

SENTINEL-3 SLSTR DATA AND MARINE OPERATIONS



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**GHRSSST Science Team Meeting
20-24 July 2015
ESA-ESTEC, The Netherlands**



Outline

- Products and formats
- Data access and Marine operations
- Cal/Val activities

EUMETSAT support for Copernicus Marine Service

YEAR 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39

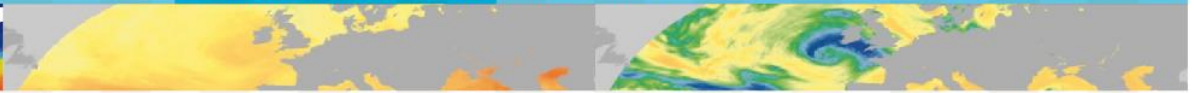
METEOSAT SECOND GENERATION (MSG)



SEA SURFACE TEMPERATURE

WATER TURBIDITY
SEVIRI

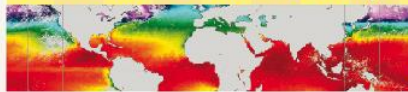
METEOSAT THIRD GENERATION (MTG)



INCOMING RADIATIVE FLUXES

CASE-1 CHLOROPHYLL
FCI

EUMETSAT POLAR SYSTEM (EPS)



SEA SURFACE TEMPERATURE

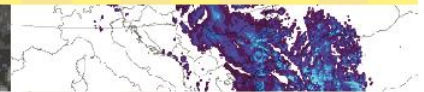


SEA ICE

MULTI-VIEW POLARIMETER
APPLICATIONS, 3MI



SEA SURFACE WIND



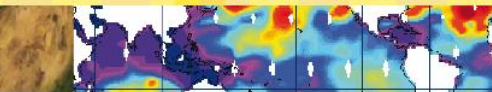
PRECIPITATION

HPOA (JASON-2, -3)

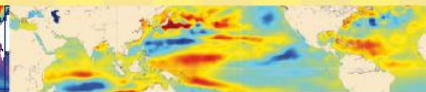


SEA SURFACE TOPOGRAPHY

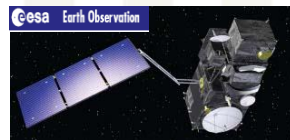
HPOA (JASON-CS)



WAVE HEIGHT



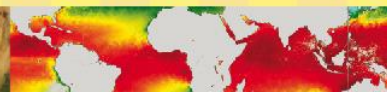
MEAN SEA LEVEL



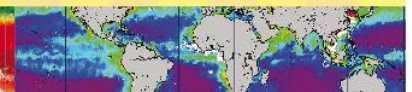
COPERNICUS SENTINEL-3



SEA SURFACE TOPOGRAPHY

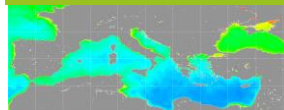


SEA SURFACE TEMPERATURE

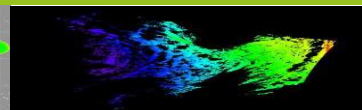


OCEAN COLOUR

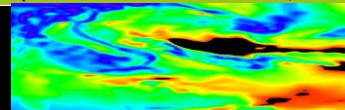
COPERNICUS CONTRIBUTING THIRD PARTY DATA (US Suomi-NPP VIIRS, JPSS, China, India, Japan...)



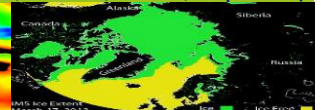
OCEAN COLOUR



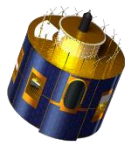
SEA SURFACE TEMPERATURE



SEA SURFACE WIND



SEA ICE



Products and formats

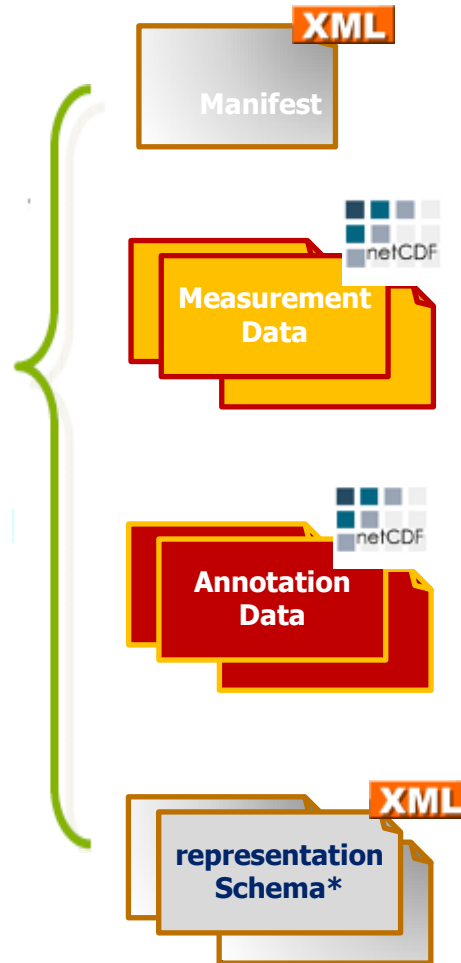
SLSTR marine products

Product	EUMETCast	ODA	Data Centre (UMARF)	Timeliness	Dissemination Unit size
SLSTR L1B RBT		✓	✓	NRT, NTC	Frame (3 min)
	-> Available from both ESA and EUMETSAT				
SLSTR L2 WST (following GHRSSST L2P GDS2)	✓	✓	✓	NRT	Full orbit: dump *changed to 3mins*
		✓	✓	NTC	Full orbit: South Pole to South Pole
-> Available from EUMETSAT					
SLSTR L2 WCT (individual algorithms)	Internal products		✓	NRT	Full orbit: dump *changed to 3mins*
			✓	NTC	Full orbit: South Pole to South Pole
-> Available from EUMETSAT to Sentinel-3 Validation Team and special users					

Sentinel 3 SAFE Package Structure



A Sentinel-3 product package is a folder holding a collection of XML and binary files (either NetCDF and/or raw binary based)



XML file containing the package metadata (e.g. sensor name, sensing start/stop, etc.) and providing as well the hierarchic structure of the product.

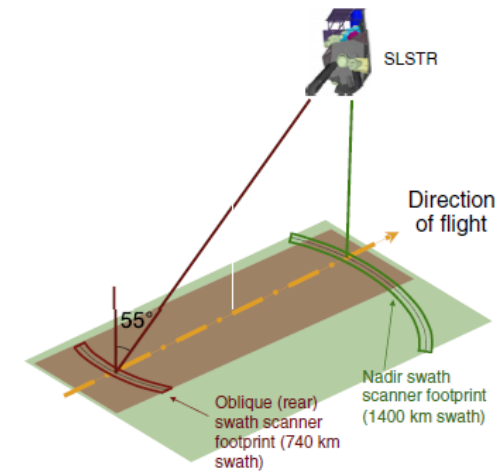
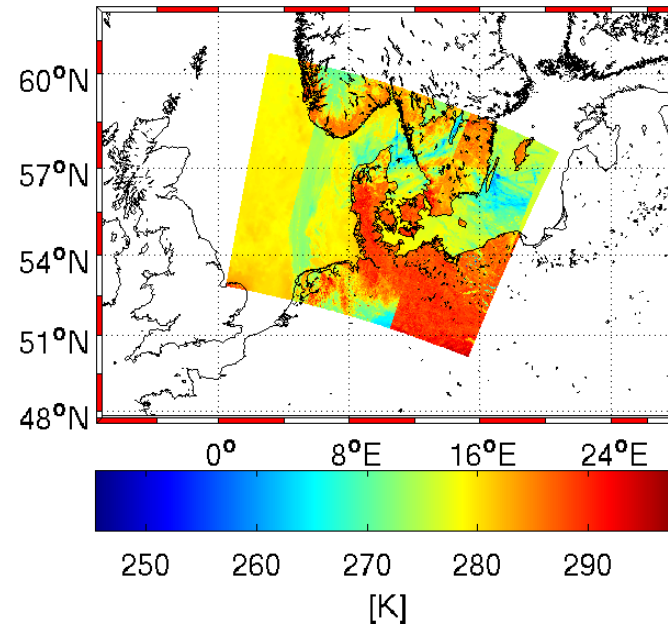
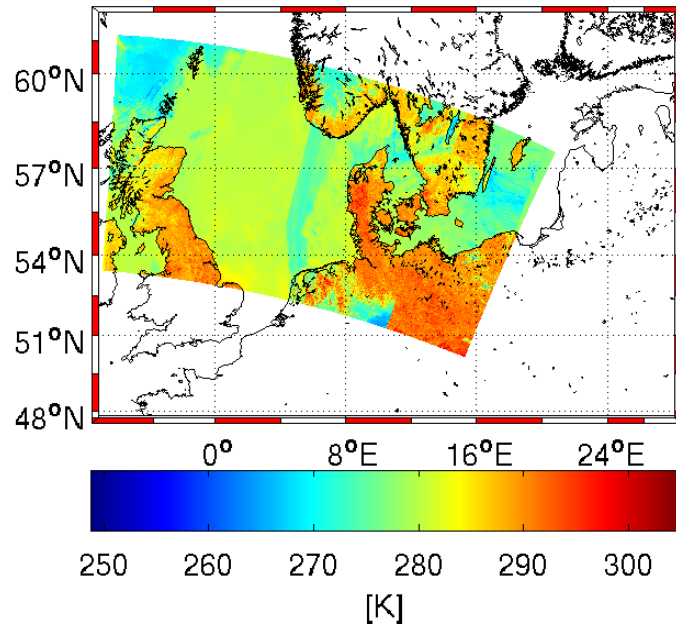
netCDF4** file(s) containing data derived from measurements (also called geophysical product or scientific data).

netCDF4** file(s) containing data that have not been derived from instrument measurements (e.g. geo-location, meteorological data, etc.); such information are applicable to multiple Measurements Data Files of the same package.

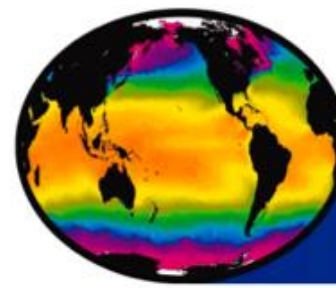
XML file(s) containing the schema of the Measurement/annotation data

L1 RBT: Radiance and brightness temperature product

111 files in package: 34 measurement data files, 76 annotation data files, 3 different resolutions, oblique and nadir views, image grid (but with ability to go to instrument grid)



Poster -> Experiences with Sentinel-3 Optical Sensor L1 and L2 Products, Igor Tomazic et al



Follows GHRSSST L2P (GDS2r5)

- NetCDF4
- Level-2 swath product
- Skin Sea Surface Temperature (one of D3, N3, D2, N2, N3R)
- Auxiliary ECMWF wind-speed, sea-ice fraction, background SST
- Aerosol dynamic indicator – Saharan Dust Index
- Uncertainty estimates: SSES, pixel theoretical uncertainty
- Experimental fields: nedt, nadir BTs.

-> Distributed by EUMETSAT

L2 WCT: Single algorithm SST

- NetCDF4
- Level-2 swath product
- Skin Sea Surface Temperature
- Separate products for D3, N3, D2, N2, N3R
- Uncertainty estimates: pixel theoretical uncertainty

-> Internal products only, available to Sentinel-3 Validation Team and special users.

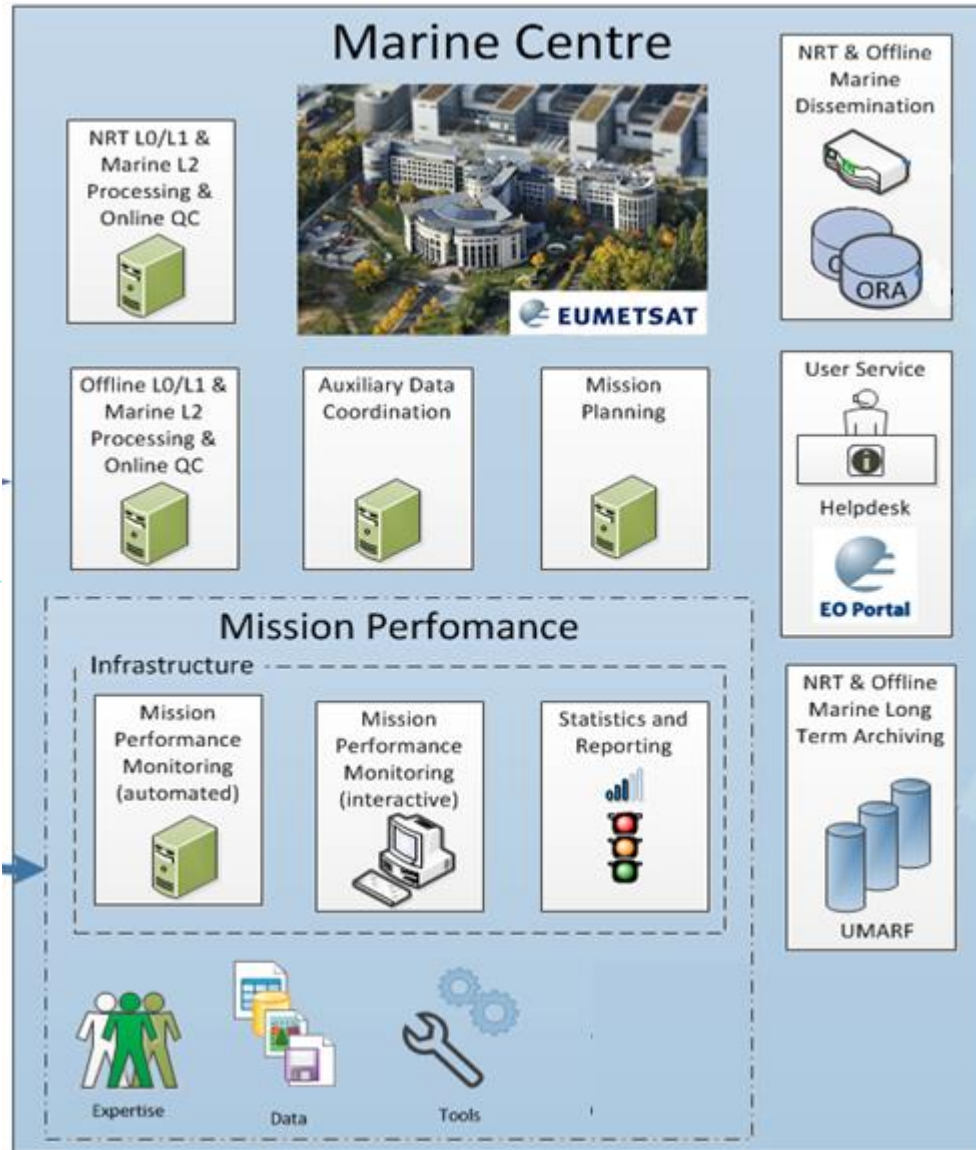
SLSTR Sea Surface Temperature

- Five single SST algorithms (view/time of day/aerosol) derived from weighted combinations of BTs measured in both views (nadir and oblique) by the thermal channels.
- Weights are functions of viewing geometry and WV loading.
- Pre and post operational activities on inter-algorithm adjustments
- Lake Surface Water Temperature to be provided in the L2P (initially using SST retrieval).

-> Sentinel-3 SLSTR products guides and ATBD's available from <https://sentinel.esa.int/web/sentinel/user-guides/sentinel-3-slstr>

Data access and marine operations

EUMETSAT Sentinel-3 Marine Centre



User Support

User Registration & Support, Product Discovery Helpdesk, etc

EUMETCast

Traditional method of disseminating NRT data in EUMETSAT. Can involve satellite and terrestrial methods.

Online Data Access (ODA)

Rolling archive of 1 month of data supporting ftp/http access

EUMETSAT Data Centre

Complete historical archive of all EUMETSAT data including S-3 marine data

Sentinel-3 information from EUMETSAT

EUMETSAT pages being populated:

<http://www.eumetsat.int/website/home/TechnicalBulletins/CopernicusUserPreparation/index.html>

The screenshot shows the EUMETSAT website interface. At the top, the EUMETSAT logo is on the left, and the tagline 'MONITORING WEATHER AND CLIMATE FROM SPACE' is in the center. A search bar is on the right. Below the header is a navigation menu with 'HOME', 'IMAGES', 'ABOUT US', 'SATELLITES', 'DATA', and 'NEWS'. A 'QUICK LINKS' section is also present. The main content area features a 'TECHNICAL BULLETINS' banner with a satellite image. Below this, the 'S-3 PRODUCTS' section is highlighted. It contains text about Sentinel-3 products for the marine environment, including Near-Real-Time (NRT), Short-Time-Critical (STC), and Non-Time-Critical (NTC) products. A map of the European Seas is shown. A sidebar on the right lists various services and links, including 'WELCOME', 'CLIMATE SERVICE', 'COPERNICUS USER PREPARATION', 'DATA CENTRE', 'EUMETCAST', 'IASI', 'GOME-2', 'TRAINING', '@EUMETSAT USERS', and 'RELATED LINKS'. At the bottom, there are checkboxes for 'ALTIMETRY', 'OCEAN COLOUR', and 'SEA SURFACE TEMPERATURE'.

The screenshot shows the 'Previous Copernicus User Preparation' section. It features a 'Marine Centre' diagram with arrows pointing to 'User Services', 'EUMETSAT', 'NRT, STC & NTC-USA', and 'Data Centre Europe'. Below this are four main sections: 'S-3 DATA ACCESS', 'S-3 FORMATS', 'COPERNICUS USERS INFORMATION DAY', and 'SENTINEL-3 VALIDATION TEAM (S3VT)'. Each section has a brief description of its content.

S-3 DATA ACCESS
As part of Copernicus EUMETSAT will be responsible for the operation of the Sentinel-3 Payload Data Ground Segment (PDGS), providing access to marine data.

S-3 FORMATS
Sentinel data products are distributed using a Sentinel-specific variation of the Standard Archive Format for Europe (SAFE) format specification.

COPERNICUS USERS INFORMATION DAY
Registration is now open for the Copernicus Users Information Day on access to Marine Data Stream, being held at EUMETSAT on 11 September.

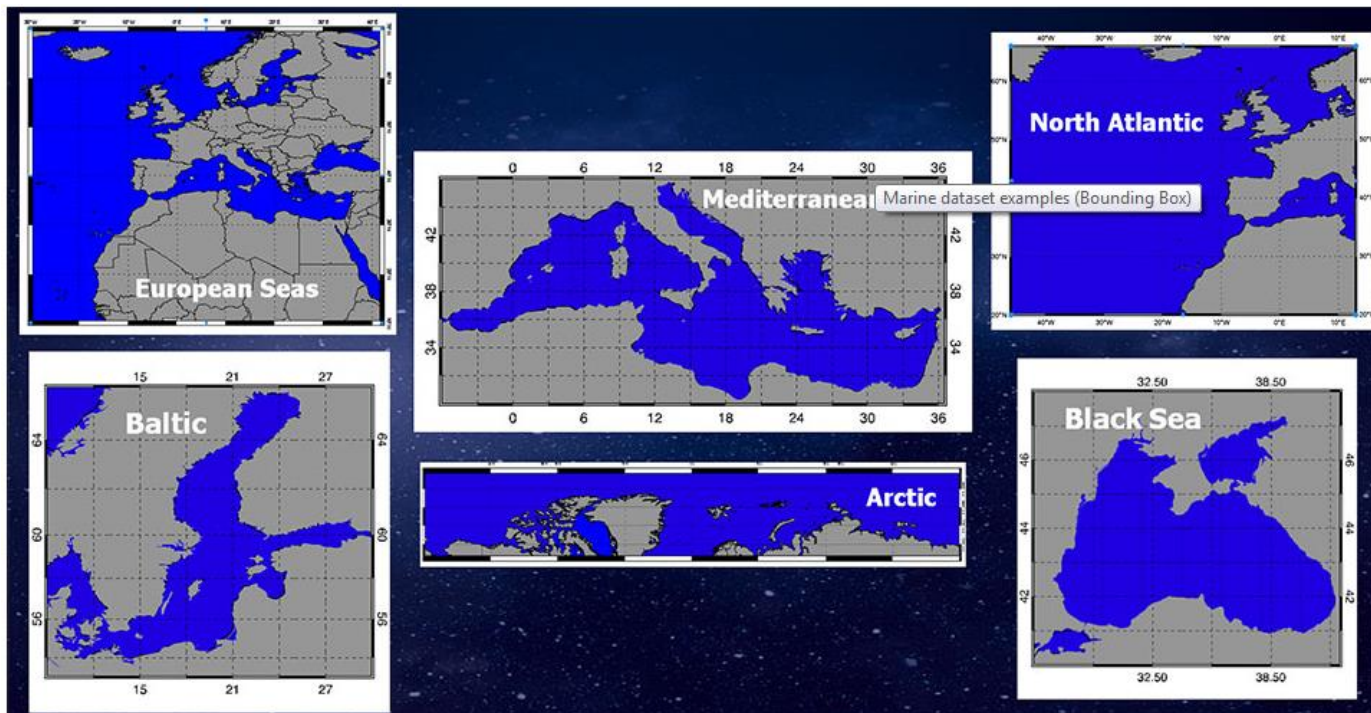
SENTINEL-3 VALIDATION TEAM (S3VT)
This section contains information on the Sentinel-3 Validation Team (S3VT) and will be regularly updated.

Look out for: test data sets; documentation; tools;
Quick-looks; Cal/Val monitoring analysis plots and time-series

Product navigator and “datasets”

- Global products available from EUMETCast, ODA, and/or archive
- Regional “datasets” available from ODA

The screenshot shows the EUMETSAT website's Product Navigator. At the top, the EUMETSAT logo and the tagline 'MONITORING WEATHER AND CLIMATE FROM SPACE' are visible. Below this is a navigation menu with options: SEARCH, SIMPLE SEARCH, EXTENDED SEARCH, BROWSE BY THEME, SETTINGS, HELP, FEEDBACK, and RESET. The main content area is titled 'PRODUCT NAVIGATOR' and displays a 'List of results' for a search query. The results list includes three entries, each with a dataset name and a brief description of the product. The first entry is 'Atlantic High Latitude Sea Surface Temperature - Multimission', the second is 'Atlantic Sea Surface Temperature - Multimission', and the third is 'Atlantic Sea Surface Temperature at Low and Mid Latitudes - Multimission'.



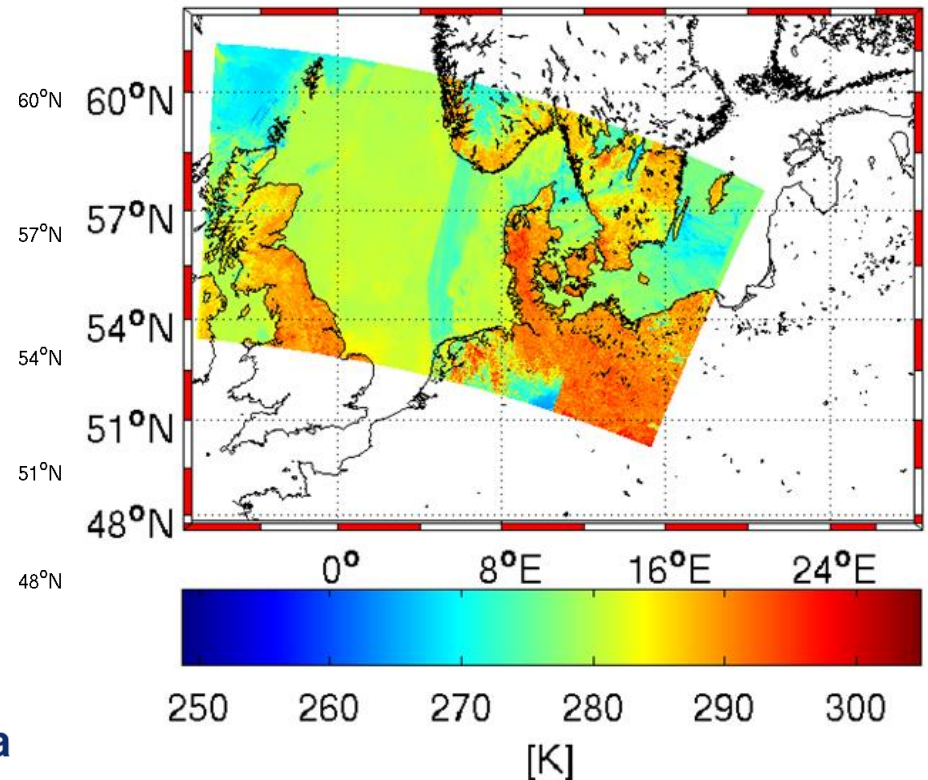
Marine dataset examples (Bounding Box)

Sentinel-3 SLSTR test data overview

Three sources:

- **ESA TDS** -> Available soon by ftp and samples from <http://sentinel.esa.int>
- **EUM TDS** -> Available from ftp://ftp.eumetsat.int/pub/EUM/out/RSP/EUM_TDS
- **35 orbits will be processed to Level-1 and Level-2**
 - > Coming soon from EUM, when processors fully integrated in ground segment

SL_1_RBT__	TDS EUM	TDS
AATSR based	Yes (based on month of data)	Yes (based on single AATSR orbit)
Duration	2 min	Orbit or 3 min
Full SLSTR swath	Yes	No (AATSR width) + missing values
Orphans	Yes	No
Duplicates, cosmetic	Yes	No
Cloud flags	Partially	Yes
Pointing flags	No	No
Extra bands	No	No



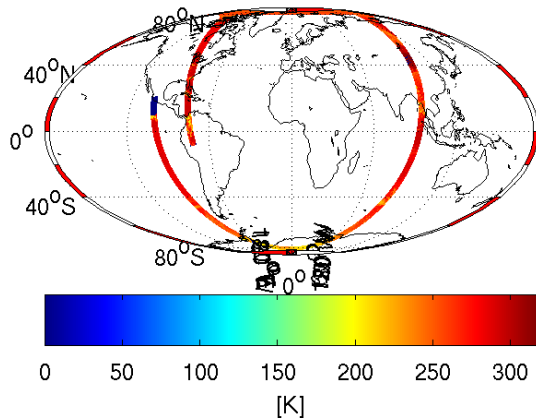
Tools available

- Manifest & filename reader (available)
- Optical S3 reader in octave/matlab & python (coming soon)
- > from EUMETSAT web-page or email igor.tomazic@eumetsat.int
- Conversion of image to instrument grid (poster)
- Calculating time of every pixel (poster)
- Others available from <http://sentinel.esa.int> e.g.S3TBX/BEAM, Felyx...
- <http://www.ifremer.fr/cerweb/docs/cerbere/>

S8_BT_in:K:

Gridded pixel brightness temperature for channel S8 (1km TIR grid, nadir view)

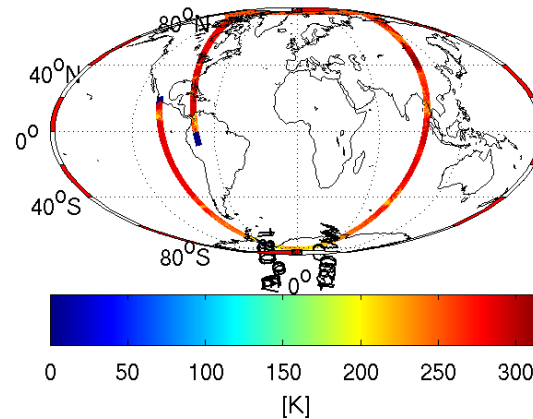
bs:257.74 std:55.56 rms:263.66 (22282240/65280000) 1500x43520
min/max: -0.0400 318.6600 nans: 42997760



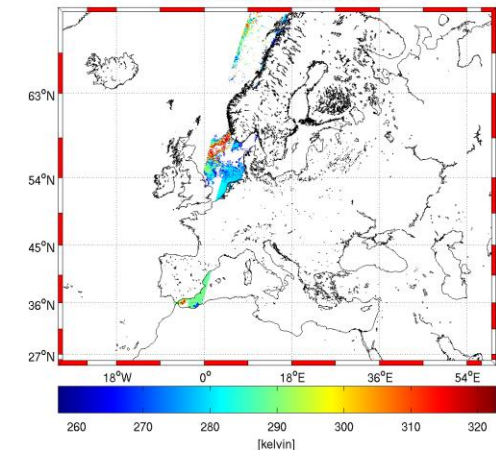
S8_BT_io:K:

Gridded pixel brightness temperature for channel S8 (1km grid, oblique view)

bs:253.43 std:58.82 rms:260.17 (22282240/39168000) 900x4:
min/max: -0.0700 318.5500 nans: 16885760

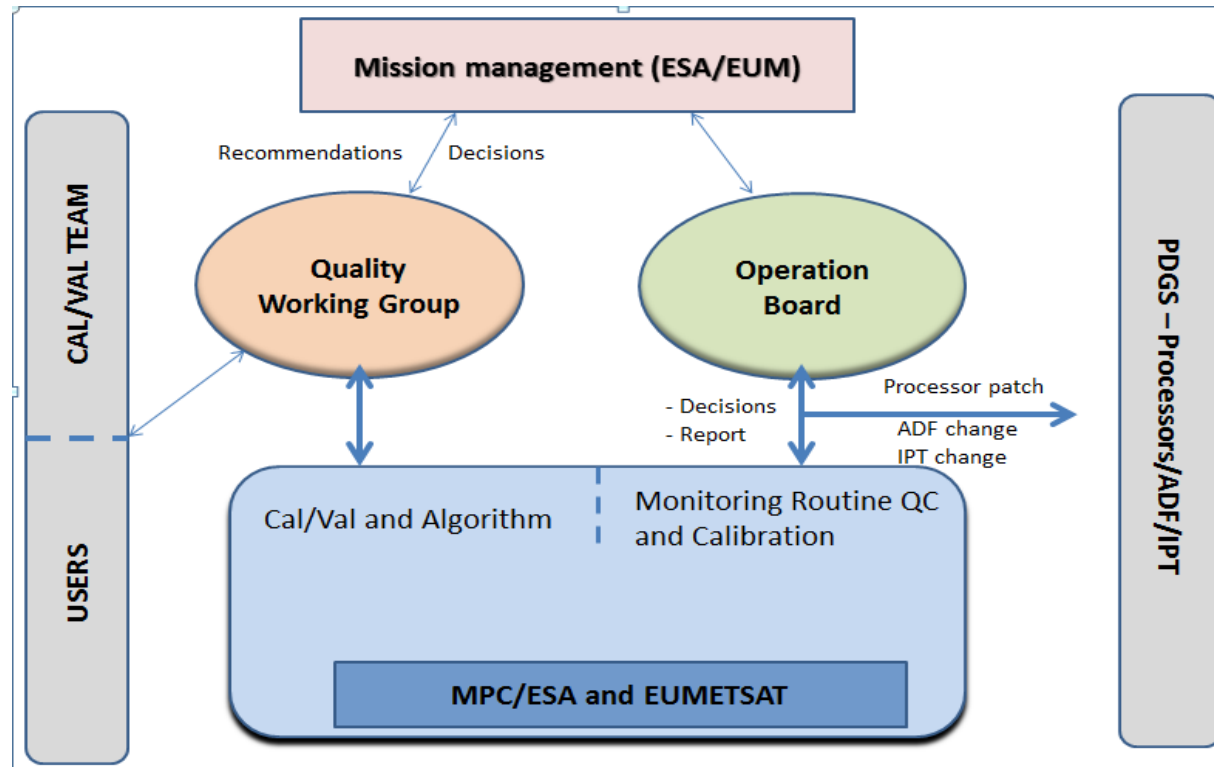


29-Dec-2007 09:49:42
sea_surface_temperature:kelvin:
sea surface temperature skin temperature
bs:283.43 std:14.05 rms:283.78 (368230/2765312) 512x5401
min/max: 257.2390 322.7670 nans: 2397082



Cal/Val activities

Mission Performance Framework



- QWGs under preparation (ESA and EUMETSAT)
- Incorporating experts from Copernicus User Community, ESA-MPC, S3VT and other relevant scientific experts and users
- To provide advice on data quality and algorithmic issues

Sentinel-3 SLSTR Cal/Val

DOCUMENT

Sentinel-3 Calibration and Validation Plan

- Operational and offline marine monitoring and validation, multi-mission approach, working together with ESA and ESA-Mission Performance Centre. Includes:

- Mission Performance Monitoring Facility (MPMF)
- L1 AVHRR/IASI/SLSTR NRT inter-comparisons
- L123 tool for NRT and offline, global and regional analysis
- OSI-SAF SLSTR MDB – NRT/NTC validation and monitoring

- Interactions with Sentinel-3 Validation Team and...

Prepared by	Helge Rebhan, Philippe Goryl
Reference	S3-PL-ESA-SY-0263
Issue	2
Revision	0
Date of Issue	21.5.2014
Status	final

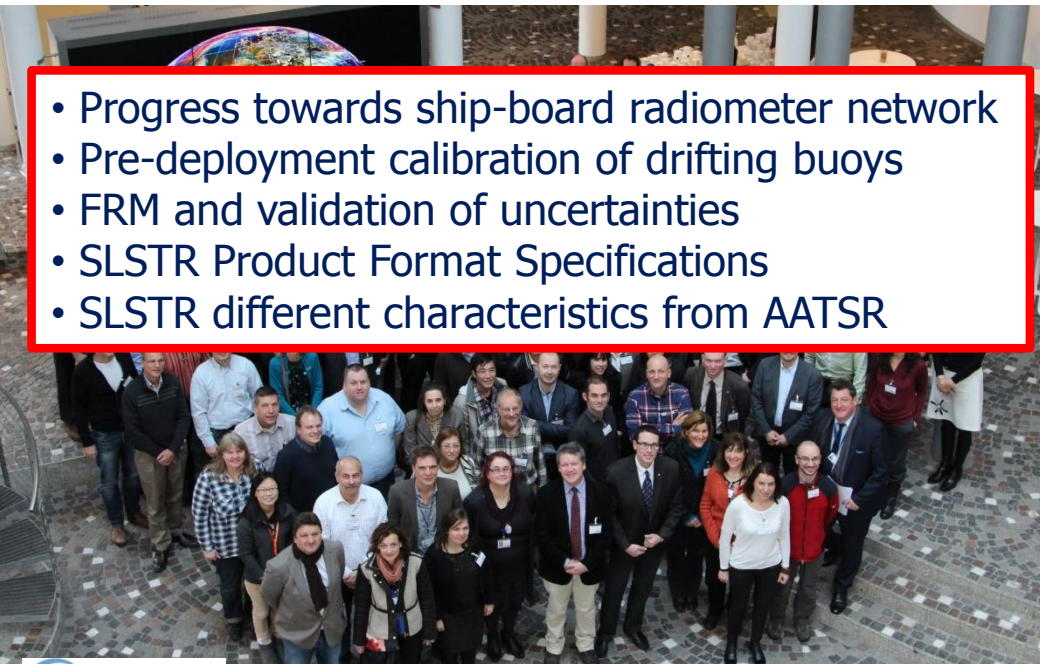
The EUMETSAT
Network of
Satellite Application
Facilities



Sentinel-3 Validation Team for Temperature

12 groups currently participating on validation using ship-board radiometers; in situ data; analysis/ model system.

- Access to SLSTR SST data (including internal products) in NRT through EUMETSAT ODA and EUMETCast, plus archive services.

- 
- Progress towards ship-board radiometer network
 - Pre-deployment calibration of drifting buoys
 - FRM and validation of uncertainties
 - SLSTR Product Format Specifications
 - SLSTR different characteristics from AATSR

More teams always welcome, please contact: Anne.Ocarroll@eumetsat.int or Craig.Donlon@esa.int for more information on how to participate

Last meeting:

http://www.eumetsat.int/website/home/News/ConferencesandEvents/DAT_2326254.html

Evolutions

In progress:

- Bayesian/probabilistic cloud detection scheme (sea and land)
- L1 Uncertainty improvements
- Additional experimental fields: dual_nadir_sst_difference & nadir_sst_theoretical_error

Considerations (including interactions with ESA MPC, QWG, S3VT):

- Dust and volcanic aerosol flags
- Utilisation of Bayesian Cloud flags in L2P
- SSES; algorithm adjustment
- Ice edge; sea-ice cloud detection

Future possibilities:

- Tailored Lake Surface Water Temperature (with SST retrieval update)
- L2P_nadir

Any questions?