

To provide operational users and the science community with the SST measured by the satellite constellation **GHRSST Products and Services**

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GHRSST PRODUCTS AND DATA MANAGEMENT OVERVIEW

Regional/Global Task Sharing





Regional Data Assembly Centers (RDACs)

- Create GHRSST-compliant data
- Some are "self-serve" but most provide their data to the...

Global Data Assembly Centers (GDACs)

- Aggregate and serve data in near real time
- Serve data for first 30 days then provides data to..

Long Term Stewardship and Reanalysis Facility (LTSRF)

 Archives and serves data for the long-term, starting 30 days after observation for most data



User requirements, services

and

feedback at

all

levels







http://www.ghrsst.org



GHRSST Data Specification (GDS)



- All GHRSST data conform to a common specification
- GHRSST Data Processing Specification (GDS) 2.0r5
- All data files are in NetCDF4 ("classic") file format
- All data files contain Climate Forecast (CF, v1.6) and Attribute Convention for Dataset Discovery (ACDD, v1.3) compliant file level metadata
- All GHRSST data products have a ISO 19115-2 compliant metadata record
- All data are free and openly available to everyone
- Some RDACs require simple registration





GHRSST Data Processing Levels



Level	GHRSST Code	Description
Level 0	LO	Unprocessed instrument and payload data at full resolution. GHRSST does not make recommendations regarding formats or content for data at this processing level.
Level 1A	L1A	Reconstructed unprocessed instrument data at full resolution, time referenced, and annotated with ancillary information, including radiometric and geometric calibration coefficients and geo-referencing parameters, computed and appended, but not applied, to L0 data. GHRSST does not make recommendations regarding formats or content for data at this processing level.
Level 1B	L1B	Level 1A data that have been processed to sensor units. GHRSST does not currently make recommendations regarding formats or content for L1B data.
Level 2 Pre- processed	L2P	Geophysical variables derived from Level 1 source data at the same resolution and location as the Level 1 data, typically in a satellite projection with geographic information. These data form the fundamental basis for higher-level GHRSST products and require ancillary data and uncertainty estimates.
Level 3	L3U L3C L3S	 Level 2 variables mapped on a defined grid with reduced requirements for ancillary data. Uncertainty estimates are still mandatory. Three types of L3 products are defined: Un-collated (L3U): L2 data granules remapped to a space grid without combining any observations from overlapping orbits Collated (L3C): observations combined from a single instrument into a space-time grid Super-collated (L3S): observations combined from multiple instruments into a space-time grid. Note that L3 GHRSST products do not use analysis or interpolation procedures to fill gaps where no observations are available.
Level 4	L4	Data sets created from the analysis of lower level data that result in gridded, gap-free products. SST data generated from multiple sources of satellite data using optimal interpolation are an example of L4 GHRSST products. GMPE products are a type of L4 dataset.





Level 2P: Common format with uncertainties







Ancillary information in L2P products: dynamic flags



http://www.ghrsst.org



Level 3: Gridded L3U, L3C, and L3S







Committee on Earth Observation Satellites Sea Surface Temperature Virtual Constellation

Helen Beggs, ABoM

Level 4: Gridded and Gap-free





http://dx.doi.org/10.6084/m9.figshare.1246151

ESA SST_CCI L4 analysis



http://www.ghrsst.org



GHRSST RDAC, GDAC, and LTSRF SERVICES

RDACs



GHRSST Data Producers - The RDACs

- Regional Data Assembly Centres
 - Provide L2P, L3U, L3C, L3S or L4 data
 - Some are "self serve", and maintain their own data access and catalog services.
 - Many rely on the GDAC/LTSRF combination for providing wide public access to their products, and connection with CEOS CWIC



GDACs and LTSRF



Global Data Assembly Centres

- Mainly real-time data distributors (up to 30 days)
- Some data retained and served for longer
- Provide a range of "value-added" services

Long-term Stewardship and Reanalysis Facility*

Long-term archive and access services

Currently conduit for GHRSST data into CEOS

* Important update: NCEI resources available for GHRSST have been reduced. GHRSST operations continue: GHRSST products that have been archived at NCEI continue to be received, archived, and made available to users. However, due to reduced resources, dedicated customer support for GHRSST products will no longer be available. User requests will have to go through the center-wide help desk and it may not be possible to meet specialized requests as effectively as in the past





GDAC and LTSRF Access Services



- Real time
 - For individual products, can go direct to relevant RDAC
 - For wide range of products, use the Global Data Assembly Centre (GDAC)
 - Primary system at NASA JPL: <u>http://podaac.jpl.nasa.gov/</u>
 - Secondary system at Ifremer: <u>http://cersat.ifremer.fr/data/collections/ghrsst</u>
 - -Requires simple registration
 - -Not all datasets are mirrored
- Delayed mode (30 days after observation)
 - -LTSRF hosted by NOAA NCEI: <u>https://ghrsst.nodc.noaa.gov</u>
 - -Many NOAA GHRSST products available in near real time
 - All have many ways to access GHRSST data
 - –FTP, HTTPS, DAP, WMS, WCS, Live Access Server, discovery services at collection and granule level such as Geoportal REST API, CSW, OpenSearch, HiTide, PO.DAAC Web Services, State of the Ocean
- Any issues please contact the GHRSST Project Office (<u>gpc@ghrsst.org</u>)





GDAC Access http://podaac.jpl.nasa.gov/







http://www.ghrsst.org





- In operations:
 - -Improved HiTide for Level 2 subsetting
 - -Improved State of the Ocean (SOTO) for visualization
 - -PO.DAAC Drive: replacement for FTP
- In final formulation:
 - -OceanXtremes: Rapid time series data anomaly analysis for SST and others
 - –MUDROD: Improved search relevance and ranking for dataset discovery
 - -Virtual Quality Screening Service: On demand SST granule quality screening
 - -CEOS COVERAGE: Coincident oceanographic grids for analysis and visualization
- See 3 posters later today on these!





GHRSST in NOAA OneStop



URL will eventually change when "soft launch" period ends, fall 2017, to <u>https://data.noaa.gov/onestop</u>



https://www.ncdc.noaa.gov/onestop *



http://www.ghrsst.org



LTSRF Data Summary Table



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https://ghrsst.nodc.noaa.gov/accessdata.html



http://www.ghrsst.org



LTSRF Archive and Services Progression

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017*
Products		22	26	27	40	59	60	62	77	84	84
Accessions		39,048	49,957	59,982	67,906	92,282	105,046	112,182	132,000	148,415	152,510
Files		679,000	993,580	1,352,901	1,662,004	2,459,724	3,290,806	3,971,657	4,894,891	5,888,939	6,173,833
Volumes (TB)		13	20	28	34	57	69	81	99	124	130
Services	ftp http	ftp http	ftp http DAP	ftp http DAP WMS WCS	ftp http DAP WMS WCS LAS	ftp http DAP WMS WCS LAS Geoportal	ftp http DAP WMS WCS LAS Geoportal Granules CWIC	ftp http DAP WMS WCS LAS Geoportal Granules CWIC	ftp http DAP WMS WCS LAS Geoportal Granules CWIC	ftp http DAP WMS WCS LAS Geoportal Granules CWIC	ftp http DAP WMS WCS LAS Geoportal Granules CWIC OneStop DSMM
Geoportal:	CSW, OpenSe Geoportal RES	earch, ST API	OneStop:	Currently On	eStop API an	d UI at	DSMM:	Data Stev	vardship Mati	urity Model A	ssessment

* As of 24 May 2017







Example tools: Live Access Server





http://www.ghrsst.org





Example tools: OPeNDAP and THREDDS



- Easy access to GDS2.0 format through OPeNDAP and THREDDS Data Servers (TDS)
- Can use IDL, MATLAB, etc., for direct access

url = 'https://podaacopendap.jpl.nasa.gov/opendap/allData/ghrsst/data/GDS 2/L4/GLOB/CMC/CMC0.2deg/v2/' \$

- + '2015/' \$
- + '311/' \$

+ '20151107120000-CMC-L4_GHRSST-SSTfnd-CMC0.2deg-GLOB-v02.0-fv02.0.nc'

file_id = NCDF_OPEN(url, /nowrite) NCDF_VARGET, file_id, 'analysed_sst', sst NCDF_CLOSE, file_id DEVICE, decomposed=0 LOADCT, 39, /silent TV, BYTSCL(sst)



No flags applied



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GHRSST Data Access Stats: JPL+NCEI



1.4 Petabytes of data in 316 million files served to over 240,000 users





Committee on Earth Observation Satellites

Sea Surface Temperature Virtual Constellation

* As of 24 May 2017

GHRSST COMMUNITY SERVICES

Community Tools: SQUAM





- Monitors differences, ΔT 's, between various satellite IR (L2/L3), analysis (L4), and *in situ* SSTs (from *i*Quam).
- Monitored are Maps, Histograms, Time Series, Dependencies, and Hovmoller diagrams

Left Outlier: Median - 4*RSD: N=12,723 (0.66%)

Right Outlier: Median + 4*RSD: N=11.294 (0.59%)

- The ΔTs should be Gaussian, centered at ~0 & narrow
- Deviations from these expected patterns suggest need to improve SST algorithms, and sensor radiances





For further information see Sasha Ignatov, Xinjia Zhou or Kai He



20

N=1.918,438

P=n/a



-0.5

-0.25

0

0.25

0.5

Community Tools: iQuam



- Near-Real Time in situ SST Quality Monitor (iQuam; <u>www.star.nesdis.noaa.gov/sod/sst/iquam/</u>)
 - Ingests various in situ SSTs (drifters, Argo floats, etc) from different sources (GTS, FNMOC, ICOADS, etc), from 1981-on
 - Performs uniform quality control and appends quality flags (all data are preserved with original QFs from data providers)
 - Supplies QC'ed data to GHRSST users via web interface
 - Monitors data product online (including global statistics, stratified by platform type, and individual platforms)







load from FTP	File Name	Update Time	
	201703-STAR-L2i OHR\$ST-\$ST-Quam-V2.00-v01.0-tv00.0.nc	2017-03-28 10:16	_
onnal. Refer to attributeo	201702-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2017-03-01 10:30	
formation.	201701-STAR-L2i GHRSST-SST-Quam-V2.00-v01.0-fv01.0.nc	2017-02-02 12:32	
usage of quality_level	201612-STAR-L2i GHR5ST-SST-Quam-V2.00-v01.0-Iv01.0.nc	2017-01-06 15:25	
natecy applications	201611-STAR-L2i GHR5ST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2016-12-02 01:13	
appleations: qually_level	201610_STAR_L2i_GHRSST_SST_iQuam_V2.00_v01.0_fv01.0.nc	2016-11-10 16:58	
ed users: refer to no of touent fields and	201609-STAR-L2i GHRSST-SST-iQuam-V2.00-v01.0-fv02.0.mc	2016-10-14 23:21	
Asps	201608-STAR-L2I_GHR5ST-SST-Quam-V2.00-v01.0-tv01.0.nc	2016-10-15 11:13	
in Kluam page are for	201607-STAR-L2i GHRSST-SST-iQuam-V2.00-v01.0-Iv02.0.nc	2016-10-15 23:33	
skoy" data only, i.e.	201606-STAR-L2I_GHRSST-SST-Quam-V2.00-v01.0-tv03.0.nc	2016-10-16 11:32	
······	201605-STAR-L2i GHR5ST-SST-iQuam-V2.00-v01.0-fv02.0.mc	2016-10-16 23:40	
her measurements in	201604-STAR-L2i_GHR5ST-SST-Quam-V2.00-v01.0-fv02.0.nc	2016-10-17 11:31	
e not been OCed.	201603-STAR-L2i GHR5ST-SST-iQuam-V2.00-v01.0-fv02.0.mc	2016-10-17 23:24	
opanized in monthly files.	201602-STAR-L2i_GHR5ST-SST-Quam-V2.00-v01.0-fv02.0.nc	2016-10-18 11:10	
ateroy	201601-STAR-L2i_GHR5ST-SST-iQuam-V2.00-v01.0-fv01.0.mc	2016-02-03 17:29	
	201512-STAR-L2i_GHR\$ST-\$ST-iQuam-V2.00-v01.0-fv02.0.nc	2016-01-04 15:17	
	201511-STAR-L2i_GHR5ST-SST-Quam-V2.00-v01.0-tv01.0.nc	2015-12-01 14:09	
	201510-STAR-L2i_GHR5ST-SST-iQuam-V2.00-v01.0-tv01.0.nc	2015-11-17 15:05	
	201509-STAR-L2i GHRSST-SST-Quam-V2.00-v01.0-fv01.0.mc	2015-11-16 20:22	
	201508-STAR-L2i GHR5ST-SST-Quam-V2.00-v01.0-tv01.0.nc	2015-11-16 20:11	
	201507-STAR-L2i GHR5ST-SST-Quam-V2.00-v01.0-fv01.0.nc	2015-11-16 20:03	
	201506-STAR-L2I_GHR5ST-SST-Quam-V2.00-v01.0-fv01.0.nc	2015-11-17 15:56	
	201505 STAR L2i GHRSST SST iQuam V2.00 v01.0 /v01.0.nc	2015-11-17 16:33	
	201504-STAR-L2i_GHR5ST-SST-Quam-V2.00-v01.0-fv01.0.nc	2015-11-17 16:10	
	201503 STAR L2i GHRSST SST (Quam V2.00 v01.0 /v01.0.nc	2015-11-17 16:35	
	201502-STAR-L2i GHR5ST-SST-Quam-V2.00-v01.0-fv01.0.nc	2015-11-16 19:47	

For further information see Sasha Ignatov, Xinjia Zhou or Kai He



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Community Tools: GMPE

GHRSST Multi Product Ensemble





http://ghrsst-pp.metoffice.com/pages/latest_analysis/sst_monitor/daily/ens/



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Community Tools: Felyx (http://hrdds.ifremer.fr)



- Designed for creating match-up databases and for EO product performance monitoring
- Extract and store subsets of large datasets over predefined static or dynamic (like buoy or ship trajectories) locations

Ifremer

Process and display metrics and diagnostics







- Open source software implemented in python
- Works with all GDS format products extensible through plugins to other datasets, new metrics,...

For further information see Jean Francois Piollé (jfpiolle@ifremer.fr)





Community Tools: SNAP – Sentinel Application Platform



http://step.esa.int/main/download/



• SNAP is an open source toolbox for visualisation, analysis, and processing of the Sentinels 1, 2 and 3 EO data. Also supports many third-party missions and generic formats (e.g. GHRSST NetCDF).



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SUMMARY

With so many GHRSST products to choose from, start by considering....

- Spatially complete?
 - Analysis or native swath data
- Duration?
 - Time series or single image
- Spatial resolution?
 - High-resolution near coast or basin scale
- Level of uncertainty?
 - Best quality only
- Depth?
 - Skin or other defined depth
- Synergy?
 - Co-located with other data
- Availability?
 - Timeliness
- Volume?
 - Local or remote processing







GHRSST Tools/Resources/Code

- <u>http://www.ghrsst.org/products-and-</u> <u>services/tools</u>
- Real time
 - Primary system at NASA JPL: <u>http://podaac.jpl.nasa.gov/</u>
 - Secondary system at Ifremer: <u>http://cersat.ifremer.fr/data/collections/ghrsst</u>
- Delayed mode (30 days after observation)

-https://ghrsst.nodc.noaa.gov

• Any issues please contact the GHRSST Project Office: <u>gpc@ghrsst.org</u>









Summary





- The provision of SST data through GHRSST has grown to a mature, sustainable, essential service
- GHRSST provides a wide range of user driven SST-related products and services
- There are many tools available to help you find and use the right GHRSST products
- And always remember behind these technologies are people who are ready and willing to help, so if you have questions, just ask!





QUESTIONS?



http://www.ghrsst.org

