0.01	0.43
Aug. 2020	28434	-0.10	0.54	-0.01	0.44
Sep. 2020	27926	0.02	0.55	0.08	0.42
Oct. 2020	27492	0.06	0.52	0.09	0.38
Nov. 2020	22546	0.03	0.46	0.07	0.37
Dec. 2020	24129	0.06	0.48	0.09	0.36
GOES-East day-time SST quality results 2nd half 2020					
Jul. 2020	33959	0.04	0.54	0.10	0.43
Aug. 2020	40262	0.02	0.53	0.11	0.43
Sep. 2020	35881	0.18	0.51	0.23	0.37
Oct. 2020	30421	0.22	0.45	0.23	0.33
Nov. 2020	25541	0.20	0.39	0.22	0.31
Dec. 2020	28972	0.16	0.39	0.19	0.31

Table 4: GOES-East SST quality results over 2nd half 2020, 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.

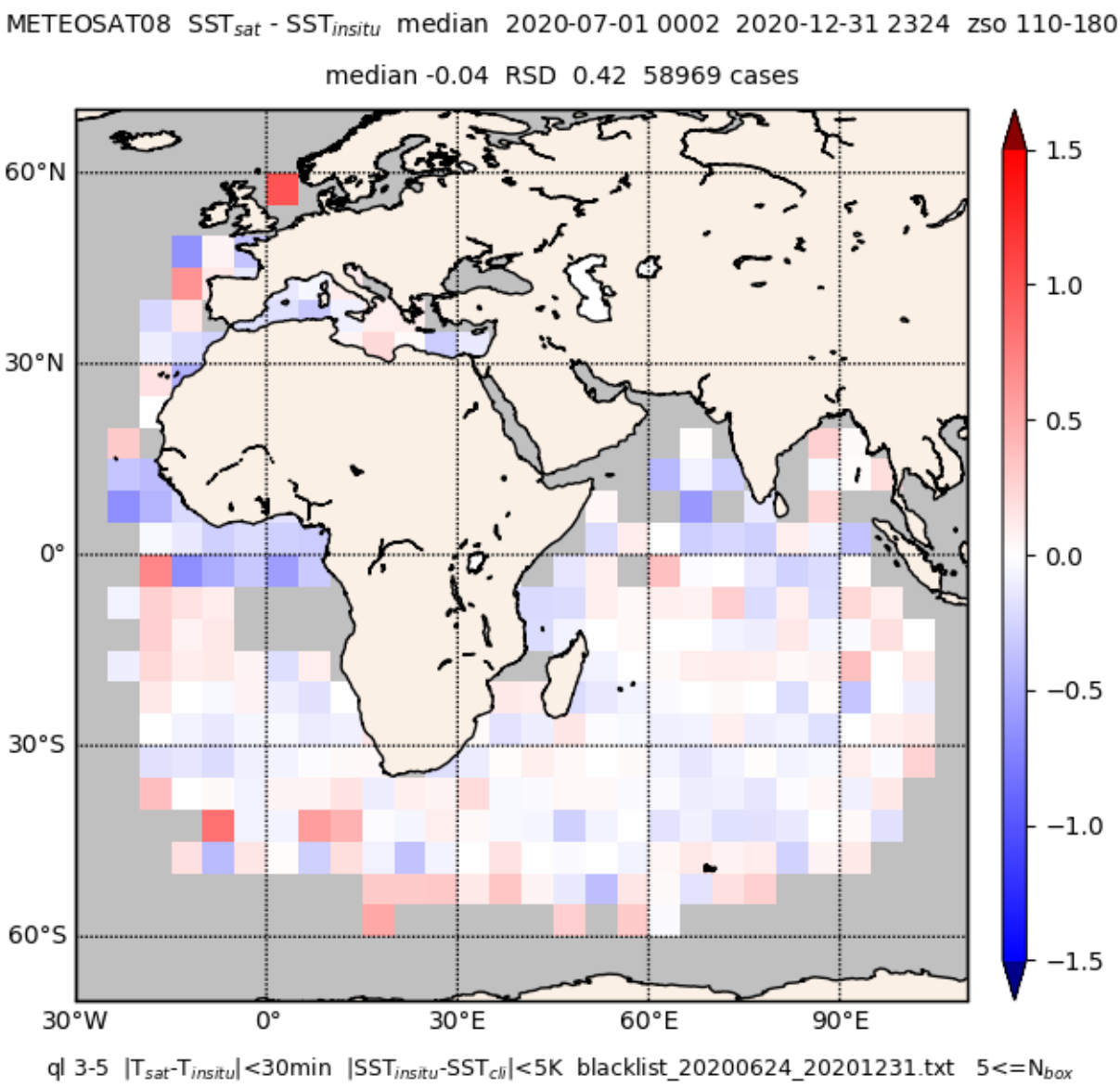


Figure 5: Meteosat Indian Ocean night-time SST median difference with respect to buoys measurements for quality level 3,4,5

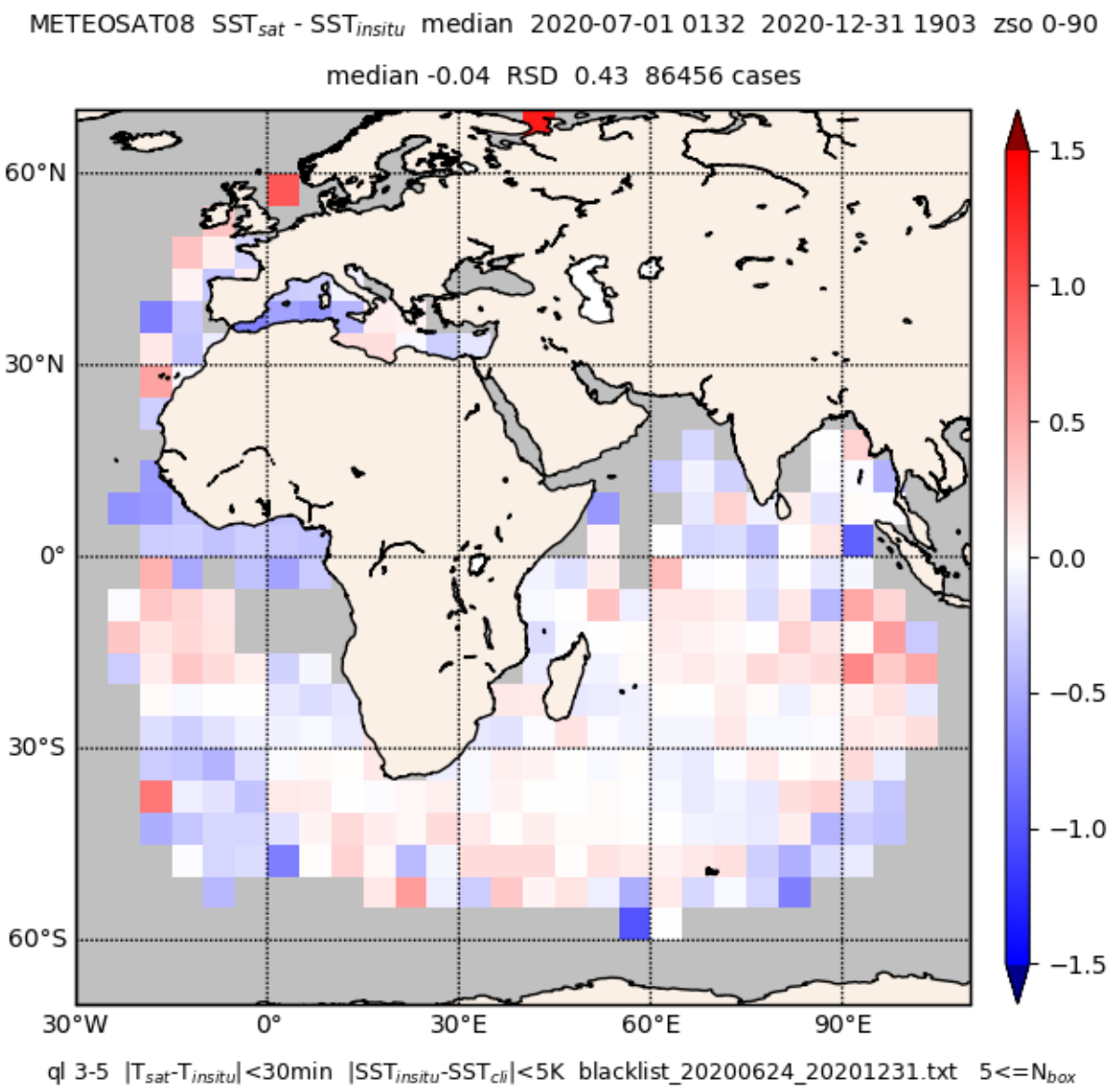


Figure 6: Meteosat Indian Ocean day-time SST median difference with respect to buoys measurements for quality level 3,4,5

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 2nd half 2020					
Month	Number of cases	Mean diff. in K (req.: ± 0.5 K)	SD in K (req.: ± 1 K)	Median in K	RSD in K
Jul. 2020	9846	-0.01	0.52	0.03	0.43
Aug. 2020	11264	-0.02	0.50	0.03	0.39
Sep. 2020	8957	-0.08	0.51	-0.05	0.42
Oct. 2020	10406	-0.13	0.48	-0.11	0.39
Nov. 2020	9671	-0.10	0.50	-0.07	0.42
Dec. 2020	8825	-0.11	0.51	-0.09	0.45
Meteosat Indian Ocean day-time SST quality results over 2nd half 2020					
Jul. 2020	12233	-0.07	0.69	0.01	0.55
Aug. 2020	14210	-0.01	0.61	0.06	0.42
Sep. 2020	12189	-0.05	0.50	-0.04	0.42
Oct. 2020	14616	-0.08	0.45	-0.07	0.38
Nov. 2020	14984	-0.07	0.45	-0.04	0.39
Dec. 2020	18224	-0.16	0.50	-0.14	0.42

Table 5: Meteosat Indian Ocean SST quality results over 2nd half 2020, for 3, 4, 5 quality indexes.

Comments:
Overall statistics are good and within the requirement.

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

The operational NAR SST is processed with AVHRR and VIIRS data, separately. Currently Metop-B and S-NPP 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 S-NPP 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. NPP 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%SNPP%20NAR%20SST_monthly%20map_monthly_Night%20time.

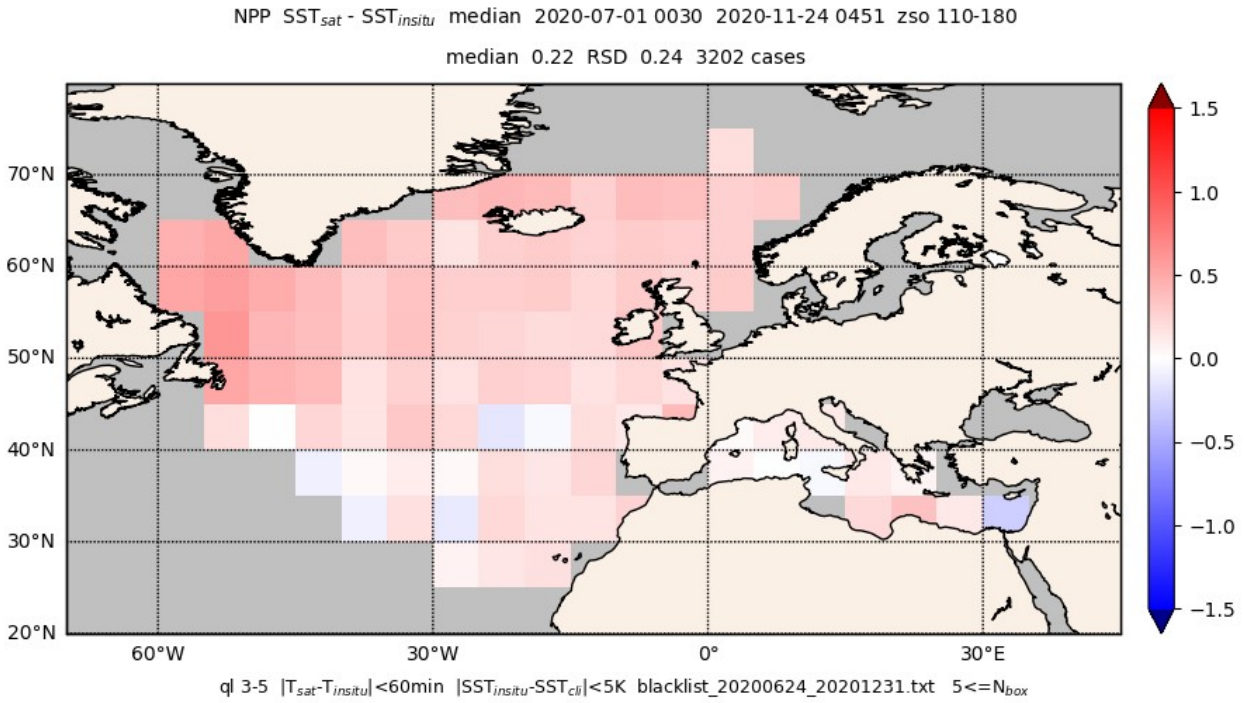


Figure 7: NPP NAR night-time SST median difference with respect to buoys measurements for quality level 3,4,5

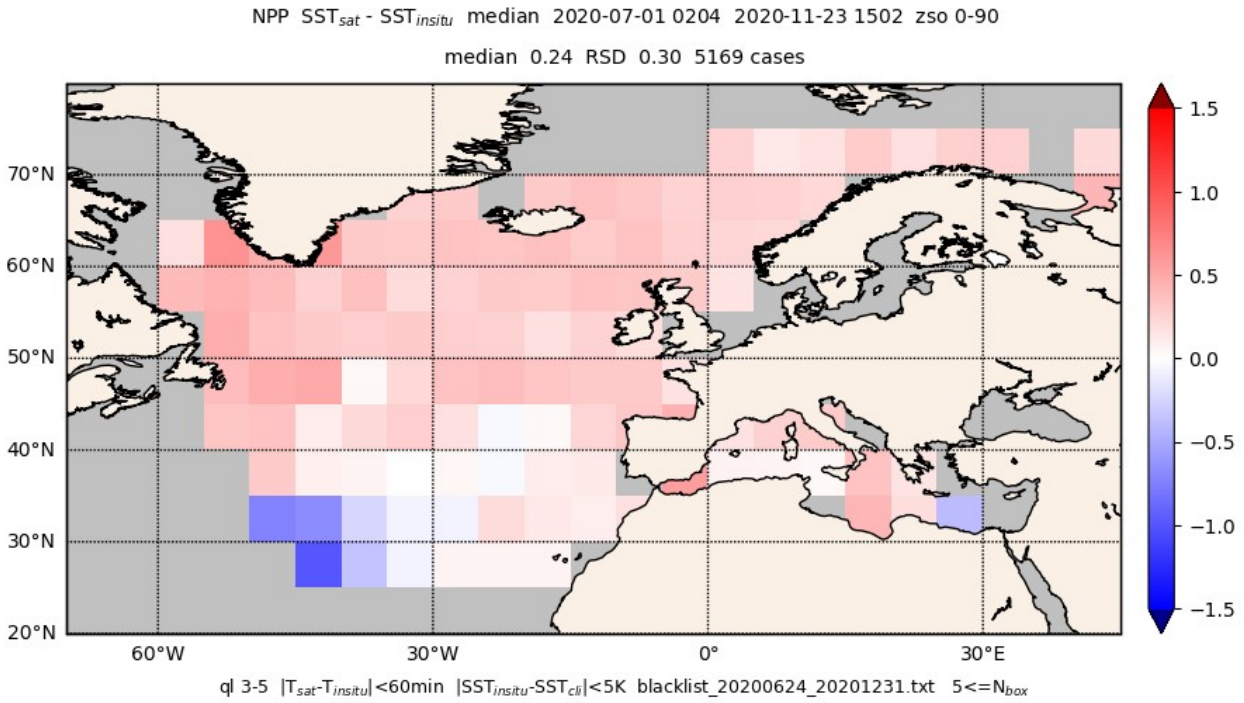


Figure 8: NPP NAR day-time SST median difference with respect to buoys measurements for quality level 3,4,5

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

NPP NAR night-time SST quality results over 2nd half 2020					
Month	Number of cases	Mean diff. in K (req.: ± 0.5 K)	SD in K (req.: ± 0.8 K)	Median in K	RSD in K
Jul. 2020	297	0.09	0.41	0.14	0.32
Aug. 2020	650	0.12	0.35	0.15	0.28
Sep. 2020	768	0.20	0.33	0.21	0.27
Oct. 2020	845	0.27	0.27	0.27	0.22
Nov. 2020	642	0.22	0.23	0.23	0.20
Dec. 2020	---------- Product discontinued on 19/11/2020----------				
NPP NAR day-time SST quality results over 2nd half 2020					
Jul. 2020	1166	0.12	0.49	0.21	0.31
Aug. 2020	1253	0.13	0.53	0.23	0.35
Sep. 2020	1257	0.19	0.44	0.25	0.30
Oct. 2020	899	0.25	0.38	0.29	0.26
Nov. 2020	594	0.25	0.33	0.28	0.25
Dec. 2020	---------- Product discontinued on 19/11/2020----------				

Table 6: Quality results for NPP NAR SST over 2nd half 2020, 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.

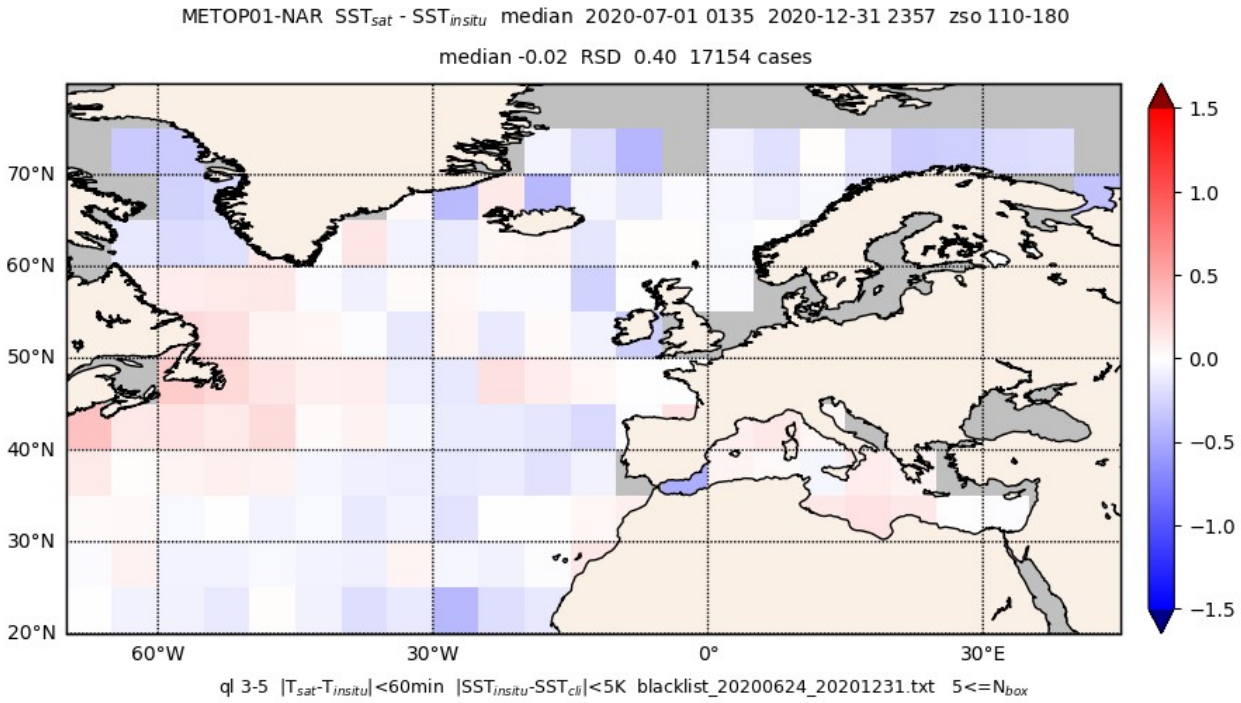


Figure 9: Metop-B NAR night-time SST median difference with respect to buoys measurements for quality level 3,4,5

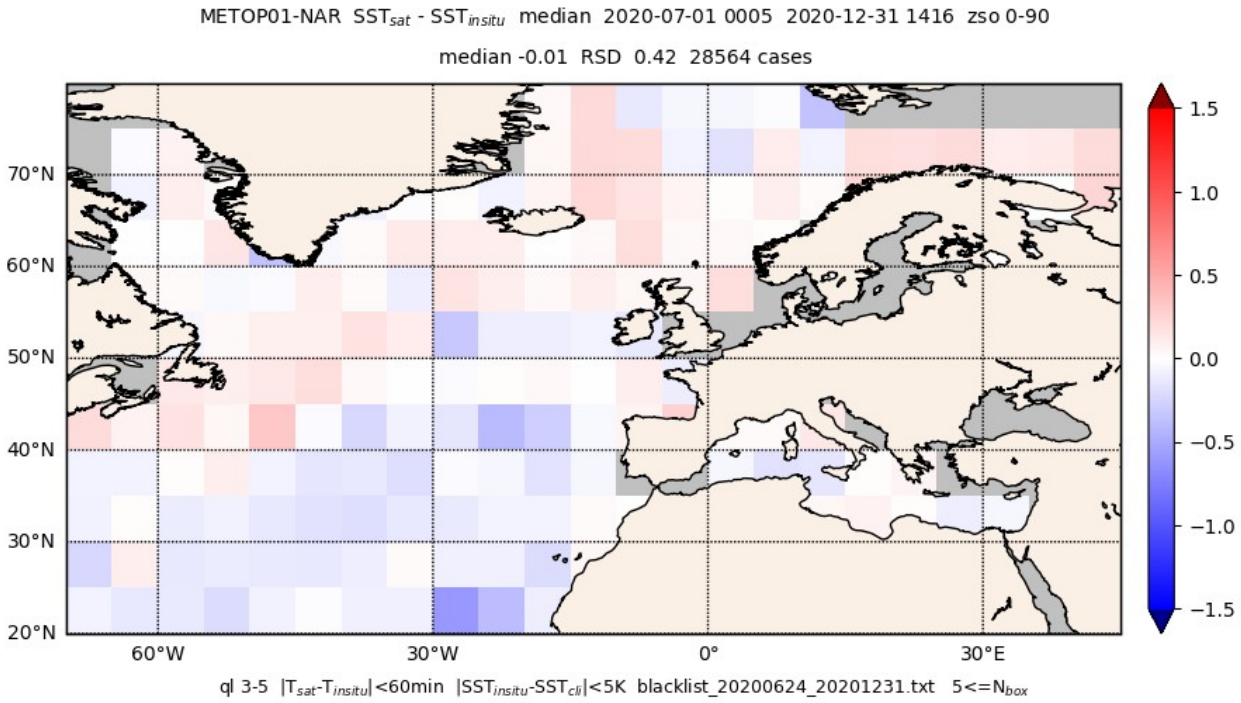


Figure 10: Metop-B NAR day-time SST median difference with respect to buoys measurements for quality level 3,4,5

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

Metop-B NAR night-time SST quality results over 2nd half 2020					
Month	Number of cases	Mean diff. in K (req.: ± 0.5 K)	SD in K (req.: ± 0.8 K)	Median in K	RSD in K
Jul. 2020	1213	-0.28	0.35	-0.23	0.30
Aug. 2020	2429	-0.21	0.53	-0.12	0.39
Sep. 2020	3247	-0.05	0.61	0.01	0.39
Oct. 2020	4114	-0.08	0.55	-0.02	0.41
Nov. 2020	3178	-0.05	0.59	0.05	0.39
Dec. 2020	2973	0.01	0.63	0.06	0.36
Metop-B NAR day-time SST quality results over 2nd half 2020					
Jul. 2020	6225	-0.23	0.61	-0.14	0.39
Aug. 2020	6543	-0.17	0.68	-0.06	0.45
Sep. 2020	5905	0.04	0.54	0.11	0.42
Oct. 2020	4543	0.00	0.46	0.06	0.36
Nov. 2020	2791	0.01	0.44	0.05	0.34
Dec. 2020	2557	0.04	0.51	0.06	0.34

Table 7: Quality results for Metop-B NAR SST over 2nd half 2020, 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.

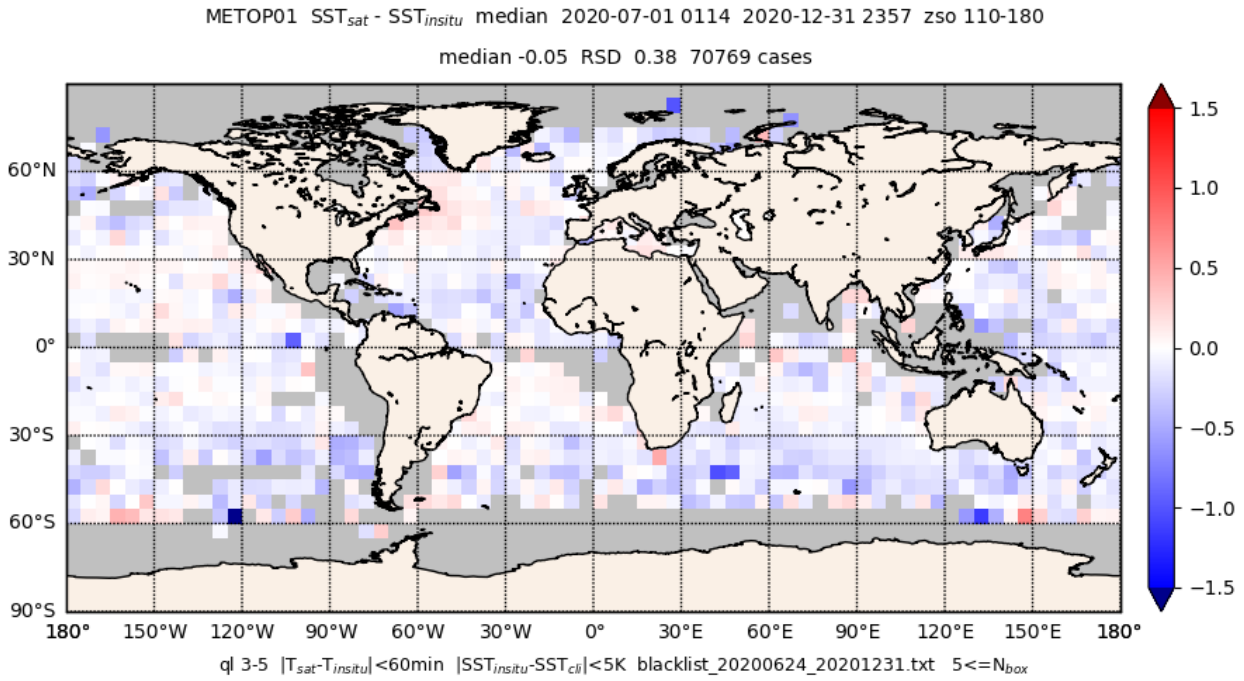


Figure 11: Metop-B night-time SST median difference with respect to buoys measurements for quality level 3,4,5

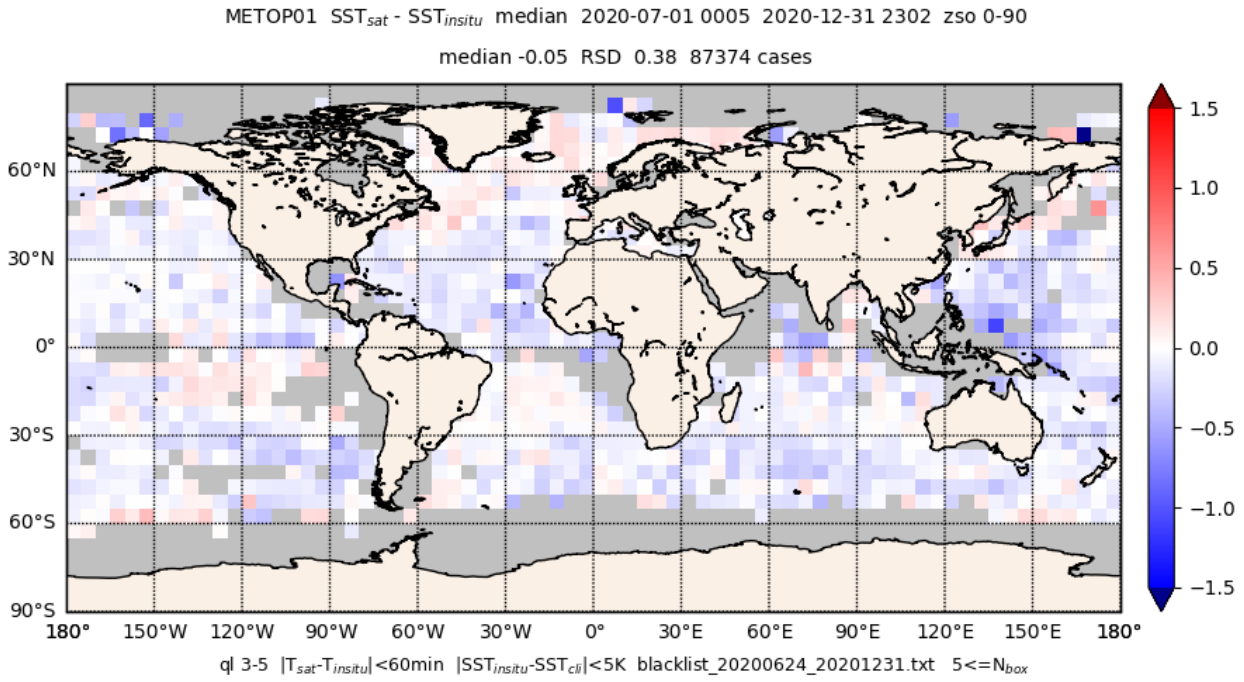


Figure 12: Metop-B day-time SST median difference with respect to buoys measurements for quality level 3,4,5

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

Global Metop-B night-time SST quality results over 2nd half 2020					
Month	Number of cases	Mean diff. in K (req.: ± 0.5 K)	SD in K (req.: ± 0.8 K)	Median in K	RSD in K
Jul. 2020	8926	-0.14	0.46	-0.06	0.35
Aug. 2020	11878	-0.17	0.50	-0.07	0.36
Sep. 2020	13086	-0.12	0.53	-0.04	0.35
Oct. 2020	13539	-0.14	0.55	-0.05	0.39
Nov. 2020	11799	-0.13	0.54	-0.03	0.39
Dec. 2020	11541	-0.10	0.53	-0.03	0.39
Global Metop-B day-time SST quality results over 2nd half 2020					
Jul. 2020	15339	-0.16	0.55	-0.09	0.39
Aug. 2020	17260	-0.15	0.58	-0.07	0.39
Sep. 2020	16643	-0.08	0.50	-0.03	0.39
Oct. 2020	14538	-0.07	0.45	-0.04	0.38
Nov. 2020	11866	-0.07	0.43	-0.03	0.36
Dec. 2020	11728	-0.07	0.45	-0.03	0.36
(*) 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 2nd half 2020, 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.
Buoy data used for the SST validation is from the Copernicus Marine Environment Monitoring Service (In Situ TAC). SIMB3 buoy data from the CRREL-Dartmouth Mass Balance Buoy Program have been used for the IST validation. An IST validation with PROMICE data (IR radiometers) for both air temperatures and calculated surface temperatures has been carried out as well. All available PROMICE data of 2020 has been used (January-September).

The IST accuracy requirements are split into two on the Product Requirement Document: Namely,

for in-situ IR radiometers, and for traditional in situ buoy data. The reason for this 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). Only validation results for OSI-205 vs. traditional buoy data (air temperatures) are subject to the quality assessment requirements. An example of validation results for OSI-205 IST vs in situ IR radiometer data is shown for reference (see Comments).

For the IST only the Northern Hemisphere is validated due to lack of in situ data from the Southern Hemisphere.

The following tables provide the monthly mean quality results over the reporting period and figures show graphs of comparison results for the half-year reporting periods.

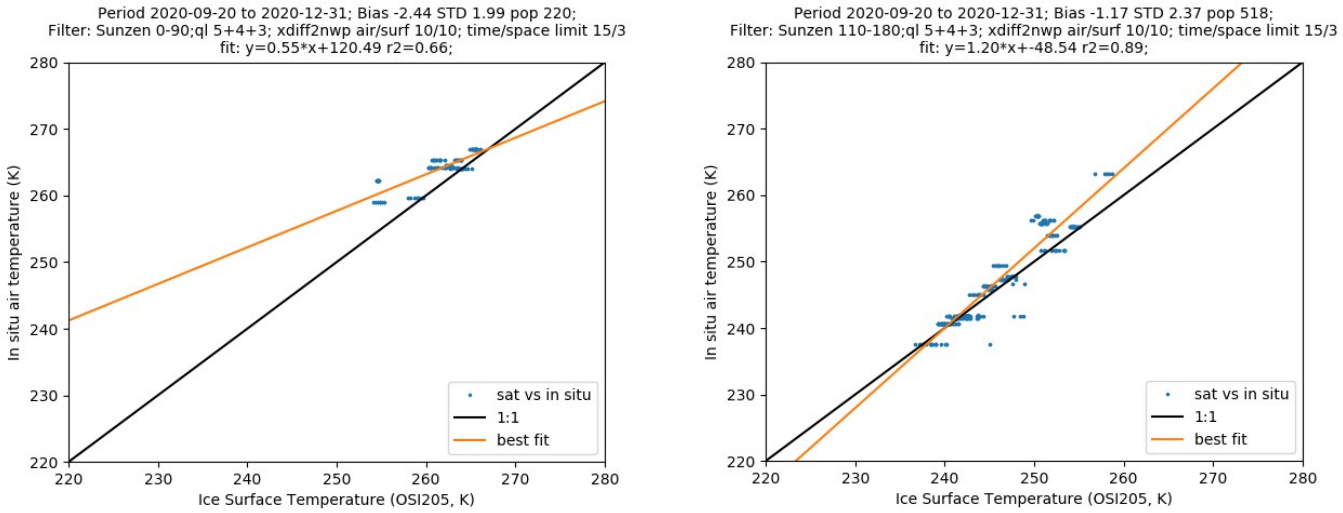


Figure 13: 2nd half 2020 OSI-205-a monthly mean IST mean difference and bias with respect to conventional buoys measurements from the CRREL buoys (air temperature) for NH. Data with quality level 3, 4, 5 are shown. The graph on the left shows day-time data, while the plot on the right only shows night-time observations.

OSI-205-a IST quality results over 2nd half 2020, 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 (**)
Jul. 2020	NA	NA	NA	NA	NA
Aug. 2020	NA	NA	NA	NA	NA
Sep. 2020	NA	NA	NA	NA	NA
Oct. 2020	NA	NA	NA	NA	NA
Nov. 2020	180	-2.11	39.7	3.09	-3.0
Dec. 2020	338	-0.66	81.1	1.67	44.3
OSI-205-a IST quality results over 2nd half 2020, 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 (**)
Jul. 2020	NA	NA	NA	NA	NA
Aug. 2020	NA	NA	NA	NA	NA
Sep. 2020	124	-1.34	61.7	0.79	73.7
Oct. 2020	96	-3.87	-10.6	2.16	28.0
Nov. 2020	NA	NA	NA	NA	NA
Dec. 2020	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 9: Quality results for OSI-205-a Metop AVHRR IST for NH over 2nd half 2020, for quality levels 3, 4 and 5, by night and by day.

Comments:
For the validation against measured air temperature of CRREL buoys the target requirements are mostly satisfied. The two 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.

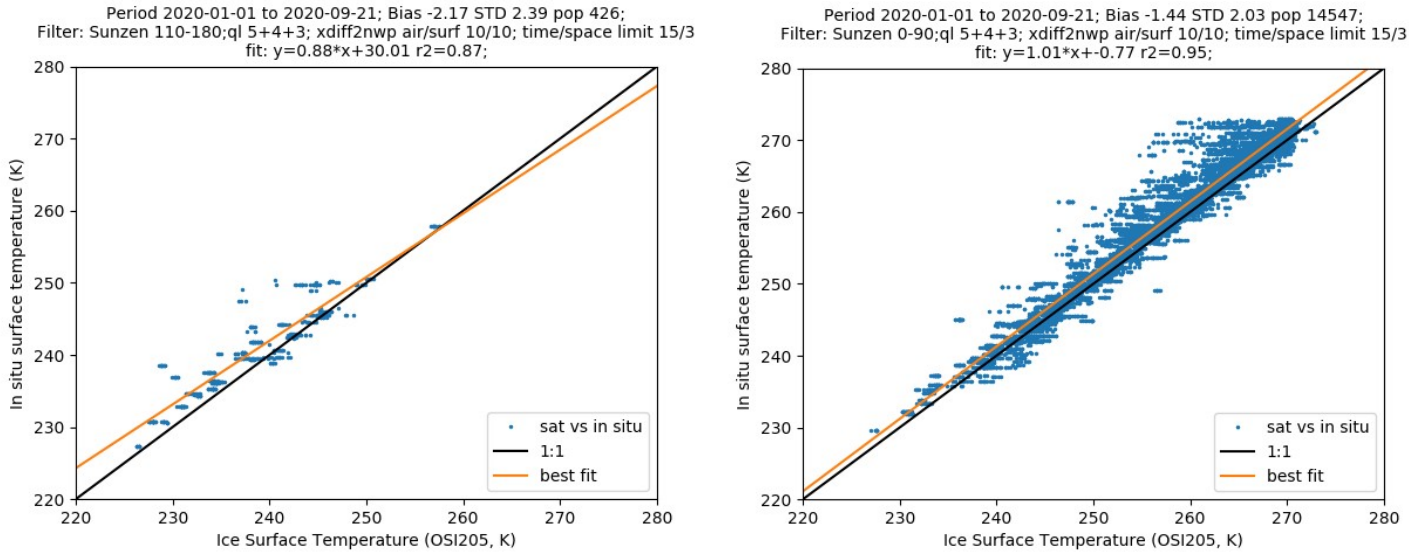


Figure 14: IST PROMICE surf: Jan. 2020 to Sep. 2020 OSI-205 monthly mean NH IST with respect to calculated surface measurements from PROMICE (Greenland). The graph on the left shows night-time data with quality flags 5, 4 & 3, while the plot on the right only shows day-time observations

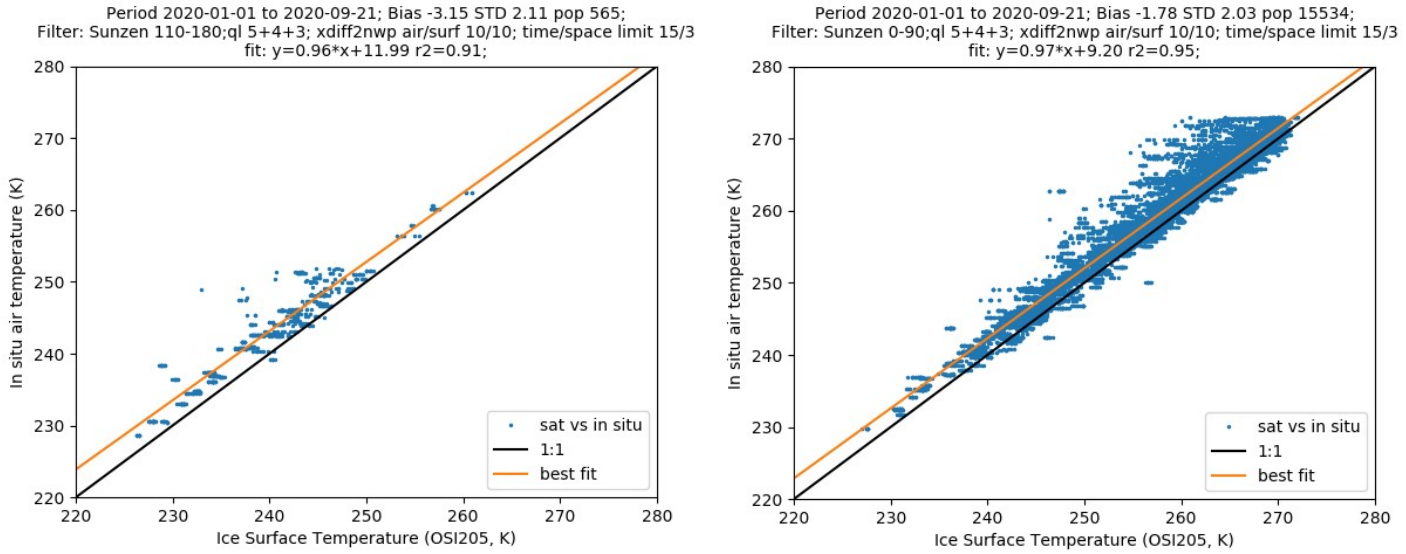


Figure 15: IST PROMICE air: Jan. 2020 to Sep. 2020 OSI-205 monthly mean NH IST with respect to air measurements from PROMICE (Greenland). The graph on the left shows night-time data with quality flags 5, 4 & 3, while the plot on the right only shows day-time observations

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 quality controlled PROMICE data is only available until end of September.
As soon as the new data becomes available, the table below will be updated.
However, there are observations of buoys for the last two months of the reporting period, as shown in the validation results for CRREL buoys previously.

OSI-205-a IST quality results over 1st and 2nd half 2020, night-time, surface temperature, PROMICE					
Month	Number of cases	Mean diff. in K (req.: -1.5 K)	Mean diff. margin (*)	SD in K (req.: 2.0 K)	SD margin (**)
Jan. 2020	293	-2.38	-58.7	2.44	-22.0
Feb. 2020	123	-1.68	-12.0	2.20	-10.0
Mar 2020	10	-2.13	-42.0	1.95	2.5
Apr. 2020	NA	NA	NA	NA	NA
May 2020	NA	NA	NA	NA	NA
Jun.2020	NA	NA	NA	NA	NA
Jul. 2020	NA	NA	NA	NA	NA
Aug. 2020	NA	NA	NA	NA	NA
Sep. 2020	NA	NA	NA	NA	NA
Oct. 2020	NA	NA	NA	NA	NA
Nov. 2020	NA	NA	NA	NA	NA
Dec. 2020	NA	NA	NA	NA	NA
OSI-205-a IST quality results over 1st and 2nd half 2020, day-time, surface temperature, PROMICE					
Month	Number of cases	Mean diff. in K (req.: -1.5 K)	Mean diff. margin (*)	SD in K (req.: 2.0 K)	SD margin (**)
Jan. 2020	104	-3.18	-112.0	2.43	-21.5
Feb. 2020	396	-0.27	82.0	1.89	5.5
Mar 2020	464	-0.21	86.0	1.73	13.5
Apr. 2020	2368	-1.32	12.0	1.77	11.5
May 2020	3456	-1.46	2.7	1.94	3.0
Jun.2020	1809	-2.08	-38.7	2.47	-23.5
Jul. 2020	1348	-1.75	-16.7	2.07	-3.5
Aug. 2020	2610	-1.37	8.7	2.11	-5.5
Sep. 2020	1992	-1.23	18.0	1.63	18.5
Oct. 2020	NA	NA	NA	NA	NA
Nov. 2020	NA	NA	NA	NA	NA
Dec. 2020	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 targeted. without margin. A negative result indicates that the product quality does not fulfil the target requirement. (***)					

Table 10: Quality results for OSI-205-a Metop AVHRR NH IST over January to December 2020, for quality levels 3, 4 and 5, by night and by day. Compared to PROMICE (Greenland) calculated surface temperature

Comments:
All validation results against the surface temperature satisfy the threshold requirements(2.5K mean diff & 3 K SD), except for the mean difference in January, day-time, which is most likely due to the few observations in this month.
The target requirements (1.5K mean diff & 2 K SD) are mostly satisfied as well during day-time.

OSI-205-a IST quality results over 1st and 2nd half 2020, night-time, air temperature, PROMICE					
Month	Number of cases	Mean diff. in K (req.: -1.5 K)	Mean diff. margin (*)	SD in K (req.: 2.0 K)	SD margin (**)
Jan. 2020	382	-3.23	-115.3	2.28	-14.0
Feb. 2020	156	-2.96	-97.3	1.70	15.0
Mar 2020	23	-3.34	-122.7	1.71	14.5
Apr. 2020	NA	NA	NA	NA	NA
May 2020	NA	NA	NA	NA	NA
Jun.2020	NA	NA	NA	NA	NA
Jul. 2020	NA	NA	NA	NA	NA
Aug. 2020	NA	NA	NA	NA	NA
Sep. 2020	4	-1.85	-23.3	0.3	85.0
Oct. 2020	NA	NA	NA	NA	NA
Nov. 2020	NA	NA	NA	NA	NA
Dec. 2020	NA	NA	NA	NA	NA
OSI-205-a IST quality results over 1st and 2nd half 2020, 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. 2020	140	-3.23	-115.3	1.82	9.0
Feb. 2020	520	-2.03	-35.3	1.60	20.0
Mar 2020	585	-1.70	-13.3	1.69	15.5
Apr. 2020	2494	-2.22	-48.0	1.78	11.0
May 2020	3506	-1.32	12.0	1.84	8.0
Jun.2020	1843	-1.79	-19.3	2.40	-20.0
Jul. 2020	1328	-1.53	-2.0	2.31	-15.5
Aug.2020	2668	-1.70	-13.3	2.21	-10.5
Sep. 2020	2450	-2.07	-38.0	1.82	9.0
Oct. 2020	NA	NA	NA	NA	NA
Nov. 2020	NA	NA	NA	NA	NA
Dec. 2020	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 targeted. without margin.					
A negative result indicates that the product quality does not fulfil the target requirement.(***)					

Table 11: Quality results for OSI-205-a Metop AVHRR NH IST over January to December 2020, for quality levels 3, 4 and 5, by night and by day. Compared to PROMICE (Greenland) measured air temperature

Comments:
The validation against the measured air temperature performed not as good as the one against the calculated surface temperature, as was expected.
Still the threshold requirements (2.5K mean diff & 3 K SD) are mostly satisfied during day-time, except for a few observations.
It should be noted that there only was a low number of measurements during night-time for this reported period.

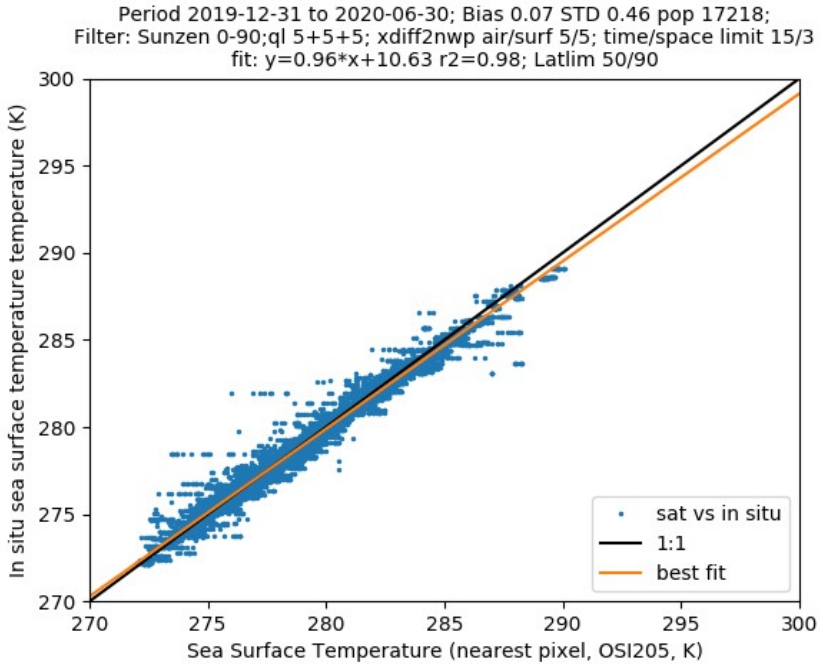


Figure 16: Jan. 2020 to Jun. 2020 OSI-205 SST mean difference and bias with respect to conventional buoys measurements from the Copernicus In Situ DB. Only daytime data with quality level 5 for the Northern Hemisphere are shown

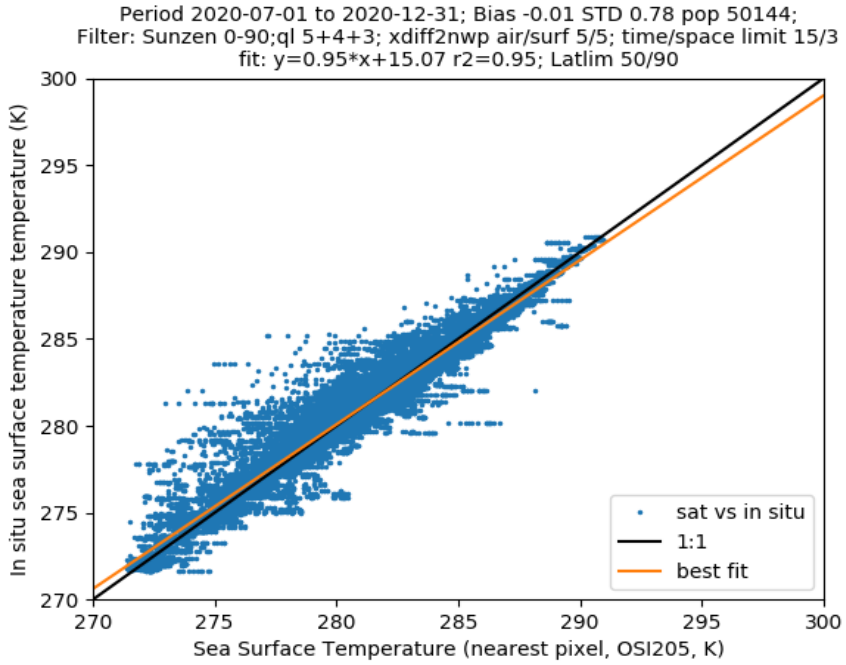


Figure 17: 2nd half 2020 OSI-205-a SST mean difference and bias with respect to conventional buoys measurements from the Copernicus In Situ DB. Only daytime data for the Northern Hemisphere are shown

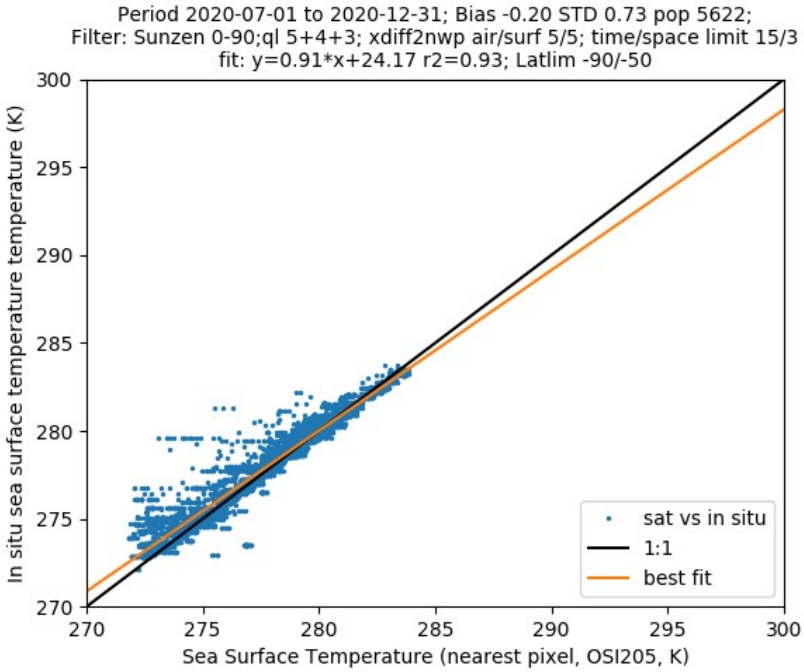


Figure 18: 2nd half 2020 OSI-205-a SST mean difference and bias with respect to conventional buoys measurements from the Copernicus In Situ DB. Only daytime data for the Southern Hemisphere are shown

The Level 2 Sea Surface Temperature (SST, OSI-205-a) is derived from polar satellites data, currently AVHRR on board Metop-B.

In the next report the OSI-205-a SST mean difference and bias for Southern Hemisphere will also be displayed for a full year as for the Northern Hemisphere.

The following tables provides the OSI-205-a SST quality results over the reporting period.

OSI-205-a AVHRR SST quality results over Jan. to Dec. 2020, night-time, NH					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
Jan. 2020	1705	-0.24	65.7	0.49	51.0
Feb. 2020	645	-0.33	52.9	0.63	37.0
Mar. 2020	384	-0.33	52.9	0.34	66.0
Apr. 2020	NA	NA	NA	NA	NA
May 2020	NA	NA	NA	NA	NA
Jun. 2020	NA	NA	NA	NA	NA
1st half 2020	*2734*	*-0.27*	*61.4*	*0.51*	*49.0*
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*
OSI-205-a AVHRR SST quality results over Jan. to Dec. 2020, day-time, NH					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
Jan. 2020	182	-0.08	88.6	0.37	63.0
Feb. 2020	364	-0.23	67.1	0.30	70.0
Mar. 2020	1449	-0.08	88.6	0.30	70.0
Apr. 2020	3591	0.06	91.4	0.33	67.0
May 2020	5428	0.05	92.9	0.49	51.0
Jun. 2020	6204	0.15	78.6	0.51	49.0
1st half 2020	*17218*	*0.07*	*90.0*	*0.46*	*54.0*
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*
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|))					
(**) SD margin = 100 * (1 - (SD / SD req.))					
100 refers then to a perfect product, 0 to a quality just as required. without margin.					
A negative result indicates that the product quality does not fulfil the requirement.					

Table 12: Quality results for OSI-205-a AVHRR SST, for the Northern Hemisphere, over Jan. to Dec. 2020, by night and by day. For the first half of 2020 only quality level 5 data was used, while for the second half-year quality levels 5, 4 and 3 were used for the validation

Comments:
A visual inspection of extreme outliers has been carried out for the reporting period.
For the validation period of 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 for Northern Hemisphere SST 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.

For the previous validation period 13 buoys were disqualified from the validation data, since they are supposedly grounded at coast lines:

- GL_TS_DB_2101624 at the coast of Kamchatka Peninsula, at the Sea of Okhotsk.
- GL_TS_DB_2601625 at the coast of Spitzbergen.
- GL_TS_DB_4401568 at the west coast of Norway.
- GL_TS_DB_4402553 at the south-west coast of Greenland.
- GL_TS_DB_4402557 at the south-west coast of Greenland.
- GL_TS_DB_4402590 at the south-west coast of Greenland.
- GL_TS_DB_4601685 at the coast of Canada, at the Pacific Ocean.
- GL_TS_DB_4801674 at the north coast of Alaska, at the Beaufort Sea.
- GL_TS_DB_4801675 at the north coast of Alaska, at the Beaufort Sea.
- GL_TS_DB_6202680 at the west coast of Norway.
- GL_TS_DB_6301682 at the north coast of Norway.
- GL_TS_DB_6401570 at the north coast of Norway.

- GL_TS_DB_6501538 at the south-west coast of Greenland.

Validation values for the first half year of 2020 for Northern Hemisphere SST are fully satisfactory and fulfil the requirements on mean error and standard deviation error.

OSI-205-a AVHRR SST quality results over Jul. to Dec. 2020, 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*
OSI-205-a AVHRR SST quality results over Jul. to Dec. 2020, 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*
(*) 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-a AVHRR SST, for Southern Hemisphere, over Jul. to Dec. 2020, for quality level 3,4 and 5, by night and by day

Comments:

Validation values for the second half year of 2020 for Southern Hemisphere SST 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.

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 burried in snow and hence measure temperatures different to the surface skin temperature.

OSI-205-b NHL VIIRS SST quality results over Jan. to Dec. 2020, night-time					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
Jan. 2020	1927	-0.393	43.9	0.877	12.3
Feb. 2020	1105	-0.435	37.9	0.905	9.5
Mar. 2020	1840	-0.281	59.8	0.798	20.2
Apr. 2020	2021	-0.165	76.4	0.751	24.9
May 2020	654	-0.402	42.6	0.908	9.2
Jun. 2020	321	-0.206	70.5	1.043	-4.3
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
OSI-205-b NHL VIIRS SST quality results over Jan. to Dec. 2020, day-time					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
Jan. 2020	612	-0.575	17.9	0.739	26.1
Feb. 2020	982	-0.557	20.5	0.738	26.2
Mar. 2020	2280	-0.368	47.5	0.671	32.9
Apr. 2020	3257	-0.144	79.5	0.579	42.1
May 2020	3237	-0.174	75.1	0.680	32.0
Jun. 2020	3034	-0.128	81.7	0.775	22.5
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
(*) 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 SST, over Northern Atlantic and Arctic Ocean, over Jan. to Dec. 2020, for 3,4,5 quality indexes, by night and by day. Comparison with drifting buoys.

OSI-205-b NHL VIIRS IST quality results over Jan. to Dec. 2020, night-time					
Month	Number of cases	Mean diff. in K (req.: ± 3.5 K)	Mean diff. margin (*)	SD in K (req.: ± 3.0 K)	SD margin (**)
Jan. 2020	424	0.45	87.2	4.85	-61.8
Feb. 2020	330	-0.23	93.5	5.33	-77.7
Mar. 2020	84	2.26	35.4	4.56	-52.1
Apr. 2020	0	-	-	-	-
May 2020	0	-	-	-	-
Jun. 2020	0	-	-	-	-
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
OSI-205-b NHL VIIRS IST quality results over Jan. to Dec. 2020, day-time					
Month	Number of cases	Mean diff. in K (req.: ± 3.5 K)	Mean diff. margin (*)	SD in K (req.: ± 3.0 K)	SD margin (**)
Jan. 2020	0	-	-	-	-
Feb. 2020	3	-	-	-	-
Mar. 2020	40	4.208	-20.2	6.132	-104.4
Apr. 2020	291	-4.929	-40.8	3.276	-9.2
May 2020	107	-3.153	9.9	3.521	-17.4
Jun. 2020	1	-	-	-	-
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	-	-	-	-
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|)) (**) SD margin = 100 * (1 - (SD / SD req.)) 100 refers then to a perfect product, 0 to a quality just as required. without margin. A negative result indicates that the product quality does not fulfil the requirement.					

Table 15: Quality results for OSI-205-b NHL VIIRS IST, over Northern Atlantic and Arctic Ocean, over Jan. to Dec. 2020, for 3,4,5 quality indexes, by night and by day. Comparison with air temperature from buoys.

Comments:
The validation results for OSI-205-b SST are all within target accuracy reguirement, both day and night, for the period covered by this HYR.
For IST the results are within requirement for bias except in December at nighttime. For standard deviation it is inside target for September at night, inside threshold in September at day and December at night, but outside threshold in October and November.

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 Jan. to Dec. 2020, night-time					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
Jan. 2020	1578	-0.752	-7.5	0.722	27.7
Feb. 2020	970	-0.764	-9.2	0.706	29.3
Mar. 2020	1146	-0.744	-6.3	0.602	39.7
Apr. 2020	1750	-0.447	36.1	0.675	32.4
May 2020	404	-0.376	46.2	0.957	4.2
Jun. 2020	150	-0.069	90.0	1.007	-0.7
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
OSI-203-a NHL AVHRR SST quality results over Jan. to Dec. 2020, day-time					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
Jan. 2020	779	-0.402	42.5	0.598	40.1
Feb. 2020	1441	-0.535	23.5	0.572	42.7
Mar. 2020	3272	-0.414	40.8	0.589	41.0
Apr. 2020	3818	-0.229	67.1	0.581	41.8
May 2020	2973	-0.095	86.3	0.580	41.9
Jun. 2020	3445	-0.043	93.8	0.705	29.4
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
(*) 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 SST over Northern Atlantic and Arctic Ocean for Jan. to Dec. 2020, for 3,4,5 quality indexes, by night and by day. Comparison with drifting buoys.

OSI-203-a NHL AVHRR IST quality results over Jan. to Dec. 2020, night-time					
Month	Number of cases	Mean diff. in K (req.: ± 3.5 K)	Mean diff. margin (*)	SD in K (req.: ± 3.0 K)	SD margin (**)
Jan. 2020	296	0.258	92.6	5.473	-82.4
Feb. 2020	201	-2.000	42.9	4.739	-58.0
Mar. 2020	40	2.089	40.3	5.584	-86.1
Apr. 2020	0	-	-	-	-
May 2020	0	-	-	-	-
Jun. 2020	0	-	-	-	-
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
OSI-203-a NHL AVHRR IST quality results over Jan. to Dec. 2020, day-time					
Month	Number of cases	Mean diff. in K (req.: ± 3.5 K)	Mean diff. margin (*)	SD in K (req.: ± 3.0 K)	SD margin (**)
Jan. 2020	0	-	-	-	-
Feb. 2020	9	-	-	-	-
Mar. 2020	32	2.231	36.2	5.684	-89.5
Apr. 2020	122	-4.960	-41.7	3.143	-4.8
May 2020	60	-3.114	11.0	3.854	-28.5
Jun. 2020	0	-	-	-	-
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	-	-	-	-
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|))					
(**) SD margin = 100 * (1 - (SD / SD req.))					
100 refers then to a perfect product, 0 to a quality just as required. without margin.					
A negative result indicates that the product quality does not fulfil the requirement.					

Table 17: Quality results for OSI-203-a NHL AVHRR IST over Northern Atlantic and Arctic Ocean for Jan. to Dec. 2020, for 3,4,5 quality indexes, by night and by day. Comparison with air temperature from buoys.

Comments:
The validation results for the period covered by this HYR for OSI-203-a SST are all within target accuracy requirement, both day and night, except night-time standard deviation in July.
For IST the results are within requirement for bias except in December at night-time. For standard deviation it is outside target accuracy for all months.

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 Jan. to Dec. 2020, night-time					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
Jan. 2020	3365	-0.373	46.7	0.806	19.4
Feb. 2020	2390	-0.395	43.6	0.784	21.6
Mar. 2020	3710	-0.291	58.4	0.733	26.7
Apr. 2020	3023	-0.297	57.6	0.820	18.0
May 2020	1356	-0.593	15.3	0.916	8.4
Jun. 2020	809	-0.372	46.9	1.111	-11.1
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
OSI-203-b NHL VIIRS SST quality results over Jan. to Dec. 2020, day-time					
Month	Number of cases	Mean diff. in K (req.: ± 0.7 K)	Mean diff. margin (*)	SD in K (req.: ± 1.0 K)	SD margin (**)
Jan. 2020	1882	-0.807	-15.2	0.752	24.8
Feb. 2020	2129	-0.757	-8.2	0.736	26.4
Mar. 2020	3995	-0.443	36.8	0.604	39.6
Apr. 2020	4056	-0.236	66.4	0.562	43.8
May 2020	3290	-0.226	67.7	0.608	39.2
Jun. 2020	3590	-0.104	85.1	0.683	31.7
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
(*) 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 SST over Northern Atlantic and Arctic Ocean for Jan. to Dec. 2020, for 3,4,5 quality indexes, by night and by day. Comparison with drifting buoys.

OSI-203-b NHL VIIRS IST quality results over Jan. to Dec. 2020, night-time					
Month	Number of cases	Mean diff. in K (req.: ± 3.5 K)	Mean diff. margin (*)	SD in K (req.: ± 3.0 K)	SD margin (**)
Jan. 2020	158	0.58	83.4	5.74	-91.6
Feb. 2020	153	0.36	89.5	6.20	-106.9
Mar. 2020	55	3.67	-5.1	5.40	-80.0
Apr. 2020	0	-	-	-	-
May 2020	0	-	-	-	-
Jun. 2020	0	-	-	-	-
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
OSI-203-b NHL VIIRS IST quality results over Jan. to Dec. 2020, day-time					
Month	Number of cases	Mean diff. in K (req.: ± 3.5 K)	Mean diff. margin (*)	SD in K (req.: ± 3.0 K)	SD margin (**)
Jan. 2020	0	-	-	-	-
Feb. 2020	0	-	-	-	-
Mar. 2020	6	-	-	-	-
Apr. 2020	128	-4.132	-18.0	3.531	-17.7
May 2020	72	-4.735	-35.3	2.964	1.2
Jun. 2020	1	-	-	-	-
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	-	-	-	-
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|))					
(**) SD margin = 100 * (1 - (SD / SD req.))					
100 refers then to a perfect product, 0 to a quality just as required. without margin.					
A negative result indicates that the product quality does not fulfil the requirement.					

Table 19: Quality results for OSI-203-b NHL VIIRS IST over Northern Atlantic and Arctic Ocean for Jan. to Dec. 2020, for 3,4,5 quality indexes, by night and by day

Comments:
The validation results for the period covered by this HYR for OSI-203-b SST are all within target accuracy requirement, both day and night, except night-time standard deviation in July.
For IST the results are within requirement for bias except in December at night-time. For standard deviation it is outside target accuracy for all months.

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.

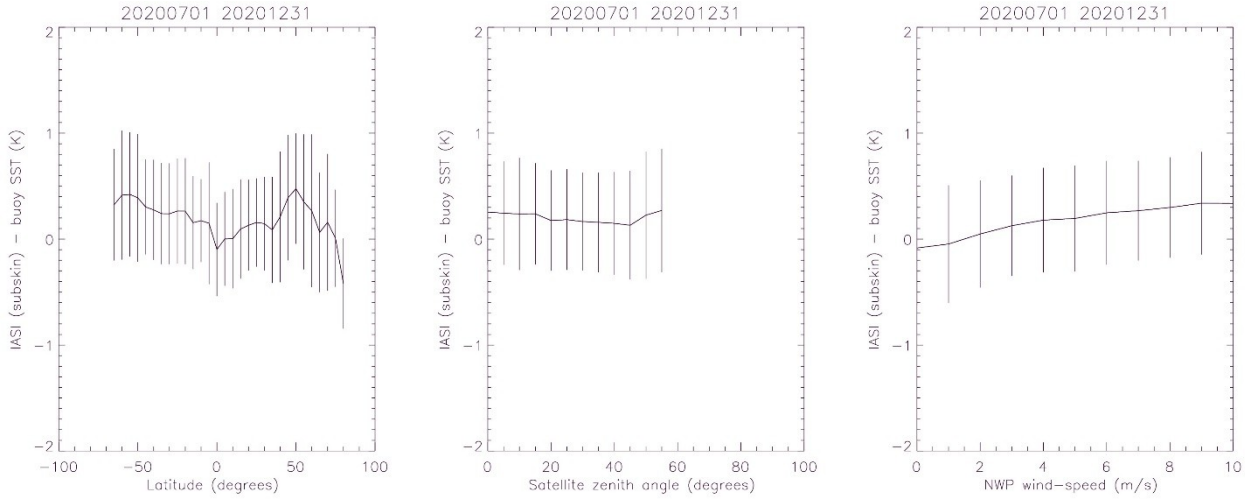


Figure 19: Mean Metop-B IASI night-time SST minus drifting buoy SST for Quality Levels 3, 4 and 5 from Jul. to Dec. 2020

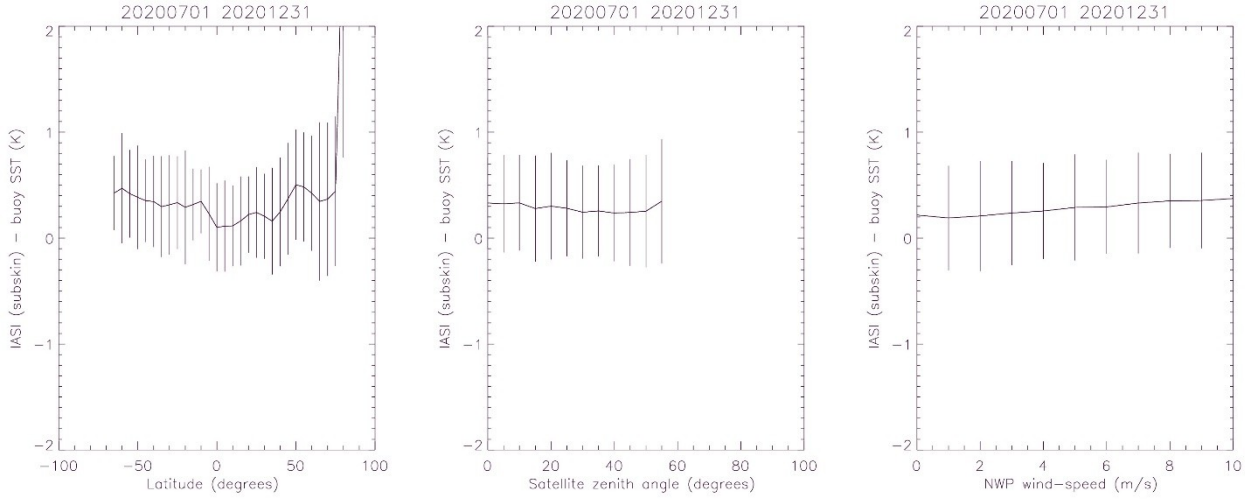


Figure 20: Mean Metop-B IASI day-time SST minus drifting buoy SST for Quality Levels 3, 4 and 5 from Jul. to Dec. 2020

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

Global Metop-B IASI night-time SST quality results over 2nd half 2020					
Month	Number of cases	Mean diff. in K (req. : ± 0.5 K)	Mean diff. margin (*)	SD in K (req. : ± 0.8 K)	SD margin (**)
Jul. 2020	2611	0.24	52	0.50	38
Aug. 2020	2648	0.25	50	0.53	34
Sep. 2020	1836	0.24	52	0.54	33
Oct. 2020	3079	0.18	64	0.48	40
Nov. 2020	2486	0.13	74	0.49	39
Dec. 2020	2663	0.16	68	0.50	38
Global Metop-B IASI day-time SST quality results over 2nd half 2020					
Jul. 2020	2381	0.38	24	0.48	40
Aug. 2020	1966	0.33	34	0.51	37
Sep. 2020	1494	0.28	44	0.50	38
Oct. 2020	2598	0.24	52	0.47	41
Nov. 2020	1937	0.21	58	0.44	45
Dec. 2020	1977	0.27	46	0.46	43
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|))					
(**) SD margin = 100 * (1 - (SD / SD req.))					
100 refers then to a perfect product, 0 to a quality just as required. without margin.					
A negative result indicates that the product quality does not fulfil the requirement.					

Table 20: Quality results for global Metop-B IASI SST over 2nd half 2020, for Quality Levels 3, 4 and 5

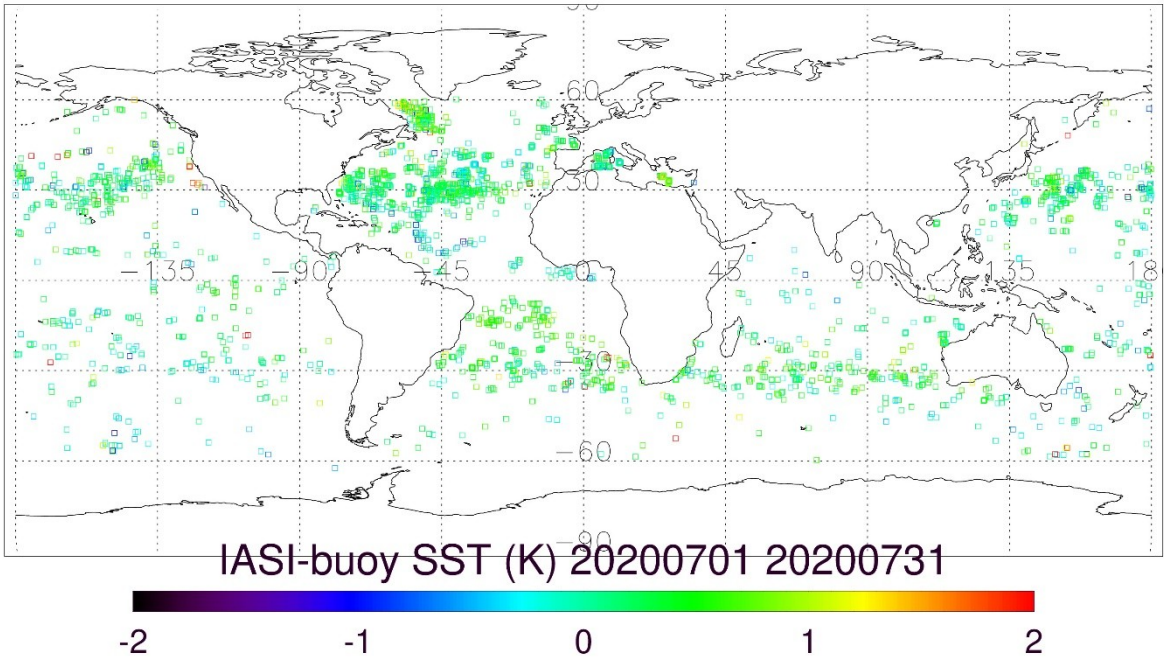


Figure 21: Mean Metop-B IASI night-time SST minus drifting buoy SST analyses for Quality Levels 3, 4 and 5, Jan. 2020 to Dec. 2020

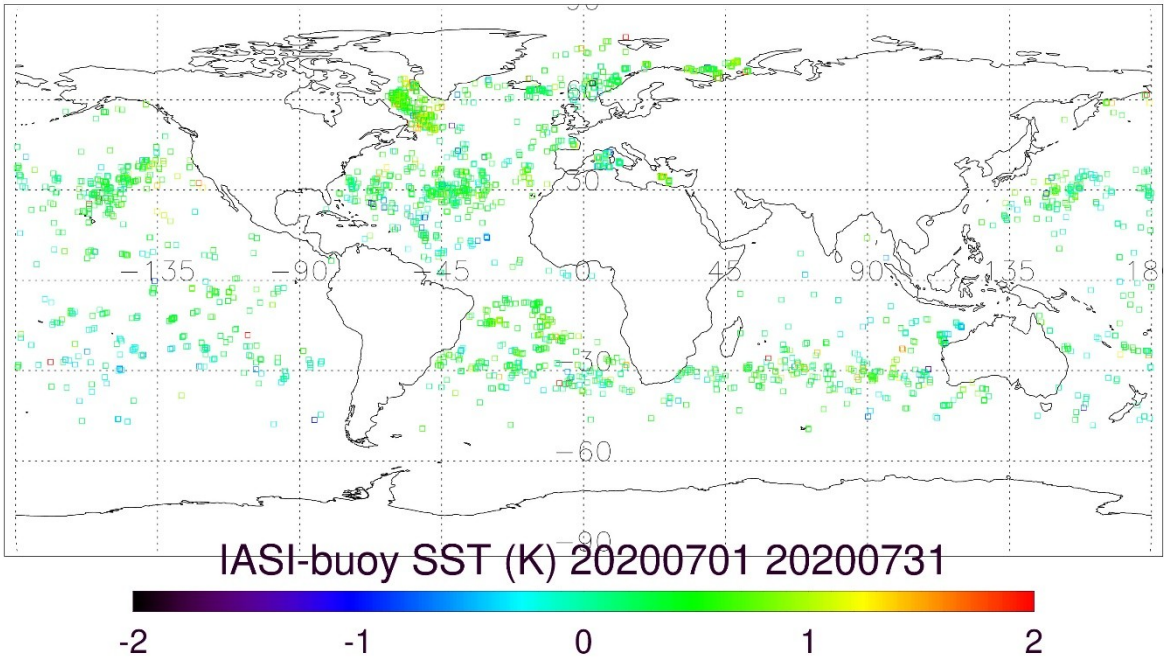


Figure 22: Mean Metop-B IASI day-time SST minus drifting buoy SST analyses for Quality Levels 3, 4 and 5, Jan. 2020 to Dec. 2020

Comments:
Over the six month reporting period the night-time mean IASI bias (for quality levels 3 and above) against drifting buoy SSTs is 0.20K with a standard deviation of 0.51K (n=15323); and the day-time mean bias is 0.29K, standard deviation 0.48K (n=12353). The monthly mean and whole time period results and within the target accuracy.

5.2. Radiative Fluxes quality

5.2.1. DLI quality

DLI products are constituted of the geostationary products (Meteosat DLI and GOES-East DLI) and the polar ones (AHL DLI). 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. Meteosat DLI (OSI-303) and GOES-East DLI (OSI-305) 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 geostationary DLI quality results over the reporting period.

Geostationary Meteosat & GOES-East DLI quality results from Jan. to Dec. 2020								
Month	Number of cases	Mean DLI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. in % (req.: ± 5 %)	Mean diff. margin(*) in %	SD in Wm^{-2}	SD in % (req. : ± 10%)	SD margin(**) in %
Jan. 2020	3626	282.69	-6.26	-2.21	55.71	18.16	6.42	35.76
Feb. 2020	3380	281.11	-3.18	-1.13	77.38	16.90	6.01	39.88
Mar. 2020	3687	300.98	-1.60	-0.53	89.37	14.41	4.79	52.12
Apr. 2020	3490	304.18	0.34	0.11	97.76	13.87	4.56	54.40
May 2020	3635	333.35	0.59	0.18	96.46	12.55	3.76	62.35
Jun. 2020	3402	361.71	4.20	1.16	76.78	12.59	3.48	65.19
Jul. 2020	3600	376.86	5.02	1.33	73.36	11.78	3.13	68.74
Aug. 2020	3587	371.21	5.74	1.55	69.07	12.78	3.44	65.57
Sep. 2020	3600	345.42	4.42	1.28	74.41	13.93	4.03	59.67
Oct. 2020	3668	318.95	0.10	0.03	99.37	15.29	4.79	52.06
Nov. 2020	3559	293.03	0.44	0.15	97.00	15.75	5.37	46.25
Dec. 2020	3622	279.51	-4.49	-1.61	67.87	15.53	5.56	44.44
(*) Mean diff. margin = 100 * (1 - (|mean diff. / mean diff. req.|)) (**) SD margin = 100 * (1 - (SD / SD req.)) 100 refers then to a perfect product, 0 to a quality just as required. without margin. A negative result indicates that the product quality does not fulfil the requirement.								

Table 21: Geostationary DLI quality results from Jan. to Dec. 2020.

Comments:
Overall statistics are good and within the requirement.

5.2.1.2. 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 geostationary DLI quality results over the reporting period.

Geostationary Meteosat Indian Ocean DLI quality results over Jan. 2020 to Dec. 2020								
Month	Number of cases	Mean DLI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. in % (req.: ± 5 %)	Mean diff. margin in %(*)	SD in Wm^{-2}	SD in % (req.: ± 10 %)	SD margin (**) in %
Jan. 2020	741	301.90	-10.00	-3.31	33.75	21.60	7.15	28.45
Feb. 2020	596	312.18	-4.12	-1.32	73.60	18.50	5.93	40.74
Mar. 2020	688	294.72	0.61	0.21	95.86	17.33	5.88	41.20
Apr. 2020	647	312.64	4.60	1.47	70.57	13.44	4.30	57.01
May 2020	719	316.25	6.63	2.10	58.07	12.31	3.89	61.08
Jun. 2020	629	343.80	6.91	2.01	59.80	12.27	3.57	64.31
Jul. 2020	642	344.67	10.01	2.90	41.92	12.45	3.61	63.88
Aug. 2020	621	363.82	7.49	2.06	58.83	14.81	4.07	59.29
Sep. 2020	720	343.21	4.70	1.37	72.61	18.45	5.38	46.24
Oct. 2020	719	334.61	-1.43	-0.43	91.45	15.81	4.72	52.75
Nov. 2020	695	310.39	-3.51	-1.13	77.38	21.13	6.81	31.92
Dec. 2020	646	315.06	-10.48	-3.33	33.47	20.04	6.36	36.39
(*) 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 22: Meteosat Indian Ocean DLI quality results from Jan. to Dec. 2020.

Comments:
Overall statistics are good and within the requirement.

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

The pyrgeometer stations used for quality assessment of the AHL DLI product are briefly described at http://nowcasting.met.no/validering/flukser/. More information on the stations is provided in 5.2.2.3

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

AHL DLI quality results from Jan. to Dec. 2020								
Month	Number of cases	Mean DLI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. in % (req.: ± 5 %)	Mean diff. margin in %(*)	SD in Wm^{-2}	SD in % (req.: ± 10 %)	SD margin (**) in %
Jan. 2020	63	274.03	-2.64	-0.95	80,9	16.47	5.95	40,5
Feb. 2020	64	261.76	3.16	1.22	75,6	19.41	7.51	24,9
Mar. 2020	74	257.19	0.39	0.15	97,0	19.10	7.44	25,6
Apr. 2020	60	270.37	9.71	3.73	25,5	14.56	5.59	44,2
May 2020	56	287.86	-1.75	-0.61	87,9	19.43	6.71	32,9
Jun. 2020	56	316.99	-3.26	-1.02	79,6	21.05	6.57	34,3
Jul. 2020	68	330.32	-8.16	-2.41	51.77	22.20	6.56	34.40
Aug. 2020	76	321.52	-4.46	-1.37	72.62	20.70	6.35	36.49
Sep. 2020	62	309.68	-7.43	-2.34	53.15	17.69	5.58	44.21
Oct. 2020	65	298.91	-6.15	-2.02	59.66	16.77	5.50	45.01
Nov. 2020	65	286.27	-9.17	-3.10	37.93	19.37	6.55	34.45
Dec. 2020	73	278.85	-11.62	-4.00	20.01	15.68	5.40	46.01
(*) 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 23: AHL DLI quality results from Jan. to Dec. 2020.

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 (Meteosat SSI and GOES-East SSI) and polar ones (AHL SSI). 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. Meteosat SSI (OSI-304) and GOES-East SSI (OSI-306) quality

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

Geostationary Meteosat & GOES-East SSI quality results from Jan. to Dec. 2020								
Month	Number of cases	Mean SSI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. in % (req.: ± 10 %)	Mean diff. margin(*) in %	SD in Wm^{-2}	SD in % (req.: ± 30 %)	SD margin (**) in %
Jan. 2020	5125	309.27	5.49	1.78	82.25	70.11	22.67	24.43
Feb. 2020	4557	336.47	5.92	1.76	82.41	77.35	22.99	23.37
Mar. 2020	6518	399.57	5.03	1.26	87.41	74.95	18.76	37.47
Apr. 2020	6898	463.37	1.13	0.24	97.56	76.91	16.60	44.67
May 2020	7684	476.34	-11.59	-2.43	75.67	68.74	14.43	51.90
Jun. 2020	7141	464.98	-9.52	-2.05	79.53	76.23	16.39	45.35
Jul. 2020	6818	507.09	-8.75	-1.73	82.74	74.40	14.67	51.09
Aug. 2020	6823	492.80	-9.55	-1.94	80.62	72.96	14.81	50.65
Sep. 2020	6320	451.49	0.02	0.00	99.96	71.66	15.87	47.09
Oct. 2020	6109	375.32	-0.93	-0.25	97.52	70.85	18.88	37.08
Nov. 2020	5095	357.39	0.65	0.18	98.18	73.53	20.57	31.42
Dec. 2020	4779	338.48	-2.70	-0.80	92.02	72.62	21.45	28.48
(*) 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 24: Geostationary SSI quality results from Jan. to Dec. 2020.

Comments:
Overall statistics are good and within the requirement.

5.2.2.2. 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 geostationary SSI quality results over the reporting period.

Meteosat Indian Ocean SSI quality results from Jan. to Dec. 2020								
Month	Number of cases	Mean SSI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. in % (req. : ± 10 %)	Mean diff. margin(*) in %	SD in Wm^{-2}	SD in % (req.: ± 30 %)	SD margin(**) in %
Jan. 2020	2656	292.06	15.01	5.14	48.61	66.03	22.61	24.64
Feb. 2020	2184	288.11	12.14	4.21	57.86	54.62	18.96	36.81
Mar. 2020	3260	397.51	8.03	2.02	79.80	67.72	17.04	43.21
Apr. 2020	3657	465.34	4.02	0.86	91.36	60.25	12.95	56.84
May 2020	4050	493.65	-8.87	-1.80	82.03	57.83	11.71	60.95
Jun. 2020	3672	454.06	-11.68	-2.57	74.28	67.98	14.97	50.09
Jul. 2020	3472	507.56	-10.65	-2.10	79.02	54.32	10.70	64.33
Aug. 2020	3725	474.48	-15.97	-3.37	66.34	63.55	13.39	55.35
Sep. 2020	3358	439.68	-6.24	-1.42	85.81	61.94	14.09	53.04
Oct. 2020	3159	354.53	0.85	0.24	97.60	67.52	19.04	36.52
Nov. 2020	2630	370.01	10.38	2.81	71.95	64.98	17.56	41.46
Dec. 2020	2422	329.12	6.46	1.96	80.37	72.03	21.89	27.05
(*) 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 25: Meteosat Indian Ocean SSI quality results from Jan. to Dec. 2020.

Comments:
Overall statistics are good and within the requirement.

5.2.2.3. 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 26: 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 26. 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 over Jan. 2020 to Dec. 2020								
Month	Number of cases	Mean SSI in Wm^{-2}	Mean diff. in Wm^{-2}	Mean diff. in % (req.: ± 10%)	Mean diff. margin in %(*)	SD in Wm^{-2}	SD in % (req.: ± 30 %)	SD margin(**) in %
Jan. 2020	24	12.20	-3.23	-20.93	-109,3	6.22	40.34	-34,5
Feb. 2020	51	26.13	-4.04	-13.40	-34,0	11.37	37.67	-25,6
Mar. 2020	98	70.93	-6.92	-8.89	11,1	24.62	31.62	-5,4
Apr. 2020	87	126.12	-20.52	-13.99	-39,9	23.98	16.35	45,5
May 2020	89	184.91	-12.40	-6.28	37,2	55.56	28.16	6,1
Jun. 2020	88	234.66	-2.08	-0.88	91,2	31.83	13.44	55,2
Jul. 2020	106	178.73	2.69	1.53	84.69	53.32	30.29	-0.97
Aug. 2020	107	150.60	1.82	1.22	87.79	33.93	22.81	23.98
Sep. 2020	99	72.39	-1.86	-2.51	74.91	23.90	32.19	-7.29
Oct. 2020	59	38.18	-2.49	-6.12	38.84	13.38	32.89	-9.65
Nov. 2020	34	20.35	-3.45	-14.49	-44.93	4.72	19.85	33.85
Dec. 2020	10	8.20	-3.15	-27.72	-177.17	6.58	57.98	-93.26
(*) 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 27: AHL SSI quality results over Jan. 2020 to Dec. 2020

Comments:
The validation for OSI-302-b shows that product is within target accuracy requirement for most months, except the winter months with very little sunlight at high latitudes. There is also a noticeable negative mean difference in April, 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 28: 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.

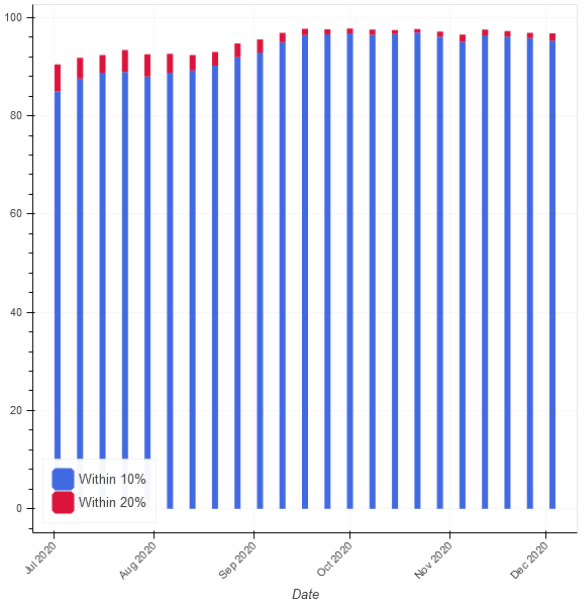


Figure 23: Comparison of ice concentrations from the NIC ice analysis and the OSI SAF concentration product. Northern hemisphere. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/- 10%, and likewise for +/-20%.

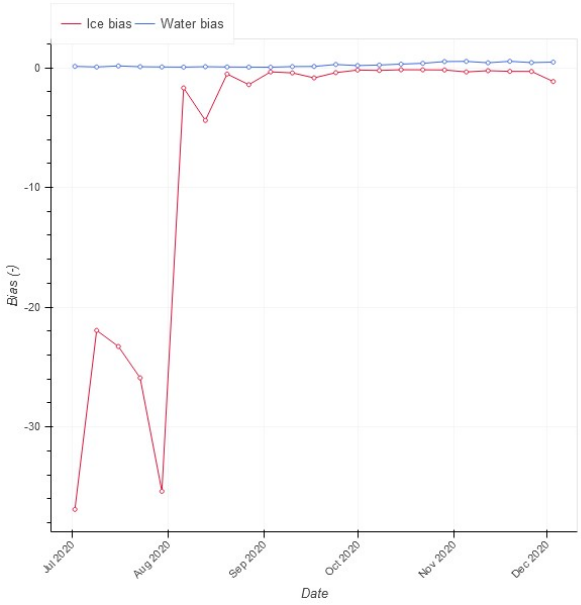


Figure 24: Difference between ice concentrations from the NIC ice analysis and OSI SAF concentration product for two categories: water and ice. When the difference is below zero, the OSI SAF sea ice concentration has a lower estimate than the ice analysis. Northern hemisphere.

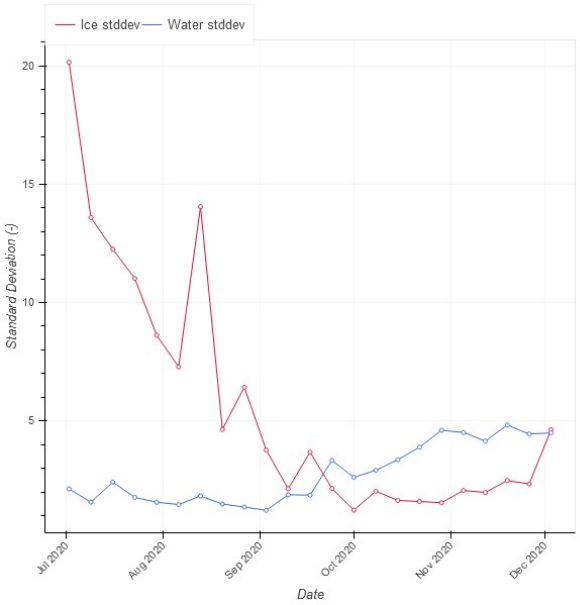


Figure 25: Standard deviation of the difference in ice concentrations from the NIC ice analysis and OSI SAF concentration product for two categories: water and ice. Northern hemisphere.

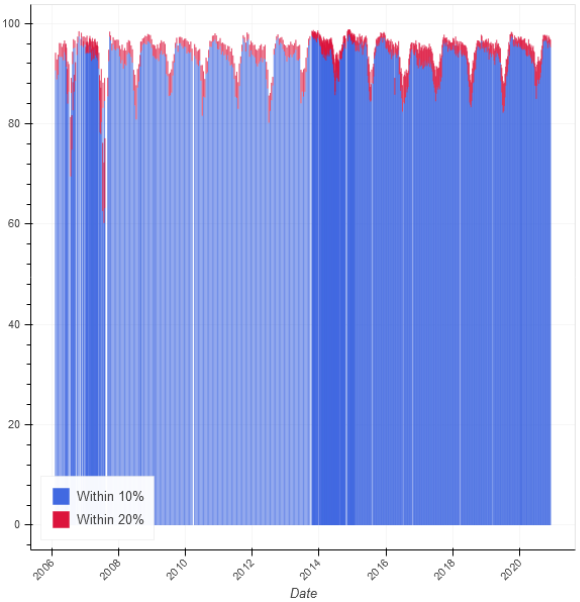


Figure 26: Multiyear variability. Comparison between ice concentrations from the NIC ice analysis and the OSI SAF concentration product. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/- 10%, and likewise for +/-20%. Northern hemisphere.

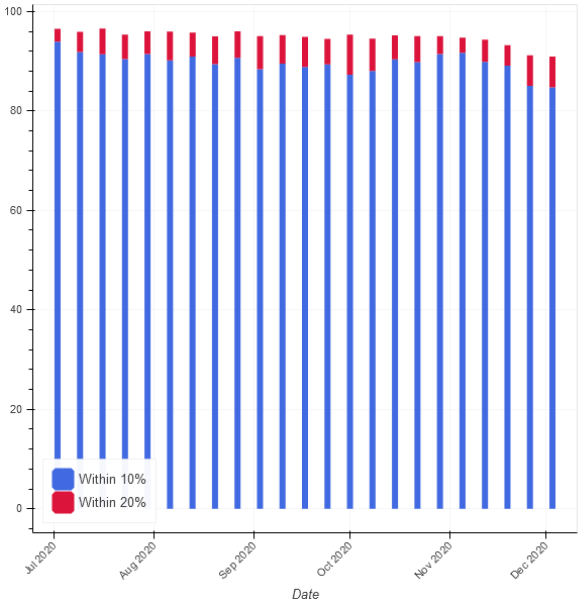


Figure 27: Comparison between ice concentrations from the NIC ice analysis and the OSI SAF concentration product. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/-10%, and likewise for +/-20%. Southern hemisphere.

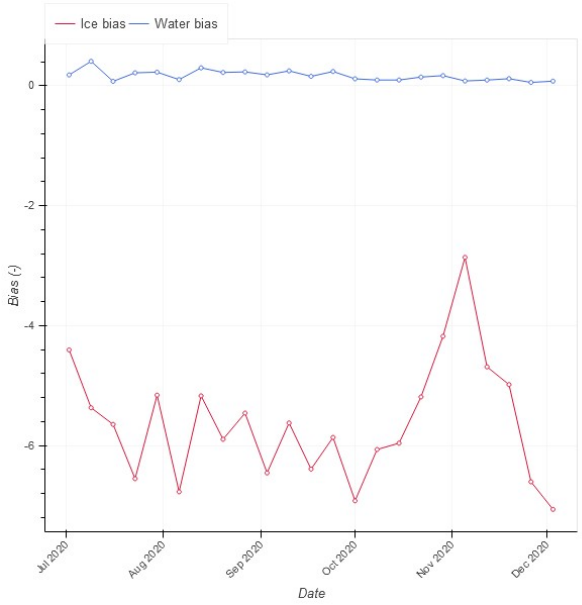


Figure 28: Difference between the ice concentrations from the NIC ice analysis and OSI SAF concentration product for two categories: water and ice. When the difference is below zero, the OSI SAF sea ice concentration has a lower estimate than the ice analysis. Southern hemisphere.

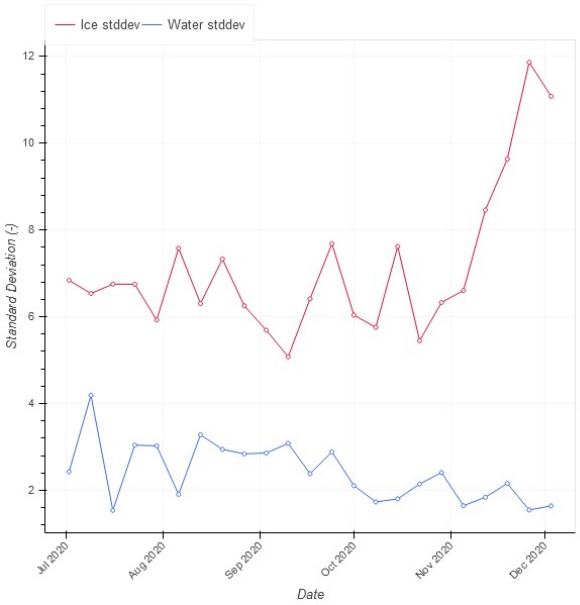


Figure 29: Standard deviation of the difference in ice concentrations from the NIC ice analysis and OSI SAF concentration product for two categories: water and ice. Southern hemisphere.

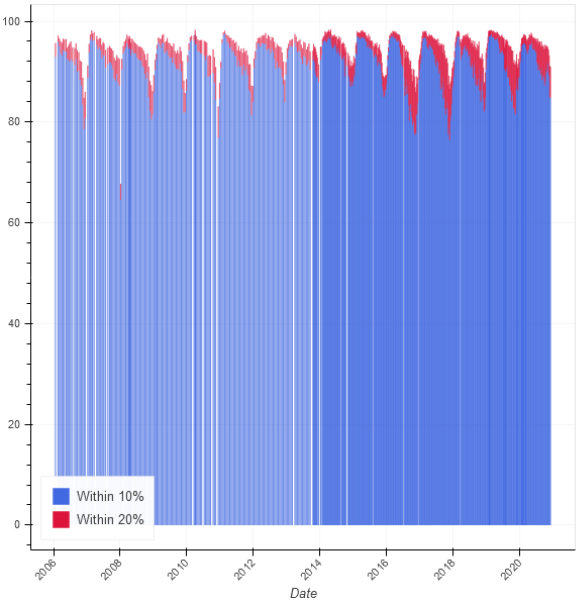


Figure 30: Multiyear variability. Comparison between ice concentrations from the NIC ice analysis and the OSI SAF concentration product. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range of +/- 10%, and likewise for +/-20%. Southern hemisphere.

Concentration product					
Month	+/- 10% [%]	+/- 20% [%]	Mean difference [%]	SD [%]	Number of obs.
Jan. 2020	96.41	97.51	-1.38	6.03	322624
Feb. 2020	95.27	96.64	-1.81	6.90	321729
Mar. 2020	94.62	95.98	-1.88	6.80	321588
Apr. 2020	92.23	93.80	-2.70	8.50	281872
May 2020	89.96	91.51	-3.50	9.75	273674
Jun. 2020	91.98	93.59	-2.93	9.09	389360
Jul. 2020	96.20	96.95	-1.69	6.87	494155
Aug. 2020	96.70	97.32	-1.35	6.79	554542
Sep. 2020	97.97	98.41	-0.8	4.83	612381
Oct. 2020	98.76	99.21	-0.46	3.21	518380
Nov. 2020	98.24	98.83	-0.67	3.92	464066
Dec. 2020	97.56	98.40	-0.93	4.84	404178

Table 29: Monthly quality assessment results from comparing the OSI SAF sea ice concentration product to MET Norway ice service analysis for the Svalbard area. From Jan. 2020 to Dec. 2020. First two columns shows how often there is agreement within 10 and 20% concentration.

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

Month	Code=5	code=4	code=3	code=2	code=1	Unprocessed
Jul. 2020	74.52	25.48	0.00	0.00	0.00	0.00
Aug. 2020	79.58	20.42	0.00	0.00	0.00	0.00
Sep. 2020	84.95	15.05	0.00	0.00	0.00	0.00
Oct. 2020	83.76	16.24	0.00	0.00	0.00	0.00
Nov. 2020	79.95	20.05	0.00	0.00	0.00	0.00
Dec. 2020	76.28	23.72	0.00	0.00	0.00	0.00

Table 30: Statistics for sea ice concentration confidence levels, Code 0-5, Northern Hemisphere, over 2nd half 2020.

Month	Code=5	code=4	code=3	code=2	code=1	Unprocessed
Jul. 2020	70.04	29.96	0.00	0.00	0.00	0.00
Aug. 2020	63.99	36.01	0.00	0.00	0.00	0.02
Sep. 2020	64.13	35.87	0.00	0.00	0.00	0.03
Oct. 2020	65.94	34.06	0.00	0.00	0.00	0.03
Nov. 2020	66.87	33.13	0.00	0.00	0.00	0.02
Dec. 2020	75.78	24.22	0.00	0.00	0.00	0.00

Table 31: Statistics for sea ice concentration confidence levels, Code 0-5, Southern Hemisphere, over 2nd half 2020.

Comments:
Figure 22 and Figure 26 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 DMI ice analysis for NH and NIC ice analysis for SH, respectively.
Average yearly SD for the period can be seen in the table just below. The product are with target accuracy of 10 % and 15 % for the NH and SH products, respectively.

Average yearly standard deviation	Average SD Ice	Average SD Water
Northern Hemisphere	5.71	2.77
Southern Hemishpere	7.13	2.41

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.

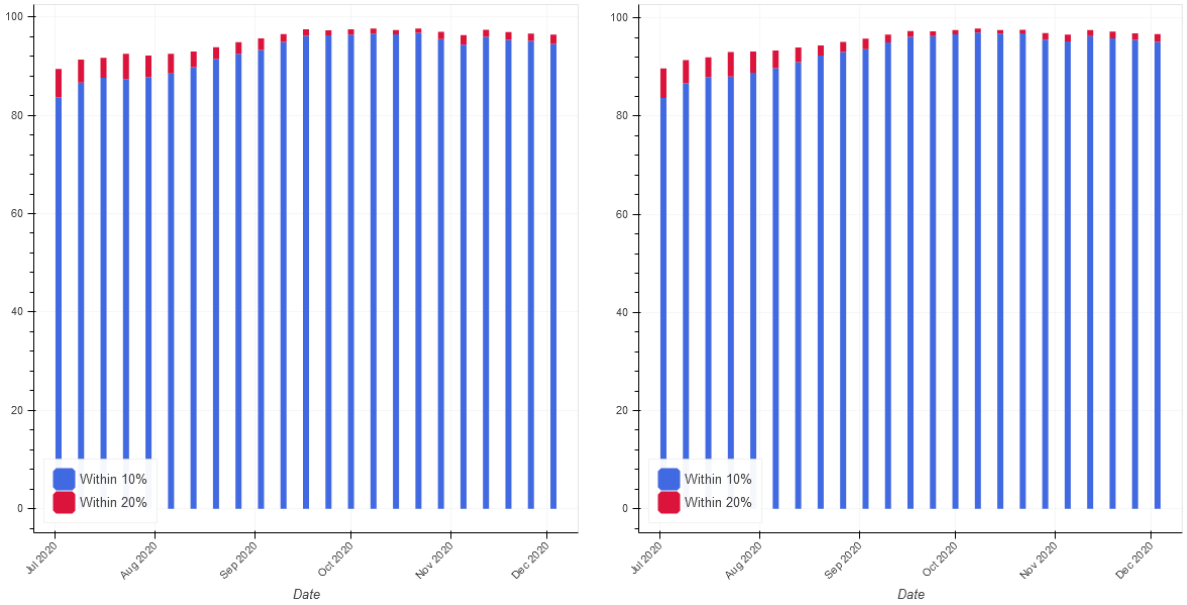


Figure 31: Comparison of ice concentrations from the NIC ice analysis and the OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right. Northern hemisphere. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range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

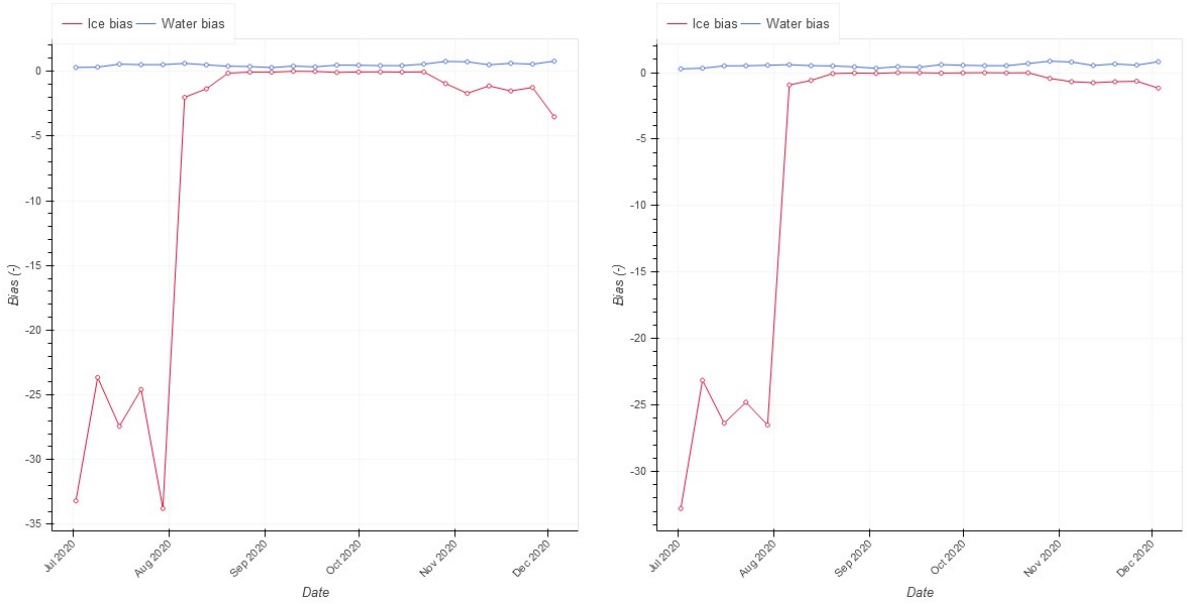


Figure 32: Difference between ice concentrations from the NIC ice analysis and OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right for two categories: water and ice. Northern Hemisphere

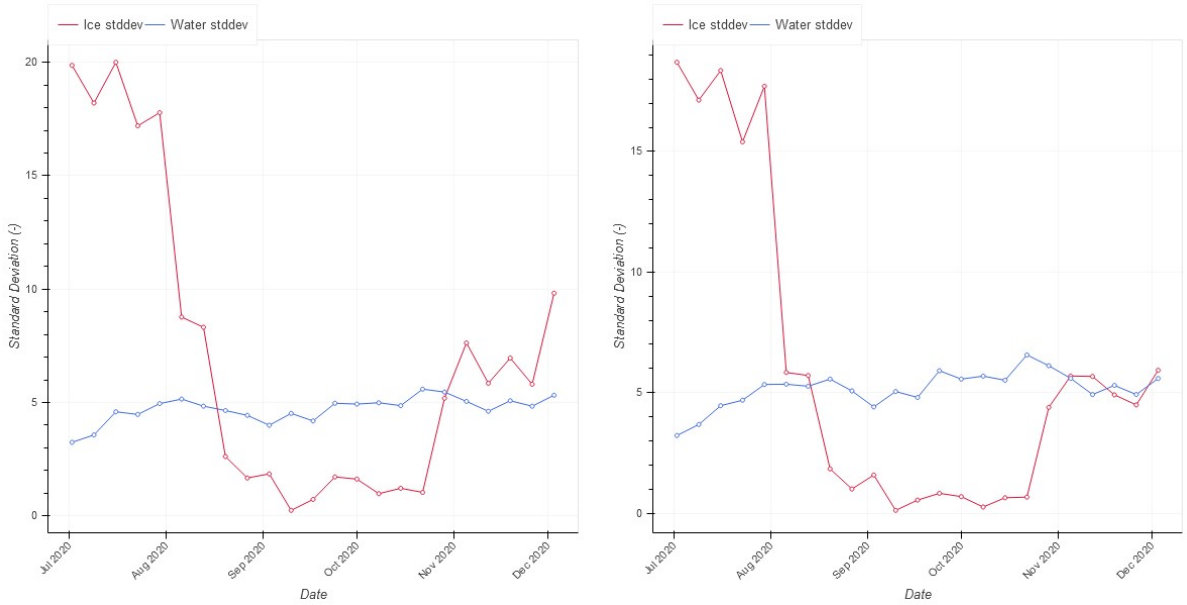


Figure 33: Standard deviation of the difference in ice concentrations from the NIC ice analysis and OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right for two categories: water and ice. Northern hemisphere.

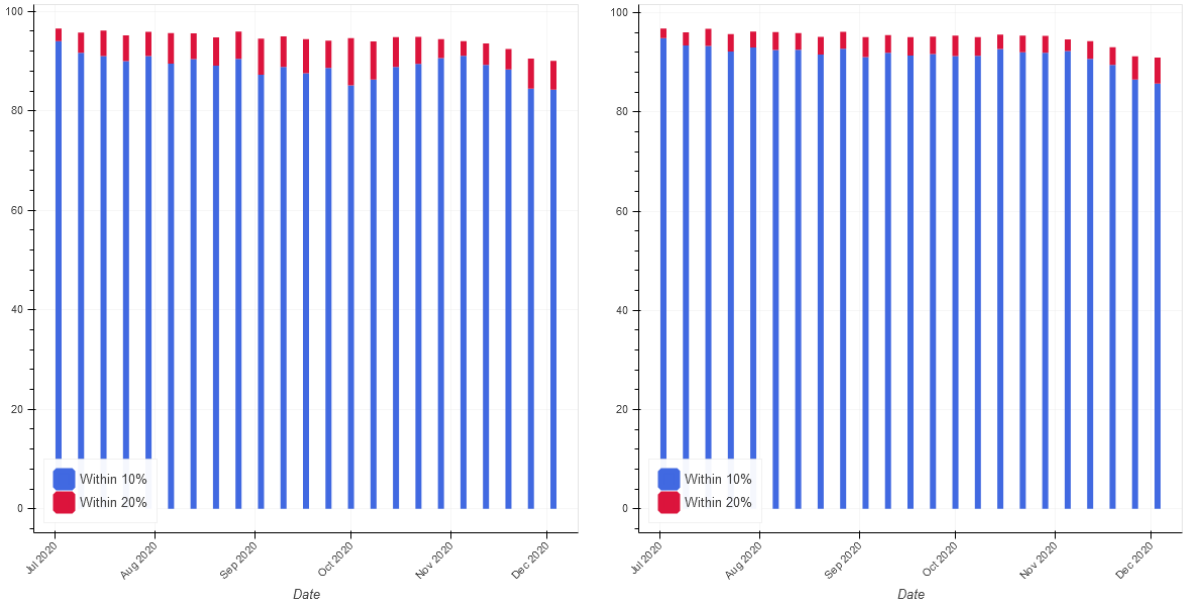


Figure 34: Comparison of ice concentrations from the NIC ice analysis and the OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right. Southern hemisphere. 'Match +/- 10%' corresponds to those grid points where concentrations are within the range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

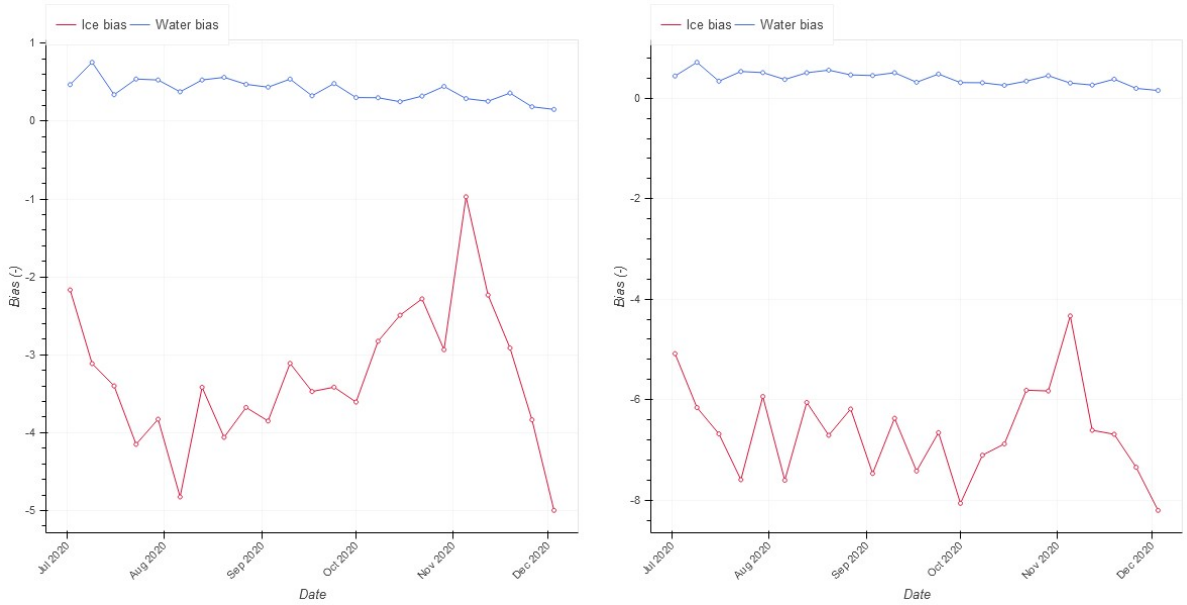


Figure 35: Difference between ice concentrations from the NIC ice analysis and OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right for two categories: water and ice. Southern Hemisphere

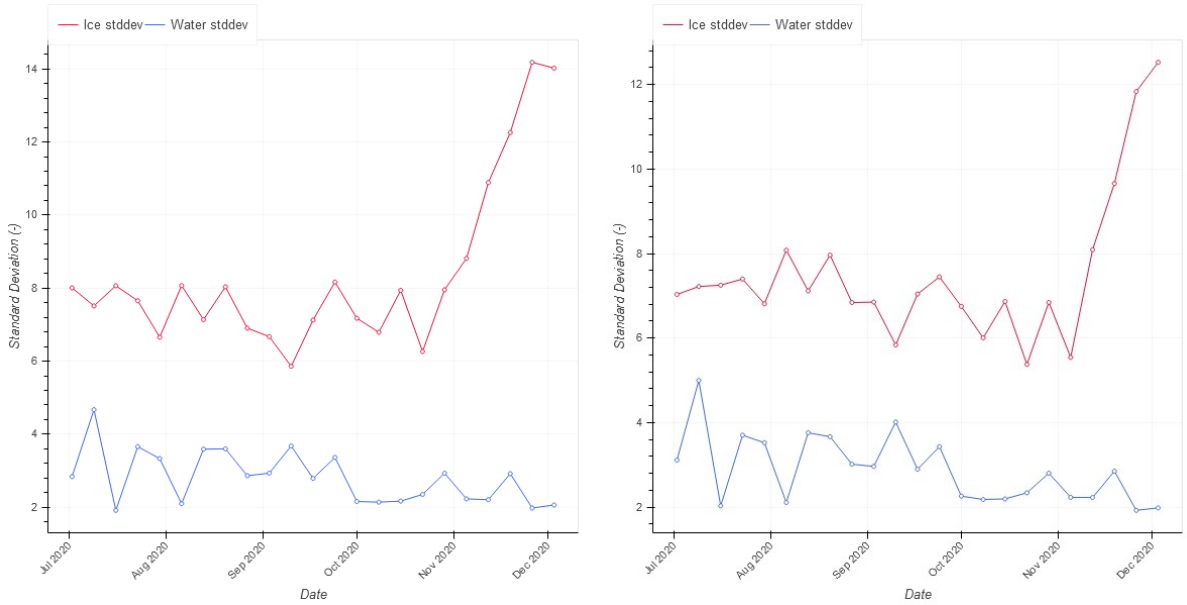


Figure 36: Standard deviation of the difference in ice concentrations from the NIC ice analysis and OSI SAF AMSR-2 concentration product based on OSHD algorithm to the left and based on TUD algorithm to the right for two categories: water and, ice. Southern hemisphere.

Comments:

Figure 30 and Figure 33 provide the essential information on the compliance of the sea ice concentration product accuracy, showing the std. dev. of the difference in ice concentration between the OSI SAF product and the DMI ice analysis for NH and NIC ice analysis for 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	7.18	4.71
	SH	8.35	2.80
TUD algorithm	NH	6.00	5.15
	SH	7.49	2.88

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.

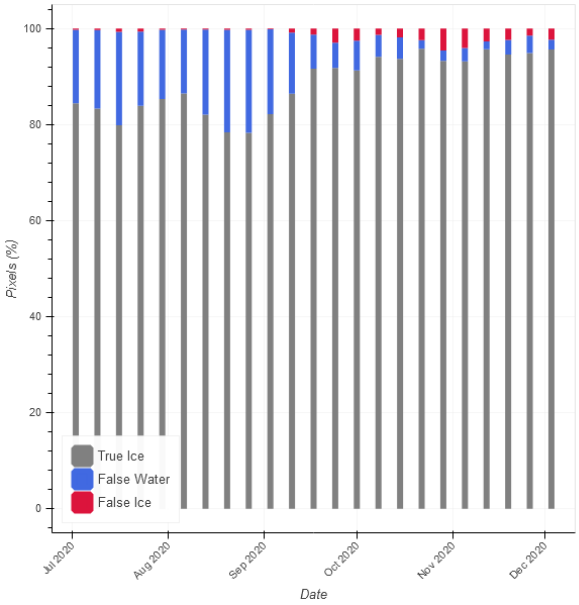


Figure 37: Comparison between the Greenland overview charts made by DMI and the OSI SAF sea ice edge product. Northern hemisphere. 'False Water' means grid points where the OSI SAF product indicated water and the DMI ice analysis indicated ice and vice versa for the 'False Ice' category.

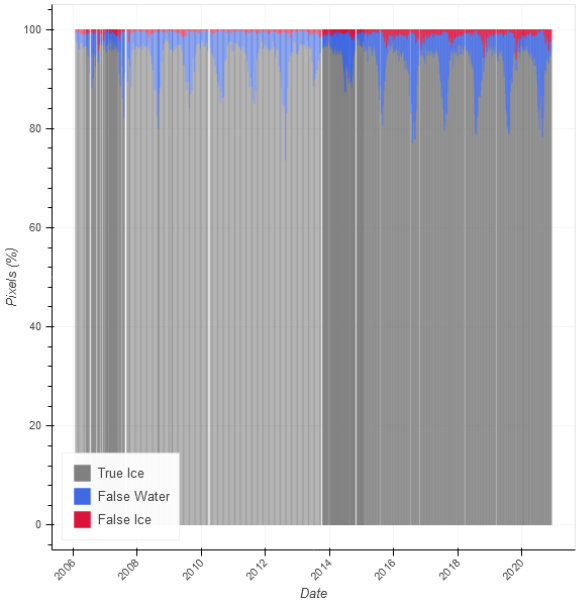


Figure 38: Multiyear variability. Comparison between the Greenland overview charts made by DMI and the OSI SAF sea ice edge product. Northern hemisphere. 'False Water' means grid points where the OSI SAF product indicated water and the DMI ice analysis indicated ice and vice versa for the 'False Ice'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

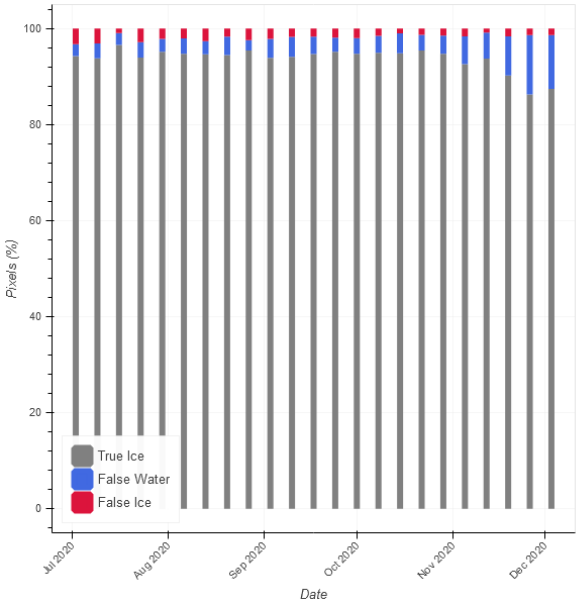


Figure 39: Comparison between the NIC ice analysis and the OSI SAF sea ice edge product. Southern hemisphere. 'False Water' means grid points where the OSI SAF product indicated water and the NIC ice analysis indicated ice and vice versa for the 'False Ice' category.

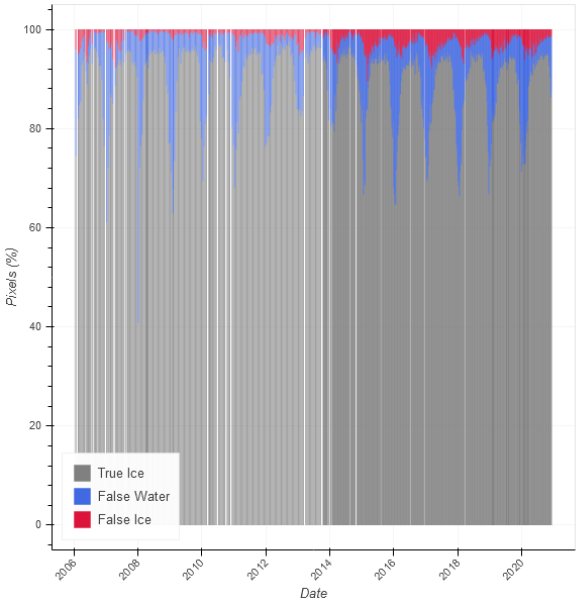


Figure 40: Multiyear variability. Comparison between the NIC ice analysis and the OSI SAF sea ice edge product. Southern hemisphere. 'False Water' means grid points where the OSI SAF product indicated water and the NIC ice analysis indicated ice and vice versa for the 'False Ice' category.

Month	Correct [%]	SAF lower [%]	SAF higher [%]	Mean edge diff [km]	Number of obs.
Jan. 2020	98.14	1.05	0.81	12.19	630529
Feb. 2020	97.18	1.65	1.17	15.46	638393
Mar. 2020	97.97	1.28	0.74	19.97	689888
Apr. 2020	97.51	1.70	0.79	23.33	622101
May 2020	96.40	2.65	0.94	27.83	539034
Jun. 2020	96.92	2.44	0.64	25.39	632059
Jul. 2020	98.25	1.14	0.61	20.43	675793
Aug. 2020	97.89	1.84	0.27	18.93	671040
Sep. 2020	98.81	0.80	0.39	16.67	703249
Oct. 2020	99.22	0.20	0.58	8.26	648615
Nov. 2020	98.83	0.36	0.81	10.28	619955
Dec. 2020	98.33	0.65	1.02	10.8	611370

Table 32: Monthly quality assessment results from comparing OSI SAF sea ice products to MET Norway ice service analysis for the Svalbard area, from Jan. to Dec. 2020. Mean edge diff is the mean difference in distance between the ice edges in the OSI SAF edge product and MET Norway ice chart.

Month	Correct [%]	SAF lower [%]	SAF higher [%]	Mean edge diff [km]	Number of obs.
Jan. 2020	98.21	1.28	0.51	35.24	368716
Feb. 2020	98.63	0.66	0.71	16.94	276859
Mar. 2020	99.34	0.25	0.41	13.61	461770
Apr. 2020	99.02	0.45	0.54	20.68	276573
May 2020	-	-	-	-	-
Jun. 2020	-	-	-	-	-
Jul. 2020	-	-	-	-	-
Aug. 2020	-	-	-	-	-
Sep. 2020	-	-	-	-	-
Oct. 2020	98.78	0.92	0.30	21.07	92043
Nov. 2020	97.88	1.85	0.27	32.38	368116
Dec. 2020	93.77	5.54	0.70	56.81	368248

Table 33: Monthly quality assessment results from comparing OSI SAF sea ice products to MET Norway ice service analysis for the Weddell Sea area, from Jan. to Dec. 2020. 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
Jul. 2020	85.97	1.17	6.29	5.44	1.14	51.18
Aug. 2020	91.20	0.75	3.47	3.58	1.00	51.07
Sep. 2020	94.71	1.16	2.08	1.63	0.41	51.46
Oct. 2020	93.06	1.63	3.09	1.81	0.41	52.37
Nov. 2020	86.59	3.80	6.28	2.73	0.61	53.04
Dec. 2020	81.22	8.24	7.00	2.92	0.62	53.70

Table 34: Statistics for sea ice edge confidence levels, Code 0-5, Northern Hemisphere, over 2nd half 2020.

Month	Code=5	code=4	code=3	code=2	code=1	Unprocessed
Jul. 2020	75.86	8.79	8.73	5.76	0.86	22.41
Aug. 2020	71.22	10.39	11.40	6.14	0.85	22.44
Sep. 2020	69.17	12.31	10.73	6.85	0.94	22.41
Oct. 2020	65.33	13.20	13.21	7.24	1.02	22.41
Nov. 2020	69.22	7.83	11.77	9.16	2.02	22.41
Dec. 2020	79.96	1.40	7.58	7.89	3.16	22.41

Table 35: Statistics for sea ice edge confidence levels, Code 0-5, Southern Hemisphere, over 2nd half 2020.

Comments:
In Table 34 the Northern Hemisphere OSI SAF 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 is 17.5 km and the target accuracy requirement of 20 km edge difference is therefore met. As previous years, the monthly differences are well below the yearly requirement all months except the spring/summer months of April-July, when melting of snow and ice makes the product quality worse.

In Table 35 the Southern Hemisphere OSI SAF 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 28.1 km and the target accuracy requirement of 45 km edge difference is therefore met. The monthly differences are well below the yearly requirement all months except the SH mid-summer month of December, when melting of snow and ice makes the product quality worse.

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.

Month	SD wrt running mean [km²]	Mean MYI coverage [km²]
Jan. 2020	39107	2289414
Feb. 2020	39644	1960795
Mar. 2020	49796	1712688
Apr. 2020	55622	1320193
May 2020	-	-
Jun. 2020	-	-
Jul. 2020	-	-
Aug. 2020	-	-
Sep. 2020	-	-
Oct. 2020	211200	2473982
Nov. 2020	64479	2000827
Dec. 2020	70375	1719181

Table 36: Monitoring of NH sea ice type quality by comparing the multi year coverage with the 11-days running mean, from Jan. to Dec. 2020

Month	Code=5	code=4	code=3	code=2	code=1	Unprocessed
Jul. 2020	85.70	0.27	0.29	13.58	0.15	51.18
Aug. 2020	90.02	0.21	0.22	9.38	0.17	51.07
Sep. 2020	91.98	0.13	0.14	7.70	0.06	51.46
Oct. 2020	97.46	0.84	1.04	0.60	0.06	52.37
Nov. 2020	96.47	0.94	1.82	0.68	0.09	53.04
Dec. 2020	94.07	0.93	4.25	0.64	0.10	53.70

Table 37: Statistics for sea ice type confidence levels, Northern Hemisphere, over 2nd half 2020.

Month	Code=5	code=4	code=3	code=2	code=1	Unprocessed
Jul. 2020	69.66	0.22	0.32	29.69	0.11	22.41
Aug. 2020	65.56	0.21	0.31	33.82	0.10	22.44
Sep. 2020	63.37	0.22	0.34	35.97	0.10	22.41
Oct. 2020	63.90	0.24	0.34	35.42	0.10	22.41
Nov. 2020	68.45	0.36	0.49	30.46	0.23	22.41
Dec. 2020	79.77	0.55	0.67	18.60	0.40	22.41

Table 38: Statistics for sea ice type confidence levels, Southern Hemisphere, over 2nd half 2020.

Comments:
In Table 38, the mid-column represents the monthly standard deviations of the daily MYI coverage variability. 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). Generally there is a higher variability in October which is in the beginning of the freezing period with very little training data for first-year ice. But in October 2020, the training data for first-year ice was lacking for more than half of the month. This caused a generation of the dynamical PDFs that favoured MYI more than was realistic, especially for a week from the 10^{th} to the 17^{th} October where the entire ice cover was classified mainly as MYI. When the situation stabilized at the end of October, and first-year ice data became available within the target regions, the area of MYI again dropped to normal values. This

longer-than-usual lack of first-year ice training data in the beginning of new freezing period was not treated in the best way in the operational retrieval method. This issue is discussed in the most recent validation report (SVR v3.0, under review at present time). The upcoming algorithm upgrades of the ice type include a better routine of the retrieval of the dynamic PDFs 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.

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

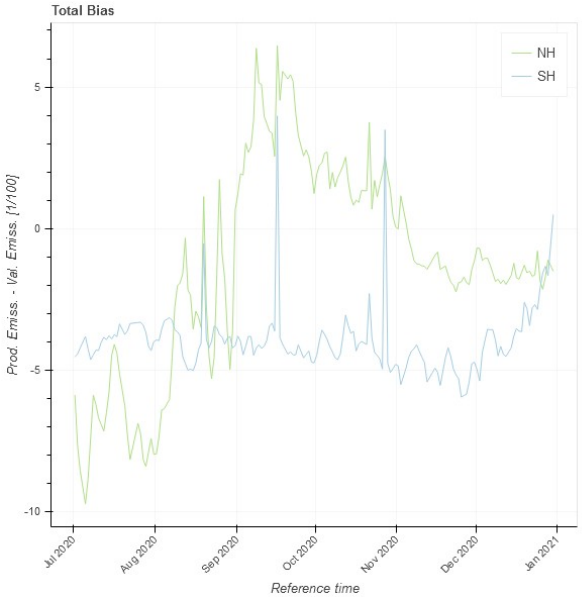


Figure 41: The mean hemispheric difference between the OSI SAF operational product and the validation product derived from NWP and SSMIS data. The y-axis unit is in hundreds (1/100)

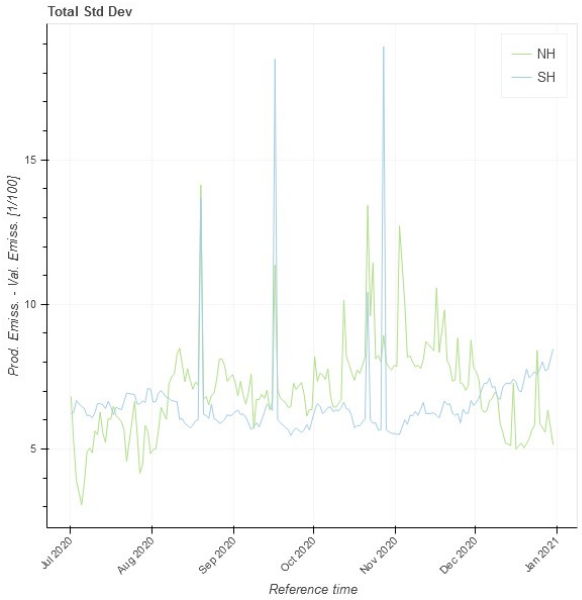


Figure 42: The standard deviation of the difference between the OSI SAF operational product and the validation product for the northern and southern hemispheres. The y-axis unit is in hundreds (1/100)

Comments:
The mean annual difference on the Northern Hemisphere is -0.01 and on the Southern Hemisphere it is -0.04. There is no clear seasonal cycle neither on the northern nor southern hemisphere. The standard deviation is just above the target accuracy, but below the threshold accuracy.

	Mean difference	SD	Target accuracy	Threshold accuracy
NH	-0.01	0.07	± 0.05	± 0.15
SH	-0.04	0.07	± 0.05	± 0.15

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

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.

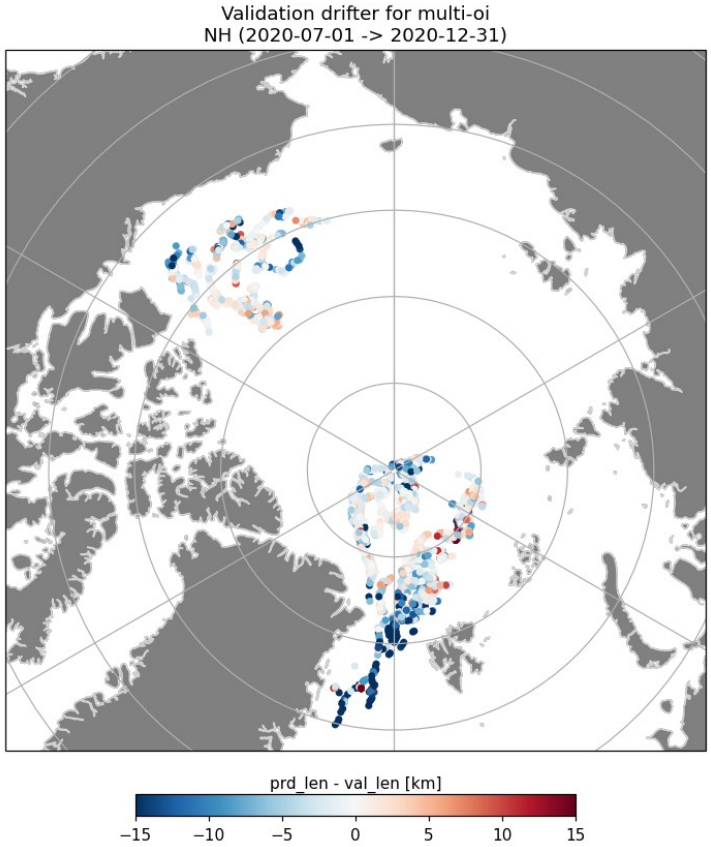


Figure 43: Location of GPS drifters for the quality assessment period (Jul. to Dec. 2020) in NH. The shade of each symbol represents the mean difference (prod-ref) in drift length (km over 2 days) for the multi-oi product.

Month	b(X) [km]	b(Y) [km]	σ(X) [km]	σ(Y) [km]	α	β[km]	ρ	N
Jan. 2020	-0,09	-0,04	2,24	2,56	0,95	0,15	0,97	890
Feb. 2020	-0,24	0,15	3,43	4,5	0,92	0,5	0,95	790
Mar. 2020	-0,73	0,5	4,71	5,29	0,88	1,35	0,93	811
Apr. 2020	-0,26	0,06	4,77	3,88	0,9	0,35	0,94	755
May 2020	-0,28	-1,34	4,31	5,65	0,87	-0,45	0,93	718
Jun. 2020	-0,26	-1,77	6,34	6,59	0,75	-0,02	0,81	648
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
Last 12 months	-0.458	-0.733	4.785	5.664	0.86	0.064	0.92	6944

Table 39: Quality assessment results for the LRSID (multi-oi) product (NH) for Jan. to Dec. 2020.

Month	b(X) [km]	b(Y) [km]	σ(X) [km]	σ(Y) [km]	α	β[km]	ρ	N
Jan. 2020	0,08	-0,07	3,71	4,08	0,95	0,22	0,92	867
Feb. 2020	-0,06	0,27	5,06	5,66	0,91	0,7	0,91	769
Mar. 2020	-0,75	0,63	5,58	6,34	0,89	1,17	0,9	773
Apr. 2020	0,1	0	6,15	6,04	0,89	0,52	0,87	671
May 2020	--	--	--	--	--	--	--	0
Jun. 2020	--	--	--	--	--	--	--	0
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
Last 12 months	-0.392	-0.031	5.208	5.482	0.92	0.237	0.92	4149

Table 40: Quality assessment results for the LRSID (SSMIS-F18) product (NH) for Jan. to Dec. 2020.

Comments:
OSI-405's performance statistics are degraded in H2 2020. The product itself is performing nominally (visual monitoring) but the validation statistics are degraded and below the requirements. This is because of the over-representation of the Fram Strait and East Greenland Sea area in the validation dataset. These on-ice buoys are from the MOSAiC expedition (2019-2020) and now exit the Arctic.

Due to the COVID-19 pandemic, no new SH buoys were deployed in the Antarctic, and we have no new data to validate the coverage there. This lack of validation data is expected to continue in the next half-yearly period.

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 41 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.

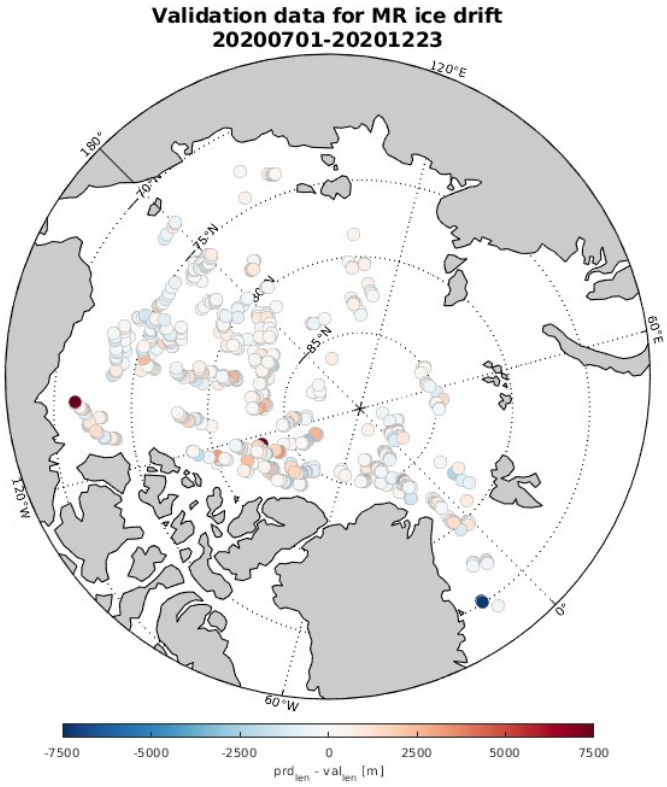


Figure 44: Location of GPS drifters for the quality assessment period (2nd half 2020). The shade of each symbol represents the difference (prod-def) in drift length in meters

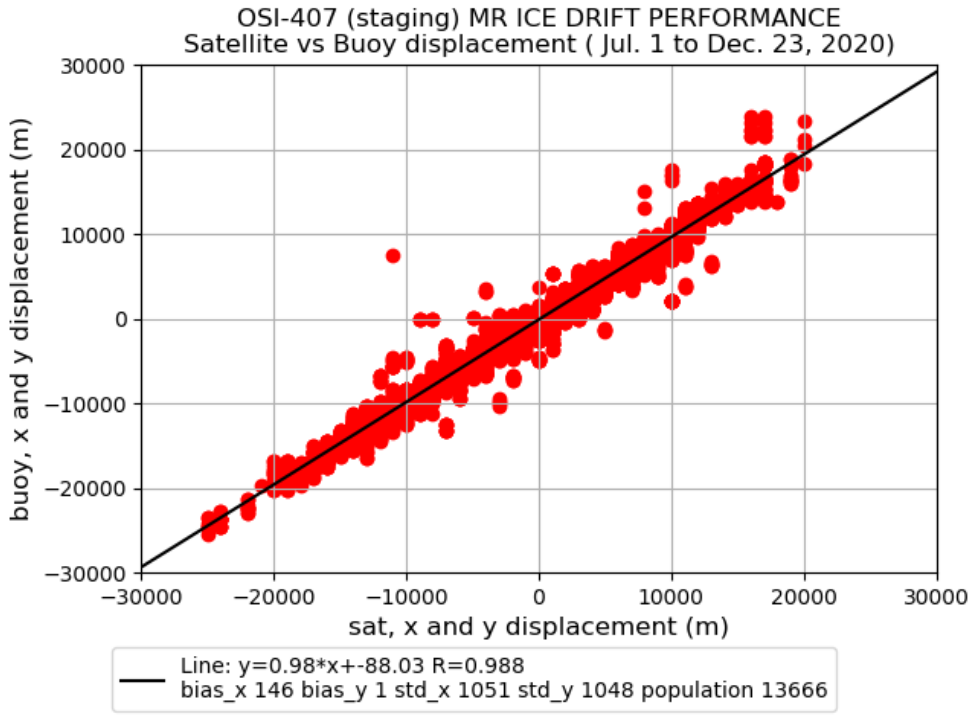


Figure 45: Scatter plot for all the observations of the buoys shown in the previous figure (2nd half 2020).

Month	b(X) [m]	b(Y) [m]	σ(X) [m]	σ(Y) [m]	α	β [m]	ρ	N
Jan. 2020	463	122	2143	1601	0.92	-232	0.894	1110
Feb. 2020	16	109	1149	1186	0.93	10	0.961	1446
Mar. 2020	31	86	1325	1282	0.95	-84	0.941	2498
Apr. 2020	-46	162	833	801	0.95	-55	0.980	1180
May 2020	221	-91	714	697	0.97	-192	0.992	742
Jun. 2020	501	113	953	819	1.05	-186	0.979	426
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
Last 12 months	139	33	1160	1099	0.97	101.8	0.983	21068

Table 41: MR sea ice drift product (OSI-407) performance, Jan. 2020 to Dec. 2020

Comments:
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 2020.

For the first half year period match-ups were found with 253 individual buoys during this period, after carrying out the automated nearest-neighbour approach.
After further quality control 149 buoys were disqualified, and the remaining 104 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):
2501542, 2501667, 2601625, 4101610, 4101622, 4101623, 4101627, 4101655, 4101658, 4101659, 4101661, 4101663, 4101664, 4101765, 4401558, 4401565, 4401568, 4401569, 4401574, 4401756, 4401825, 4401895, 4401896, 4401897, 4401898, 4401899, 4402553, 4402556, 4402558, 4402562, 4402564, 4402565, 4402566, 4402589, 4402593, 4402594, 4402597, 4402598, 4402600, 4402602, 4601550, 4701658, 4701659, 4800642, 4800769, 4801632, 4801639, 4801671, 4801674, 4801675, 4801676, 4802539, 5301764, 6202661, 6202667, 6202668, 6202669, 6202675, 6202676, 6202683, 6203549, 6203564, 6203569, 6203582, 6203585, 6203587, 6203588, 6203710, 6203718, 6301535, 6301536, 6301564, 6401561, 6401568, 6401569, 6401811, 6401814, 6401820, 6401822, 6401823, 6401824, 6402505, 6402506, 6402508, 6402509, 6402510, 6402511, 6402512, 6402513, 6402514, 6402515, 6402516, 6402517, 6402518, 6402519, 6402522, 6402524, 6402525, 6402526, 6402527, 6402528, 6402529, 6402530, 6402531, 6402532, 6402533, 6402536, 6402537, 6402538, 6402539, 6402540, 6402541, 6402542, 6501500, 6501501, 6501538, 6501542, 6501543, 6501544, 2601623, 4101662, 4101771, 4401750, 4602501, 4602502, 4602503, 4602504, 6202666, 6203550, 6203551, 6203555, 6203556, 6203562, 6203563, 6203586, 6203715, 6203719, 6301537, 6301538, 6301542, 6301681, 6301682, 6301683, 6401502, 6401547, 6401570, 6401784, 6401804, 6501556

For the second half year period 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

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 January 2019 to December 2020. 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/.

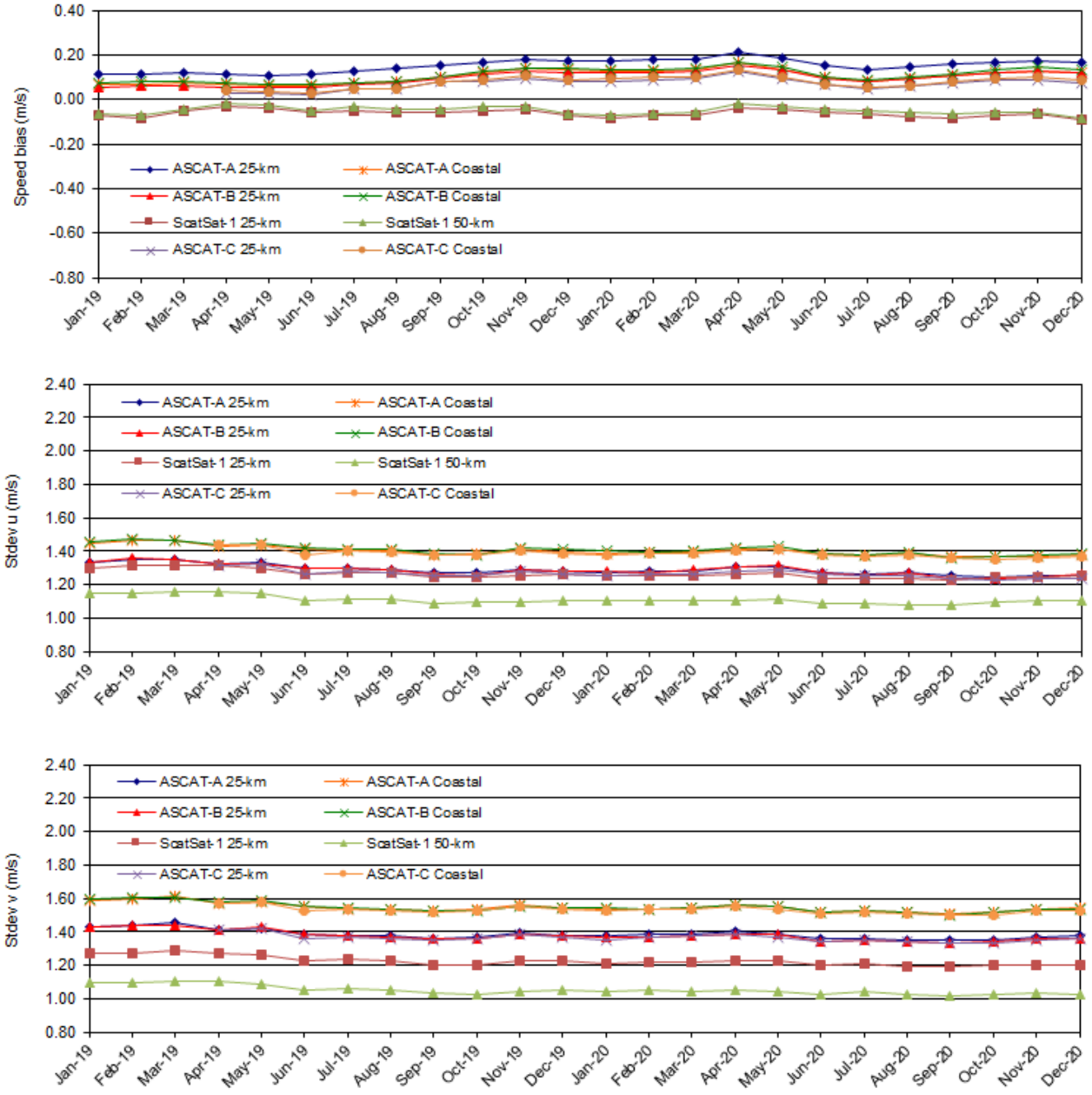


Figure 46: Comparison of scatterometer winds against ECMWF NWP forecast winds (monthly averages). For each product, the wind speed mean difference (scatterometer minus ECMWF, top), wind u component standard deviation (middle) and wind v component standard deviation (bottom) are shown.

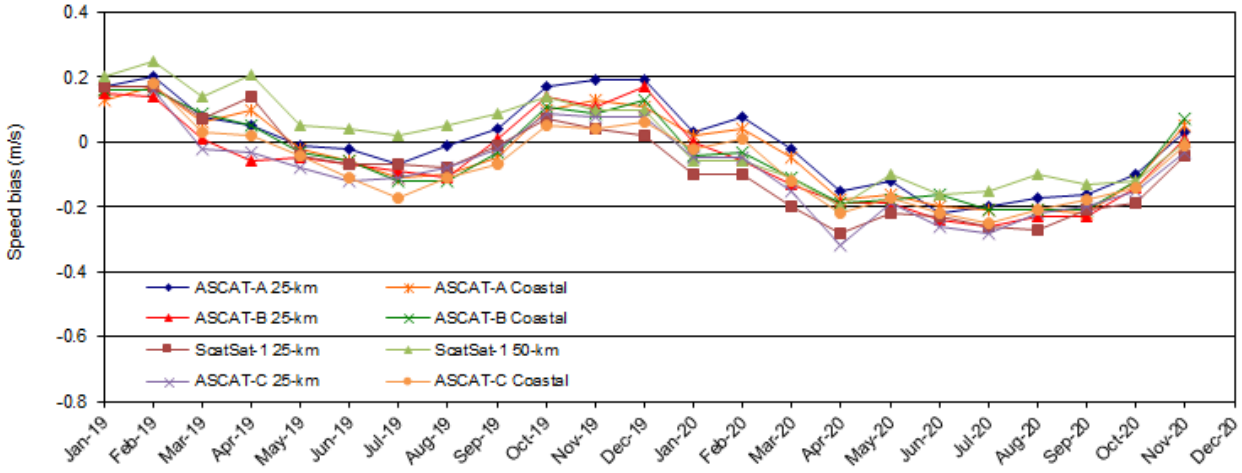
5.4.2. Comparison with buoys

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 January 2019 to November 2020. 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.



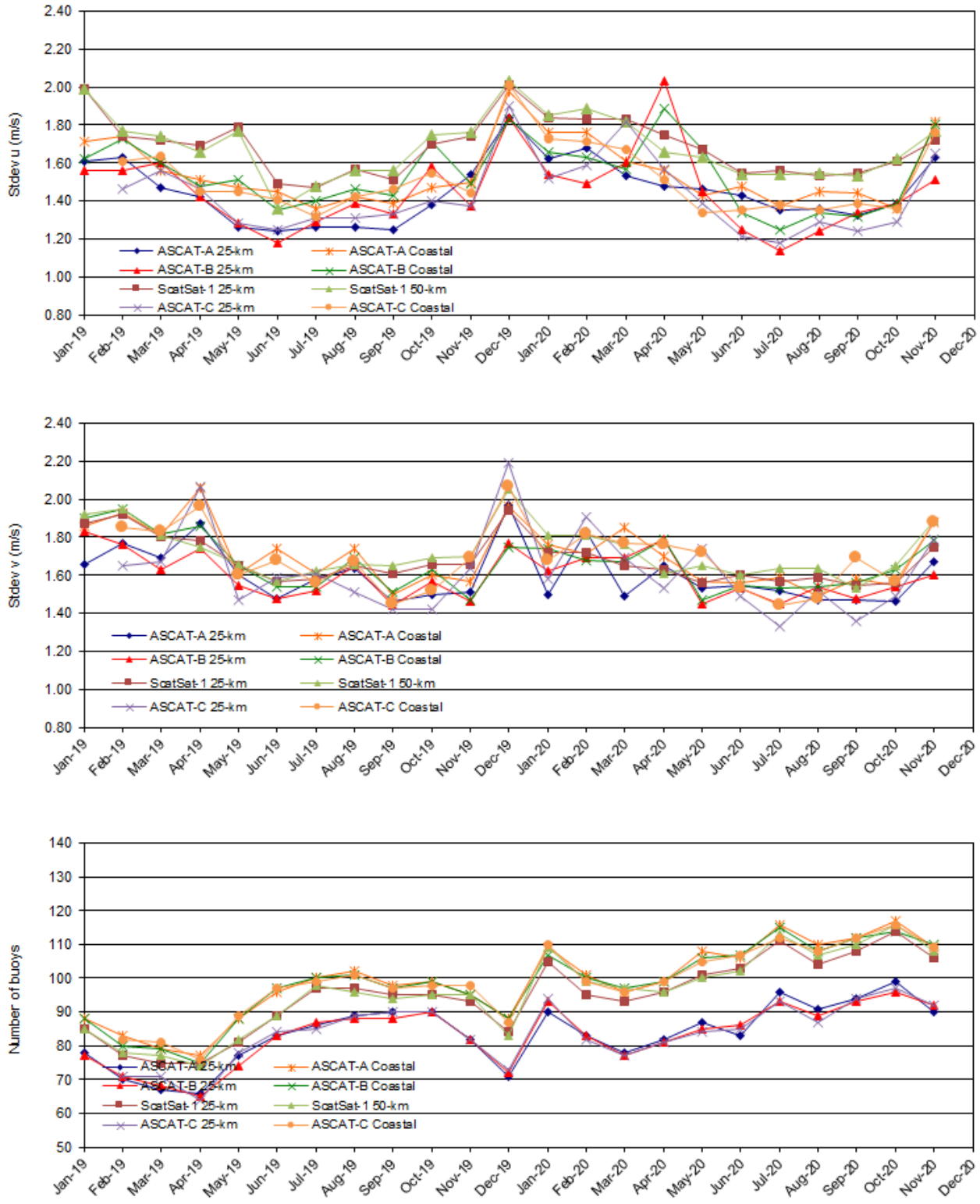


Figure 47: Comparison of scatterometer winds against buoy winds (monthly averages). For each product, the wind speed mean difference (scatterometer minus buoy, top), wind u component standard deviation (2nd plot) and wind v component standard deviation (3rd plot) are shown. Also the number of buoys available 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
Jul. 2020	1891	1262
Aug. 2020	1906	1407
Sep. 2020	1925	1659
Oct. 2020	1947	1735
Nov. 2020	1968	1535
Dec. 2020	1982	1236

Table 42: Statistics on central OSI SAF web site use over 2nd half 2020.

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

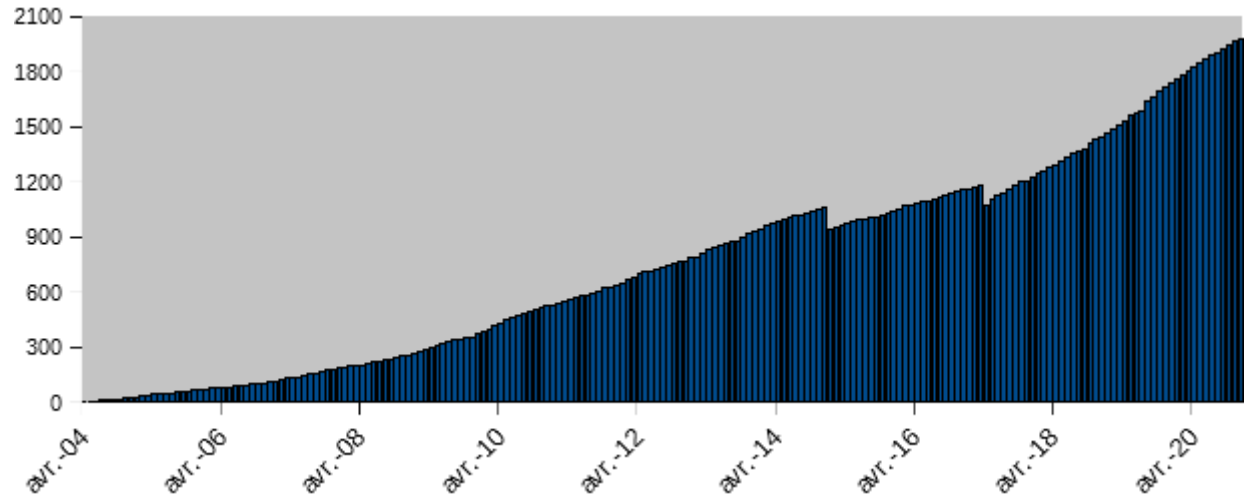


Figure 48: Evolution of external registered users on the central Web Site from April 2004 to Dec. 2020.

The following table lists the institutions or companies the new registered users (over 2nd half 2020) are from

Country	Institution, establishment or company	Acronym
Brazil	Federal University of Minas Gerais	
Brazil	Universidade de são paulo	
Brazil	Universidade Federal do Rio Grande	
Canada	LGL Ltd Environmental consultants	
China	Nanjing University of Information Science & Technology	
China	Aerospace Information Research Institute, CAS	
China	China University of Geoscience, Beijing	
China	Chinese Academy of Meteorological Sciences	
China	Chinese Academy of Sciences	
China	Chinese Academy of Sciences	
China	Fudan University	
China	Guangdong Ocean University	
China	National Satellite Meteorological Center, CMA	
China	National Satellite Ocean Application Service	
China	Ocean University of China	
China	Xiamen University	
China	Xiamen University	
Denmark	Danish Meteorological Institute	
Denmark	Danish Meteorological Institute	
France	Collecte localisation Satellites	
Gabon	DIRECTION GENERALE DE LA METEOROLOGIE	
Germany	Alfred Wegener Institute for Polar and Marine Research	
Germany	Alfred Wegener Institute for Polar and Marine Research	
Germany	Institute of Environmental Physics, Uni Bremen	
India	Bharathidsan University	
India	India Meteeorological Department	
India	Indian Navy	
India	Teri School of Advanced Studies	
Indonesia	The National Institute of Aeronautics and Space of Indonesia	
Iran	Oceanic and Atmospheric science Center, IRIMO	
Iran	University of Hormozgan	
Japan	Kyushu University	
Korea	Pusan National University	
Lebanon	Beirut arab university	
Morocco	Center of remote sensing applications	
Morocco	Direction de la Météorologie Nationale du Maroc	
Netherlands	Delft University of Technology	
Norway	Institute of Marine Research	
Norway	Norwegian Meteorological Institute	
Norway	Norwegian Meteorological Institute	
Norway	University Centre in Svalbard	
Portugal	Instituto Português do Mar e da Atmosfera	
Portugal	Oceanic Observatory of Madeira	

Country	Institution, establishment or company	Acronym
Russian Federation	Arctic and Antarctic Research Institute	
Singapore	National University of Singapore	
Spain	Univeritat de les Illes Balears	
Spain	Universitat Politècnica de Catalunya	
Sri Lanka	University of Colombo	
Sweden	NTI Gymnasiet Johanneberg	
Taiwan	National Central University	
Turkey	Türkish State Meteorological Services	
United Kingdom	Met Office	
United Kingdom	University of Cambridge	
United States	Louisiana State University	
United States	Marine Hydrophysical Institute	
United States	National Oceanic and Atmospheric Administration	
United States	University Corporation for Atmospheric Research	
United States	University of Colorado Boulder	
United States	University of Jaén	
United States	University of Maryland, College Park	

Table 43: List of institutes of the new registered users over 2nd half 2020 on the central Web Site

Moreover 41 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 2nd half 2020 (pages views)						
Countries	Jul. 2020	Aug. 2020	Sep. 2020	Oct. 2020	Nov. 2020	Dec. 2020
United State	539	618	739	765	679	520
China	191	211	248	272	215	224
United Kingdom	77	111	122	100	106	115
France	134	79	104	117	107	80
Japan	38	26	41	35	28	22
Spain	24	20	31	43	26	31
Korea	22	48	32	26	34	11
Germany	27	20	27	32	44	18
Russian Federation	18	28	34	33	31	20
Netherlands	12	20	40	54	17	18
Others/Commercial	24	46	33	45	64	41

Table 44: Usage of the OSI SAF central Web Site by country (top 10) over 2nd half 2020

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 12. All requests were acknowledged or answered within three working days. 7 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 20. All requests were acknowledged or answered within three working days. 17 were categorized as ‘info’, 1 as ‘archive’, 1 as ‘unavailable’ and 1 as ‘anomaly’.

The total number of OSI SAF helpdesk inquiries at scat@knmi in this half year was 25. All requests were acknowledged or answered within three working days. 20 were categorized as ‘info’, 4 as ‘archive’ and 1 as ‘unavailable’ (referring to a ScatSat-1 outage).

6.1.2. Statistics on the OSI SAF Sea Ice Web portal

The following graph illustrates the evolution of sites/visitors on the OSI SAF High Latitude portal (http://osisaf.met.no/), as defined by the analysis software webalizer. This only include the numbers from the website osisaf.met.no. As we have been moving to the new website with address osisaf-hl.met.no during the end of 2020, this trend is decreasing. The next HYR report will contain only visits to the new website, which is analysed with a different analysis software.

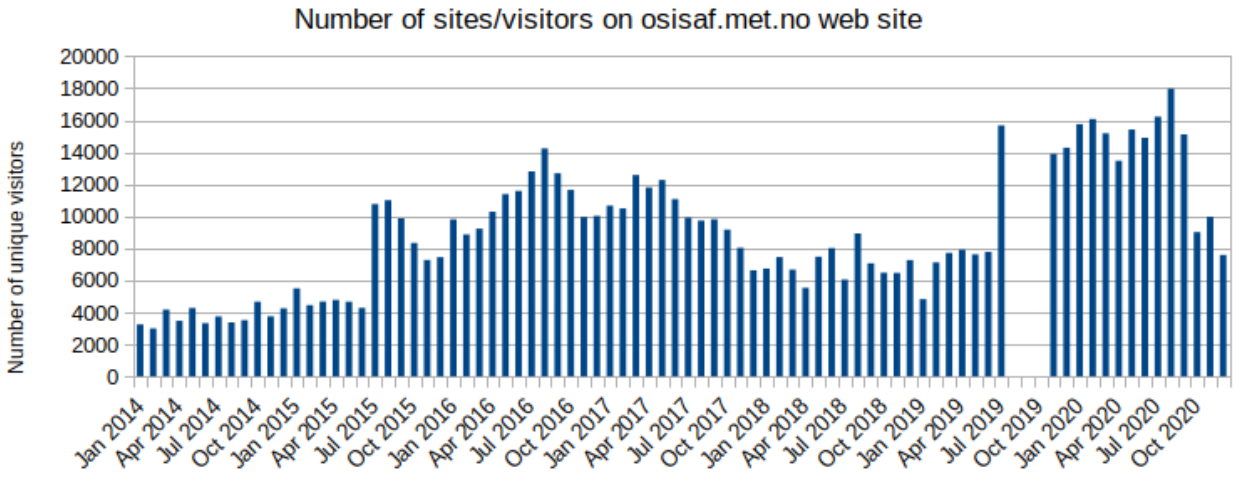


Figure 49: Evolution of sites/visitors on the HL OSI SAF Sea Ice portal from January 2014 to Dec. 2020 (http://osisaf.met.no), as defined by the analysis software webalize

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 Dec. 2020. Only external sessions (from outside KNMI) are counted.

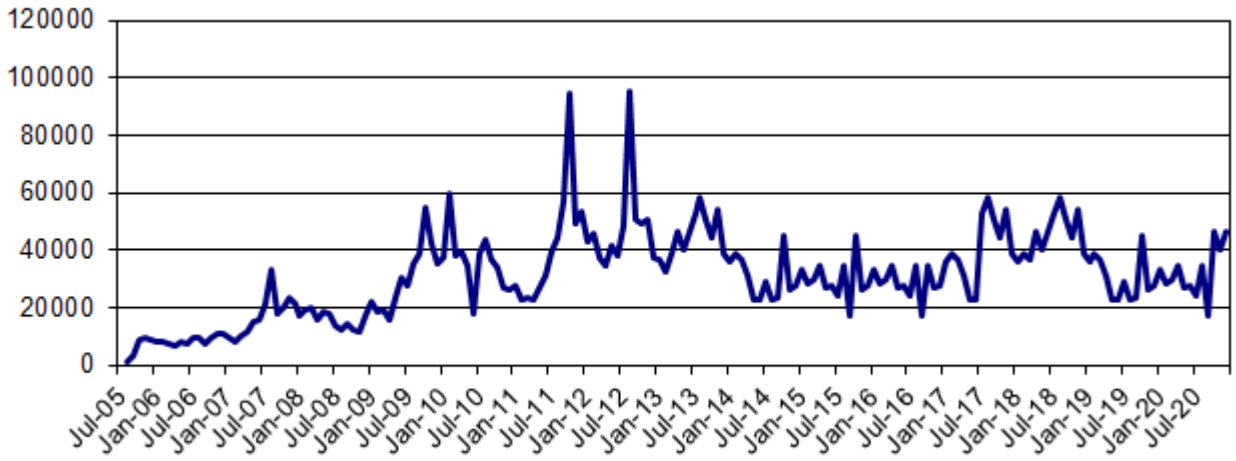


Figure 50: Number of page views on KNMI scatterometer website per month

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

Entity	**Country**
China University of Geosciences (Wuhan)	China
National Central University	China
AdaptiveMeteo S.R.L.	Italy
Iranian national institute for oceanography and atmospheric science	Iran
Surfline Wavetrak Inc.	USA
Fudan University	China

Table 45: 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.

		Jul. 2020		Aug. 2020		Sep. 2020		Oct. 2020		Nov. 2020		Dec. 2020	
		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	580 / 4956	228	709 / 4826	190	628 / 3846	3611	1676 / 2284	248	709 / 1409	339	722 / 2509	248
OSI-202 series	NAR SST	547	316	529	322	645	356	736	441	663	368	521	1204
OSI-204 series	MGR SST	213988 / 0	34617	208454 / 528	35077	226724 / 496	1336654	251611 / 530	49939	403819 / 470	46565	309159 / 545	36486
OSI-206 series	Meteosat SST	10644	2499	12205	3186	9220	2869	47885	6018	9372	2768	19077	15821
OSI-207 series	GOES-East SST	1474	0	1496	0	1624	4	2187	23618	2185	6500	2195	0
OSI-IO-SST	Meteosat-8 SST	30617	11991	28459	717	29026	949	26311	4166	30887	1407	31845	1239
OSI-208 series	IASI SST	34186	1036	37283	0	38327	4104	53167	18207	36110	13248	39341	13188
OSI-250	Meteosat SST Data record	0		1		0		0		0		0	
OSI-303 series	Meteosat DLI	91381	x	91041	x	87184	x	83012	x	91639	x	100883	x
OSI-304 series	Meteosat SSI	91381	x	91041	x	87184	x	83012	x	91639	x	100883	x
OSI-305 series	GOES-East DLI	3494	x	23936	x	8764	x	4258	x	9943	x	16507	x
OSI-306 series	GOES-East SSI	3494	x	23936	x	8764	x	4258	x	9943	x	16507	x
OSI-IO-DLI	Meteosat-8 DLI	3096	x	2772	x	2933	x	3783	x	4466	x	4618	x
OSI-IO-SSI	Meteosat-8 SSI	3096	x	2772	x	2933	x	3783	x	4466	x	4618	x

Table 46: Number of OSI SAF products downloaded from Ifremer FTP server and PO.DAAC server over 2nd half 2020.

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

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

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

OSI SAF HL FTP server		Jul. 2020	Aug. 2020	Sep. 2020	Oct. 2020	Nov. 2020	Dec. 2020
OSI-401 series	Global Sea Ice Concentration (SSMIS)	66007	72506	143925	99493	66672	45894
OSI-402 series	Global Sea Ice Edge	6989	54668	44758	5644	7827	55192
OSI-403 series	Global Sea Ice Type	87876	59282	98813	61451	61108	28924
OSI-404 series	Global Sea Ice Emissivity	63	62	61	65	63	723
OSI-405 series	Low resolution Sea Ice Drift	25062	11889	19645	9804	23253	52130
OSI-407 series	Medium resolution Sea Ice Drift	5353	135	6785	357	508	6570
OSI-408 series	Global Sea Ice Concentration (AMSR-2)	2373	1546	1872	10998	8028	3063
OSI-409	Ice Concentration Data Record v1.2	7410	20477	106309	8917	6634	10173
OSI-430	Ice Concentration ICDR v1.2	330	5809	325	4370	153	3439
OSI-430-b	Ice Concentration ICDR v2.0	8532	20408	17230	18996	28041	21844
OSI-450	Ice Concentration Data Record v2.0	53896	155868	229919	81221	167515	50140
OSI-203 series	NHL L3 SST/IST	702	252	462	245	375	295
OSI-205 series	L2 SST/IST	62687	119633	5224	8289	854	893
OSI-301+OSI-302 series	AHL DLI and SSI	32	33	32	32	30	36

Table 47: Number of OSI SAF products downloaded from OSI SAF HL FTP server over 2nd half 2020

Redistribution by CMEMS and C3S		Jul. 2020		Aug. 2020		Sep. 2020		Oct. 2020		Nov. 2020		Dec. 2020	
		CMEMS	C3S	CMEMS	C3S	CMEMS	C3S	CMEMS	C3S	CMEMS	C3S	CMEMS	C3S
OSI-401 series	Global Sea Ice Concentration (SSMIS)	38149	-	46191	-	43063	-	37776	-	34778	-	51163	-
OSI-402 series	Global Sea Ice Edge	33080	-	40007	-	41722	-	36549	-	31318	-	46329	-
OSI-403 series	Global Sea Ice Type	34646	-	42692	-	40914	-	37351	-	31812	-	47261	-
OSI-405 series	Low resolution Sea Ice Drift	33936	-	43683	-	38325	-	34902	-	31491	-	44441	-
OSI-409	Ice Concentration Data Record v1.2	-	60611	-	95885	-	88782	-	139731	-	9886	-	7841
OSI-430	Ice Concentration ICDR v1.2	-	13997	-	16534	-	19175	-	37402	-	948	-	714
OSI-430-b	Ice Concentration ICDR v2.0	1744	-	778	-	5772	-	540	-	2357	-	2981	40
OSI-450	Ice Concentration Data Record v2.0	9	-	3	-	5463	-	579	-	1857	-	2130	1126

Table 48: Number of OSI SAF products redistributed by CMEMS (downloads/product/day) and C3S (number of files) over 2nd half 2020

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

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

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

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

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

		Jul. 2020		Aug. 2020		Sep. 2020		Oct. 2020		Nov. 2020		Dec. 2020	
		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	14 per file (BUFR), 18 per file (NetCDF)	92513	14 per file (BUFR), 18 per file (NetCDF)	43279	14 per file (BUFR), 18 per file (NetCDF)	60486	13 per file (BUFR), 18 per file (NetCDF)	89284	13 per file (BUFR), 18 per file (NetCDF)	79385	13 per file (BUFR), 18 per file (NetCDF)	59195
OSI-102-b	ASCAT-B 25 km	56 per file (BUFR), 18 per file (NetCDF)	80111	56 per file (BUFR), 18 per file (NetCDF)	53971	56 per file (BUFR), 18 per file (NetCDF)	87022	52 per file (BUFR), 18 per file (NetCDF)	38887	52 per file (BUFR), 18 per file (NetCDF)	63109	52 per file (BUFR), 18 per file (NetCDF)	58558
OSI-102-c	ASCAT-C 25 km	19 per file (BUFR), 9 per file (NetCDF)	21549	19 per file (BUFR), 9 per file (NetCDF)	21767	19 per file (BUFR), 9 per file (NetCDF)	25765	18 per file (BUFR), 10 per file (NetCDF)	30262	18 per file (BUFR), 10 per file (NetCDF)	37119	18 per file (BUFR), 10 per file (NetCDF)	36738
OSI-104	ASCAT-A Coastal	44 per file (BUFR), 18 per file (NetCDF)	11475	44 per file (BUFR), 18 per file (NetCDF)	6377	44 per file (BUFR), 18 per file (NetCDF)	16020	44 per file (BUFR), 18 per file (NetCDF)	27996	44 per file (BUFR), 18 per file (NetCDF)	7545	44 per file (BUFR), 18 per file (NetCDF)	21112
OSI-104-b	ASCAT-B Coastal	46 per file (BUFR), 18 per file (NetCDF)	45543	46 per file (BUFR), 18 per file (NetCDF)	13394	46 per file (BUFR), 18 per file (NetCDF)	14745	46 per file (BUFR), 18 per file (NetCDF)	85060	46 per file (BUFR), 18 per file (NetCDF)	5591	46 per file (BUFR), 18 per file (NetCDF)	25399
OSI-104-c	ASCAT-C Coastal	11 per file (BUFR), 9 per file (NetCDF)	2123	11 per file (BUFR), 9 per file (NetCDF)	3859	11 per file (BUFR), 9 per file (NetCDF)	4001	11 per file (BUFR), 10 per file (NetCDF)	20165	11 per file (BUFR), 10 per file (NetCDF)	2905	11 per file (BUFR), 10 per file (NetCDF)	8484
OSI-112-a	ScatSat-1 25 km wind vectors	68 per file (BUFR), 10 per file (NetCDF)	N/A	68 per file (BUFR), 10 per file (NetCDF)	N/A	68 per file (BUFR), 10 per file (NetCDF)	N/A	55 per file (BUFR), 9 per file (NetCDF)	N/A	55 per file (BUFR), 9 per file (NetCDF)	N/A	55 per file (BUFR), 9 per file (NetCDF)	N/A
OSI-112-b	ScatSat-1 50 km wind vectors	68 per file (BUFR), 10 per file (NetCDF)	N/A	68 per file (BUFR), 10 per file (NetCDF)	N/A	68 per file (BUFR), 10 per file (NetCDF)	N/A	55 per file (BUFR), 9 per file (NetCDF)	N/A	55 per file (BUFR), 9 per file (NetCDF)	N/A	55 per file (BUFR), 9 per file (NetCDF)	N/A

Table 49: Number of OSI SAF products downloaded from KNMI FTP server and PO.DAAC server over 2nd half 2020

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 50: 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 2nd half 2020

The table below lists the products downloaded from the EUMETSAT Data Center (EDC), the volume of the downloaded data in megabytes (MB) and the number of files over the **2nd half 2020**.

	Item	Volume in MB	Number of files
OSI-102-c	M03_OAS025_OPE	10525	2934
OSI-103 (with soil moisture)	M01_OAS025_OPE	95916	34171
OSI-103 (with soil moisture)	M02_OAS025_OPE	95966	33942
OSI-103	M02_OASW012_OPE	25923	4408
	M02_OASW025_OPE	265	332
OSI-104-a	M02_OASWC12_OPE	439166	51496
OSI-104-b	M01_OASWC12_OPE	306575	46394
OSI-104-c	M03_OASWC12_OPE	18222	2100
OSI-112-a	SCATSAT1_OSSW025_OPE	100328	52451
OSI-112-b	SCATSAT1_OSSW050_OPE	2412	402
OSI-150-b	M02_OR1ASWC12_OPE	70184	6601
OSI-153-a	OCEANSAT2_OR1OSW025_OPE	237285	39292
OSI-153-b	ERS2_OR1ERW025_OPE	5377	5020
OSI-201 series	M01_OSSTGLB_OPE	77301	647
	M01_OSSTGLBN_OPE	65091	1706
	M02_OSSTGLB_OPE	124025	5500
OSI-202 series	M02_OSSTNAR_OPE	76	8
	N20_OSSTNARN_OPE	20	1
	M01_OSSTNARN_OPE	48	2
Old NAR SST	N17_OSSTMOCC_OPE	5616	9742
	N18_OSSTMOCC_OPE	5616	5978
OSI-203 series	MML_OSSTAHL_OPE	39	57
OSI-206 series	MSG2_OSIHSSTN_OPE	67045	334
	MSG4_OSIHSSTN_OPE	108604	8967
OSI-304 series	MSG1_OSIDSSI_OPE	29885	44
	MSG2_OSIDSSI_OPE	30958	967
	MSG3_OSIDSSI_OPE	37997	3501
	MSG3_OSIHSSI_OPE	140	14
OSI-303/OSI-304 series	MSG2_ODDLISSI_OPE	8111	35
	MSG2_OHDLISSI_OPE	487879	2640
	MSG3_OHDLISSI_OPE	41478	1
	MSG4_ODDLISSI_OPE	9702	784
	MSG4_OHDLISSI_OPE	658724	74470
OSI-401 series	MML_OSICOGBN_OPE	46260	2589
OSI-402 series	MML_OSIEDGB_OPE	6	46
	MML_OSIEDGBN_OPE	622	142
OSI-403 series	MML_OSITYGBN_OPE	19647	2367
OSI-405 series	MML_OSIDRGB_OPE	9086	17052
OSI-407 series	M01_OMRSIDRN_OPE	33196	3858
OSI-407 series	M02_OMRSIDRN_OPE	17250	553
	MML_OR2017SICOGB_OPE	16697	1694

Table 51: Volume of data downloaded (in MB) by products from EDC over 2nd half 2020.

Ingestion Summary over the 2nd half 2020

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

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

Product id.	Product name	Jul. 2020	Aug. 2020	Sep. 2020	Oct. 2020	Nov. 2020	Dec. 2020
OSI-404	Global Sea Ice Emissivity (DMSP-F18)	100	100	100	100	100	100
OSI-305-a	Daily Downward Longwave Irradiance (GOES-16)	100	100	100	100	100	100
OSI-306-a	Daily Surface Solar Irradiance (GOES-16)						
OSI-305-a	Hourly Downward Longwave Irradiance (GOES-16)	99.3	98.5	100	100	100	100
OSI-306-a	Hourly Surface Solar Irradiance (GOES-16)						
OSI-207-a	Hourly Sea Surface Temperature (GOES-16)	99.0	97.7	100	100	100	100
OSI-408	Sea Ice Concentration (AMSR-2)	100	100	100	100	100	100
OSI-102-b	ASCAT 25km Wind (Metop-B)	100	99.5	100	100	99.7	100
OSI-104-b	ASCAT 12.5km Coastal Wind (Metop-B)	100	99.5	100	100	99.7	100
OSI-102	ASCAT 25km Wind (Metop-A)	100	99.5	100	100	96.5	100
OSI-104	ASCAT 12.5km Coastal Wind (Metop-A)	100	99.7	100	100	96.5	100
OSI-102-c	ASCAT 25 km Wind (Metop-C)	99.7	100	100	100	100	100
OSI-104-c	ASCAT 12.5 km Coastal Wind (Metop-C)	99.7	100	100	100	100	100
OSI-201-b	Global Sea Surface Temperature (Metop-B)	100	98.3	100	100	100	100
OSI-202-b	NAR Sea Surface Temperature (Metop-B)	98.3	98.3	100	96.7	100	100
OSI-202-b	NAR Sea Surface Temperature (NPP)	100	98.3	100	100	100	NA
OSI-202-c	NAR Sea Surface Temperature (NOAA-20)	NA	NA	NA	NA	100	100
OSI-407-a	Sea Ice Drift (Multi Mission)	100	100	100	99.1	100	99.2
OSI-205-a	SST/IST L2 (Metop-B)	100	100	100	100	100	100
OSI-205-b	SST/IST L2 (NPP)	100	100	100	99.7	97.0	100
OSI-203-a	SST/IST L3 (Metop-B)	100	100	100	100	96.7	100
OSI-203-b	SST/IST L3 (NPP)	100	100	100	100	100	100
OSI-401-b	Global Sea Ice Concentration (Multi Mission)	100	100	100	100	100	100
OSI-405-c	Global Low Resolution Sea Ice Drift	100	99.1	98.3	100	100	100
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	96.7	100	100	100	100
OSI-304-a	Daily Surface Solar Irradiance (MSG)						
OSI-303-a	Hourly Downward Longwave Irradiance (MSG)	100	97.9	100	100	100	99.8

Product id.	Product name	Jul. 2020	Aug. 2020	Sep. 2020	Oct. 2020	Nov. 2020	Dec. 2020
OSI-304-a	Hourly Surface Solar Irradiance (MSG)						
OSI-206-a	Hourly Sea Surface Temperature (MSG)	100	98.2	100	100	100	100
OSI-112-a	ScatSat-1 25 km wind vectors	100	100	100	100	100	100
OSI-112-b	ScatSat-1 50 km Wind vectors	100	100	100	100	100	100

Table 52: Percentage of received OSI SAF products in EDC in 2nd half 2020

7. Recent publications

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