

STAR JPSS Oceans



Satellite Oceanography & Climatology Division (STAR/SOCD) and JPSS Ocean EDRs: A sea of activity

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With contributions from: Mark Eakin, Daniel Tong, Avichal Mehra, Eric Bayler, Cara Wilson, Eileen Maturi, Sasha Ignatov, Menghua Wang, Michael Soracco

2016 STAR/JPSS Annual Science Meeting
College Park, MD, 8-12 August 2016





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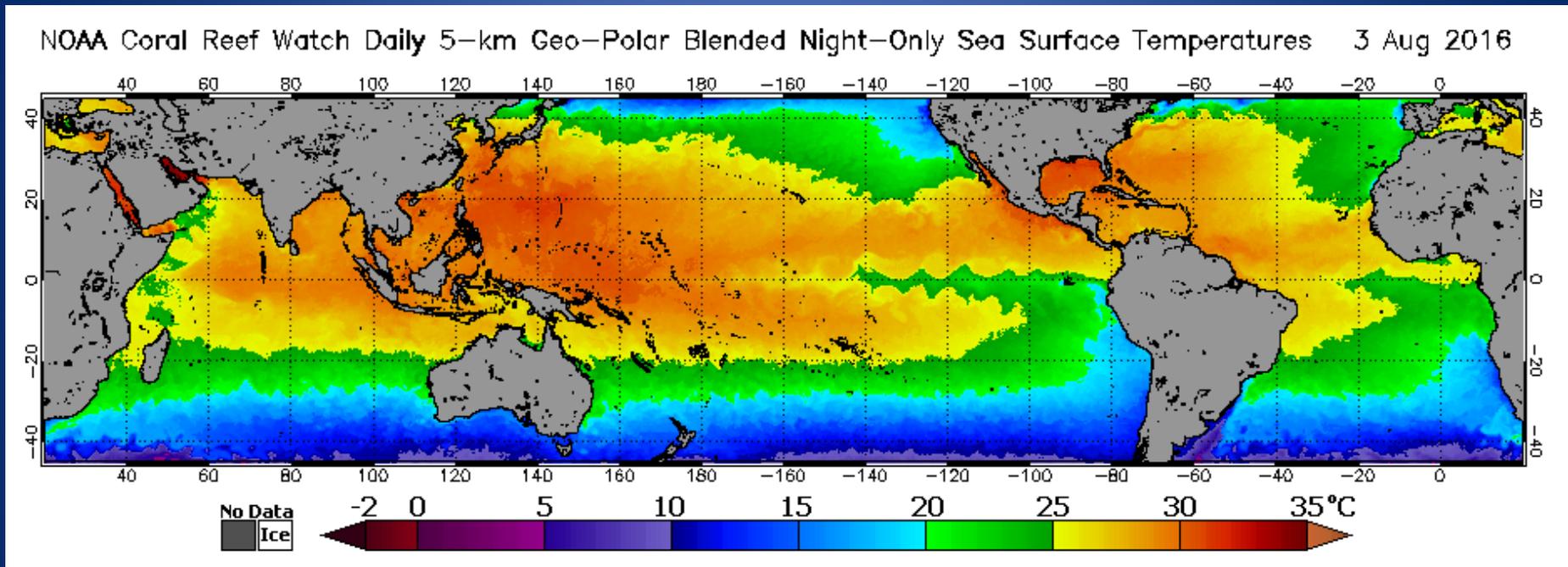
Outline

- Users & Applications – representation from NOS, NMFS, NWS, OAR and NESDIS
- Highlights from VIIRS SST and Ocean Color EDR Teams
- Reprocessing (Oceans) at STAR
- Non-NOAA data at STAR



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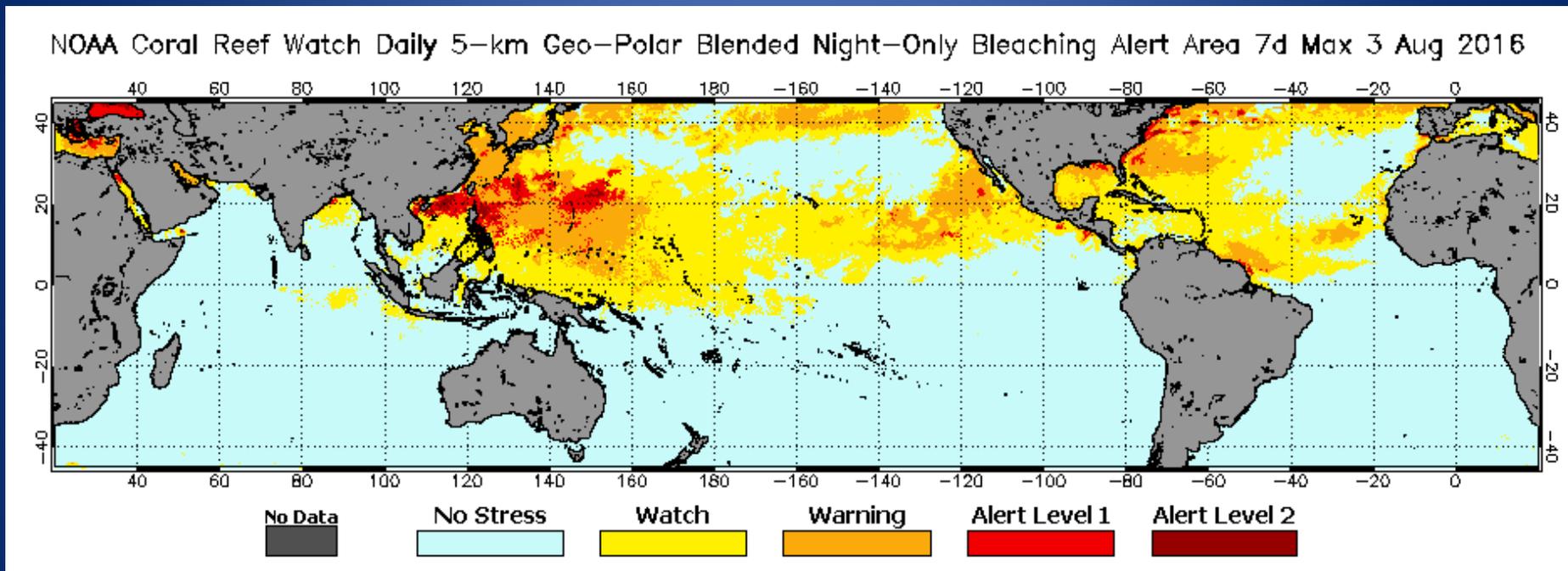
VIIRS SST User: NESDIS & NOAA Coral Reef Conversation Program



Coral Reef Watch uses the latest 5 km global blended GOES-POES Sea Surface Temperature (SST) product ...

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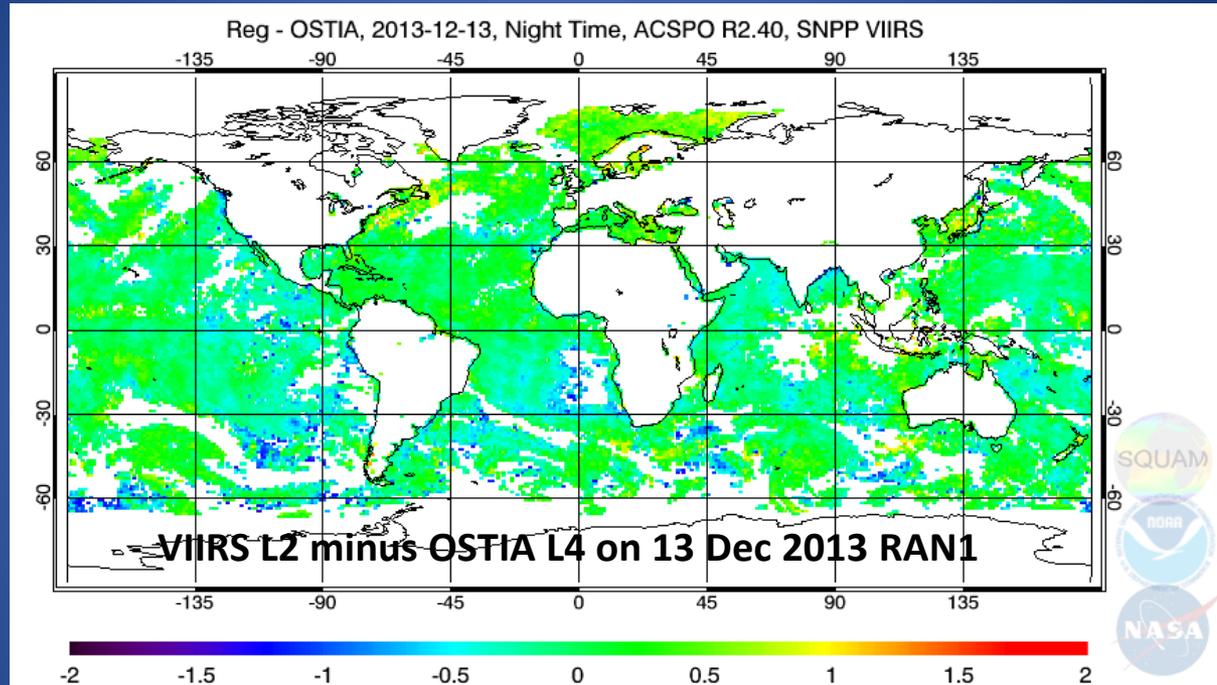
VIIRS SST User: NESDIS & NOAA Coral Reef Conversation Program



... to generate a new climatology for their bleaching alert and monitoring products for coral reef managers around the globe.

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VIIRS SST Users: GHRSSST and International Met Offices



GHRSSST, UK Met office, Canada Met Office,
BoM of Australia, Japanese Met Agency
and other agencies, academics, etc.



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VIIRS Ocean Color User: NOS

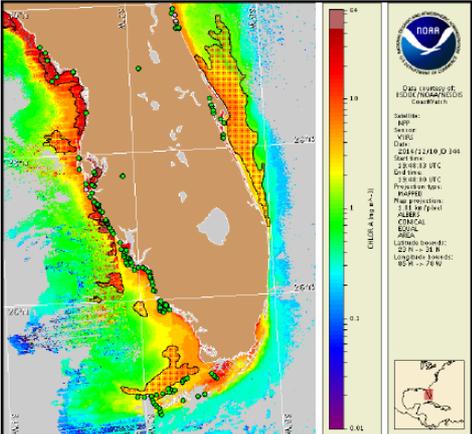
- JPSS PGRR Program has supported integration of VIIRS ocean color data into NOS HAB bulletins.
- Currently testing Science Quality dataset to better interpret NRT data stream.



Gulf of Mexico Harmful Algal Bloom Bulletin
 Region: Southwest Florida
 Friday, 12 December 2014
 NOAA National Ocean Service
 NOAA Satellite and Information Service
 NOAA National Weather Service
 Last bulletin: Tuesday, May 27, 2014

Conditions Report
Does the image look good to you?

Analysis
Blah blah blah

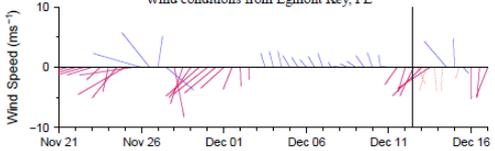


Satellite chlorophyll image with possible *K. brevis* HAB areas shown by red polygon(s), when applicable. Points represent cell concentration sampling data from December 2 to 11: red (high), orange (medium), yellow (low b), brown (low a), blue (very low b), purple (very low a), pink (present), and green (not present). Cell count data are provided by Florida Fish and Wildlife Conservation Commission (FWC) Fish and Wildlife Research Institute. For a list of sample providers and a key to the cell concentration categories, please see the HAB-OFS bulletin guide:
http://tidesandcurrents.noaa.gov/hab/habfi_bulletin_guide.pdf

Detailed sample information can be obtained through FWC Fish and Wildlife Research Institute at:
<http://myfwc.com/redtidestatus>

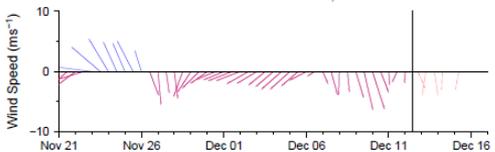
To see previous bulletins and forecasts for other Harmful Algal Bloom Bulletin regions, visit at:
<http://tidesandcurrents.noaa.gov/hab/bulletins.html>

Wind conditions from Egmont Key, FL



Wind speed and direction are averaged over 12 hours from buoy measurements. Length of line indicates speed; angle indicates direction. Red indicates that the wind direction favors upwelling near the coast. Values to the left of the dotted vertical line are measured values; values to the right are forecasts. Wind observation and forecast data provided by NOAA's National Weather Service (NWS).

Wind conditions from Venice Pier, FL



Wind Analysis
Test for VIIRS products

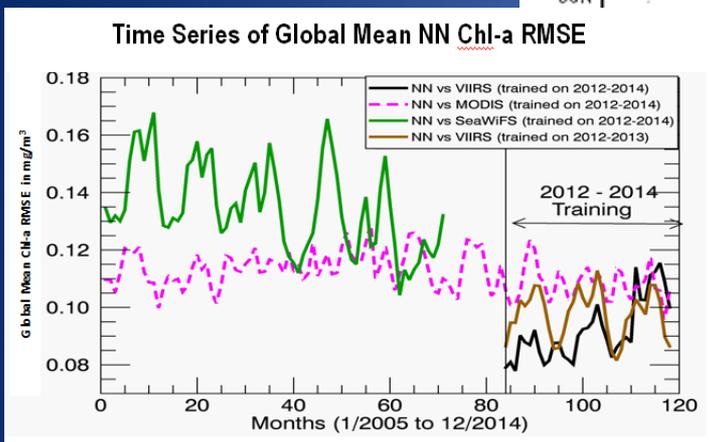
NOAA CoastWatch is working with NOS as part of the NOAA Ecological Forecasting Initiative



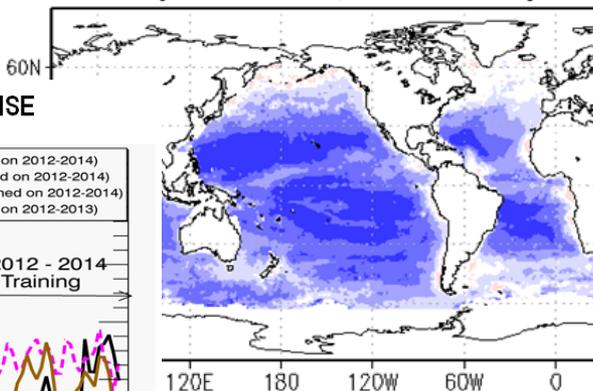
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VIIRS Ocean Color
User: NWS

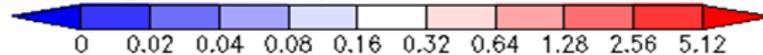
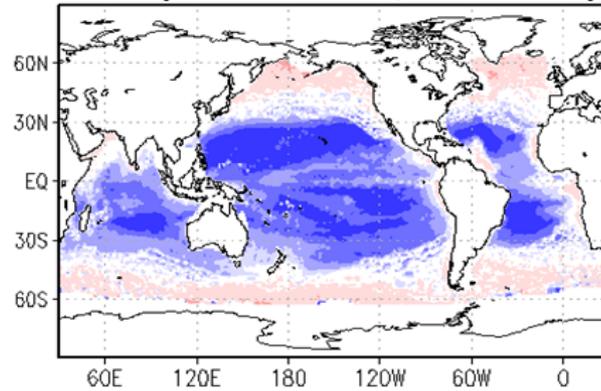
Neural Network Chlorophyll-a RMSE – Referenced to Satellite Observations



RMSE (OBS=VIIRS, 2012-2014)



RMSE (OBS=SeaWiFS, 2005-2010)

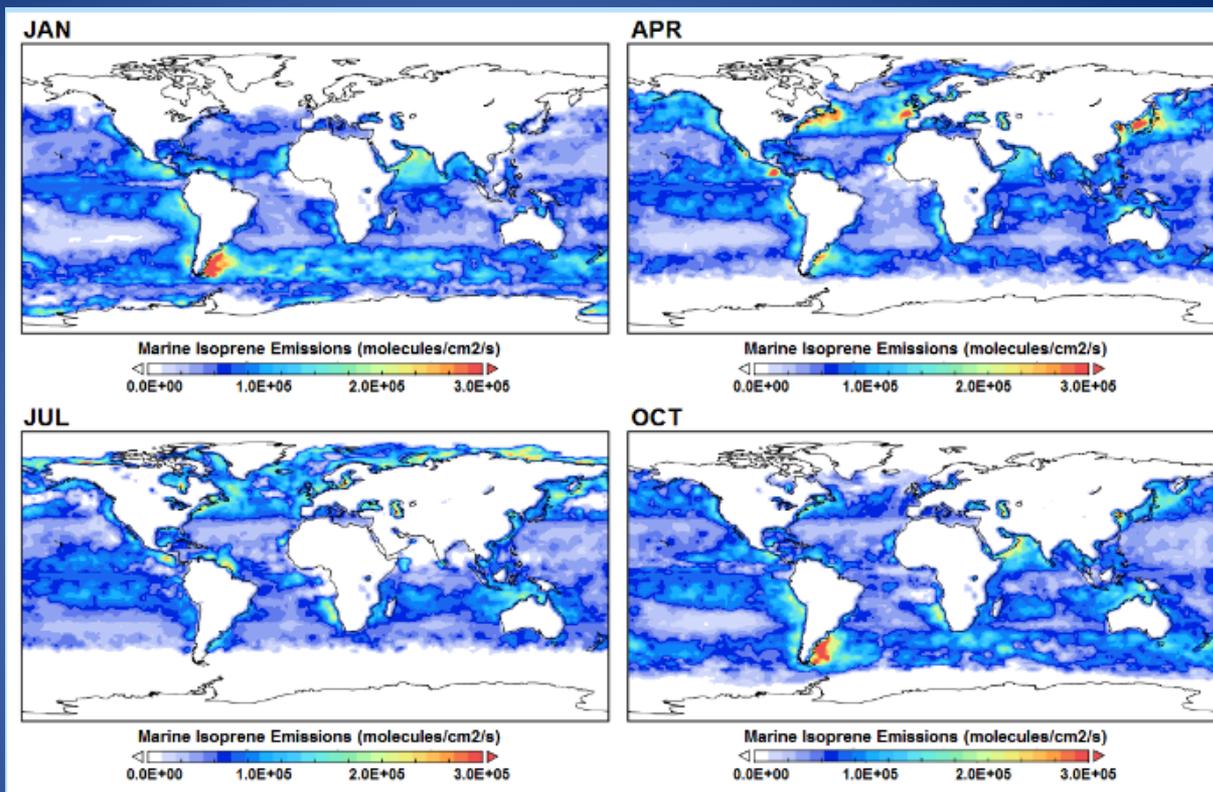


Chlorophyll-a RMSE (mg/m³)

NWS/NCEP/EMC is using VIIRS Ocean Color to train a neural network to estimate gap-free, consistent ocean color fields (e.g., chlorophyll-a) to be assimilated into a pre-operational environment for NOAA's operational ocean models (HYCOM, MOM4). (And see Kim et al. at OC Breakout, Wednesday afternoon.)

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*VIIRS Ocean
Color User:
OAR*



The **NOAA Air Resources Laboratory (OAR)** derives the global distribution of marine isoprene which is then incorporated into emission models for the National Air Quality Forecasting Capability (NAQFC).

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VIIRS Ocean Color & SST Data Users: NMFS

The **Satellite Data Training Course** conducted by Cara Wilson of NMFS/SEFSC is enabling fisheries research & operational applications.

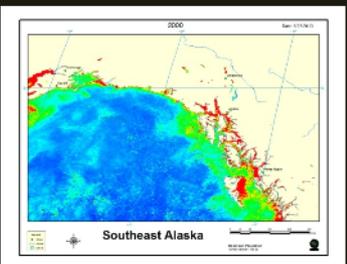
Developing ecological indicators for sablefish recruitment

Objectives

1. Support an ecosystem approach to management
2. \$ 142 million fishery for sablefish in U.S.
3. Develop indicators for sablefish recruitment
4. Use satellite color data to index chl-a, blooms
5. Quantify blooms in rearing areas
6. Link to future sablefish recruitment

Ocean survey results

High age-2 recruitment in 2002 was linked to high chlorophyll-a in the late summer in 2000.



Coastal rearing habitat for young sablefish

Sablefish (*Anoplopoma fimbria*)

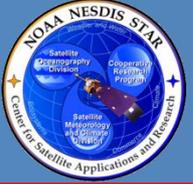
Future Use spatial of ocean

Ellen Martinson, NMFS/A



Not a complete photo - 9 people missing

High quality, long term time series satellite data are essential to an “Integrated Ecosystem Assessment” approach to fisheries management at NMFS.



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Highlights from VIIRS SST

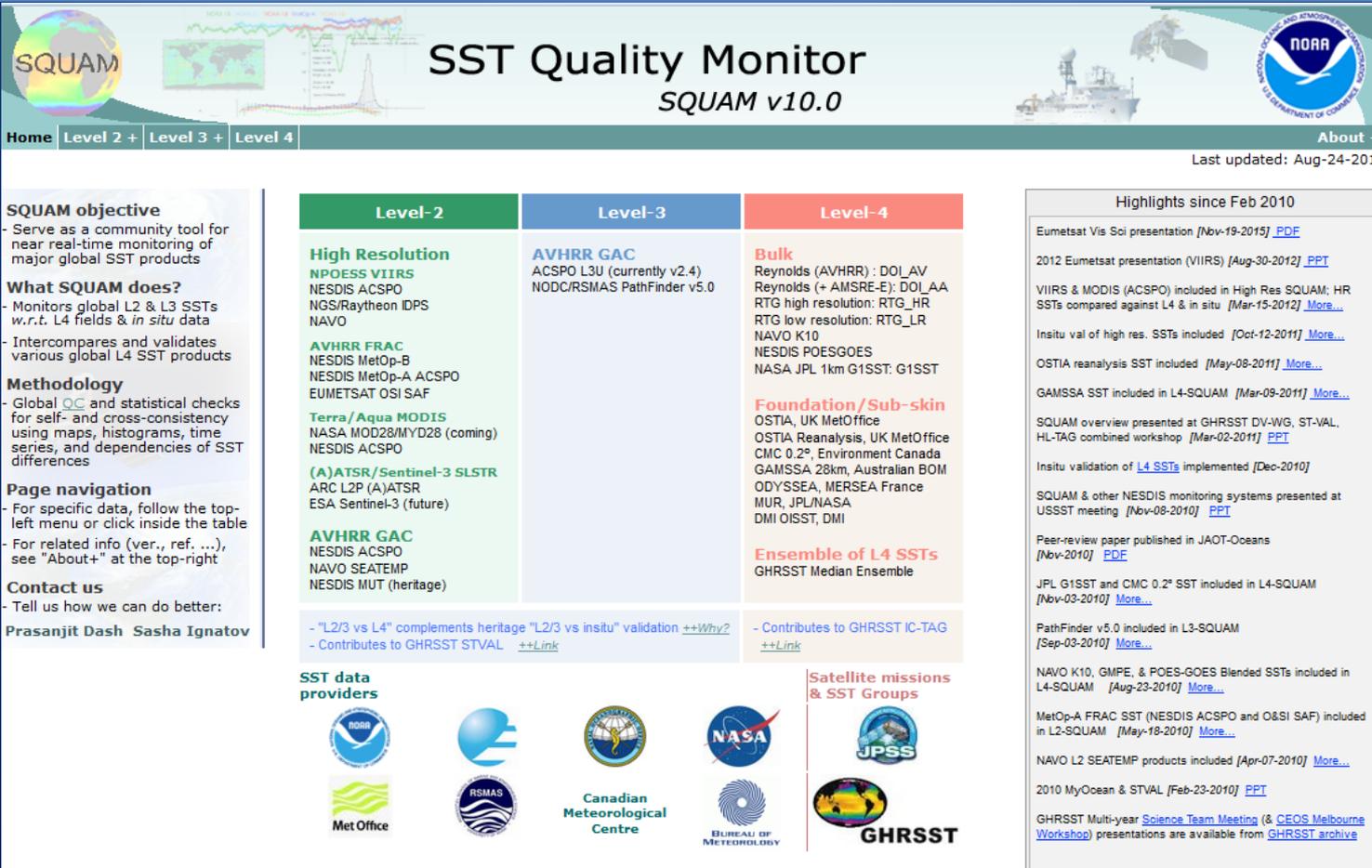


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Redesigned SQUAM AVHRR GAC page and updated ACSP0 AVHRR RAN1 in SQUAM



SQUAM SST Quality Monitor *SQUAM v10.0*

Home | Level 2 + | Level 3 + | Level 4 | About +

Last updated: Aug-24-2015

SQUAM objective

- Serve as a community tool for near real-time monitoring of major global SST products

What SQUAM does?

- Monitors global L2 & L3 SSTs w.r.t. L4 fields & *in situ* data
- Intercompares and validates various global L4 SST products

Methodology

- Global QC and statistical checks for self- and cross-consistency using maps, histograms, time series, and dependencies of SST differences

Page navigation

- For specific data, follow the top-left menu or click inside the table
- For related info (ver., ref. ...), see "About+" at the top-right

Contact us

- Tell us how we can do better:

Prasanjit Dash **Sasha Ignatov**

Level-2	Level-3	Level-4
<p>High Resolution</p> <p>NPOESS VIIRS NESDIS ACSP0 NGS/Raytheon DPS NAVO</p> <p>AVHRR FRAC NESDIS MetOp-B NESDIS MetOp-A ACSP0 EUMETSAT OSI SAF</p> <p>Terra/Aqua MODIS NASA MOD28/MYD28 (coming) NESDIS ACSP0</p> <p>(A)ATSR/Sentinel-3 SLSTR ARC L2P (A)ATSR ESA Sentinel-3 (future)</p> <p>AVHRR GAC NESDIS ACSP0 NAVO SEATEMP NESDIS MUT (heritage)</p>	<p>AVHRR GAC ACSP0 L3U (currently v2.4) NODC/RSMAS Pathfinder v5.0</p>	<p>Bulk</p> <p>Reynolds (AVHRR) : DO1_AV Reynolds (+ AMSRE-E): DO1_AA RTG high resolution: RTG_HR RTG low resolution: RTG_LR NAVO K10 NESDIS POESGOES NASA JPL 1km G1SST: G1SST</p> <p>Foundation/Sub-skin</p> <p>OSTIA, UK MetOffice OSTIA Reanalysis, UK MetOffice CMC 0.2°, Environment Canada GAMSSA 28km, Australian BOM ODYSSSEA, MERSEA France MUR, JPL/NASA DMI OISST, DMI</p> <p>Ensemble of L4 SSTs GHRSSST Median Ensemble</p>
<p>- "L2/3 vs L4" complements heritage "L2/3 vs insitu" validation ++Why? - Contributes to GHRSSST STVAL ++Link</p>		<p>- Contributes to GHRSSST IC-TAG ++Link</p>

Highlights since Feb 2010

- Eumetsat Vis Sci presentation [Nov-19-2015] [PDF](#)
- 2012 Eumetsat presentation (VIIRS) [Aug-30-2012] [PPT](#)
- VIIRS & MODIS (ACSP0) included in High Res SQUAM; HR SSTs compared against L4 & *in situ* [Mar-15-2012] [More...](#)
- Insitu val of high res. SSTs included [Oct-12-2011] [More...](#)
- OSTIA reanalysis SST included [May-08-2011] [More...](#)
- GAMSSA SST included in L4-SQUAM [Mar-09-2011] [More...](#)
- SQUAM overview presented at GHRSSST DV-WG, ST-VAL, HL-TAG combined workshop [Mar-02-2011] [PPT](#)
- Insitu validation of [L4 SSTs](#) implemented [Dec-2010]
- SQUAM & other NESDIS monitoring systems presented at USSST meeting [Nov-08-2010] [PPT](#)
- Peer-review paper published in JAOT-Oceans [Nov-2010] [PDF](#)
- JPL G1SST and CMC 0.2° SST included in L4-SQUAM [Nov-03-2010] [More...](#)
- PathFinder v5.0 included in L3-SQUAM [Sep-03-2010] [More...](#)
- NAVO K10, GMPE, & POES-GOES Blended SSTs included in L4-SQUAM [Aug-23-2010] [More...](#)
- MetOp-A FRAC SST (NESDIS ACSP0 and O&SI SAF) included in L2-SQUAM [May-18-2010] [More...](#)
- NAVO L2 SEATEMP products included [Apr-07-2010] [More...](#)
- 2010 MyOcean & STVAL [Feb-23-2010] [PPT](#)
- GHRSSST Multi-year [Science Team Meeting](#) (& [CEOS Melbourne Workshop](#)) presentations are available from [GHRSSST archive](#)

SST data providers



Satellite missions & SST Groups

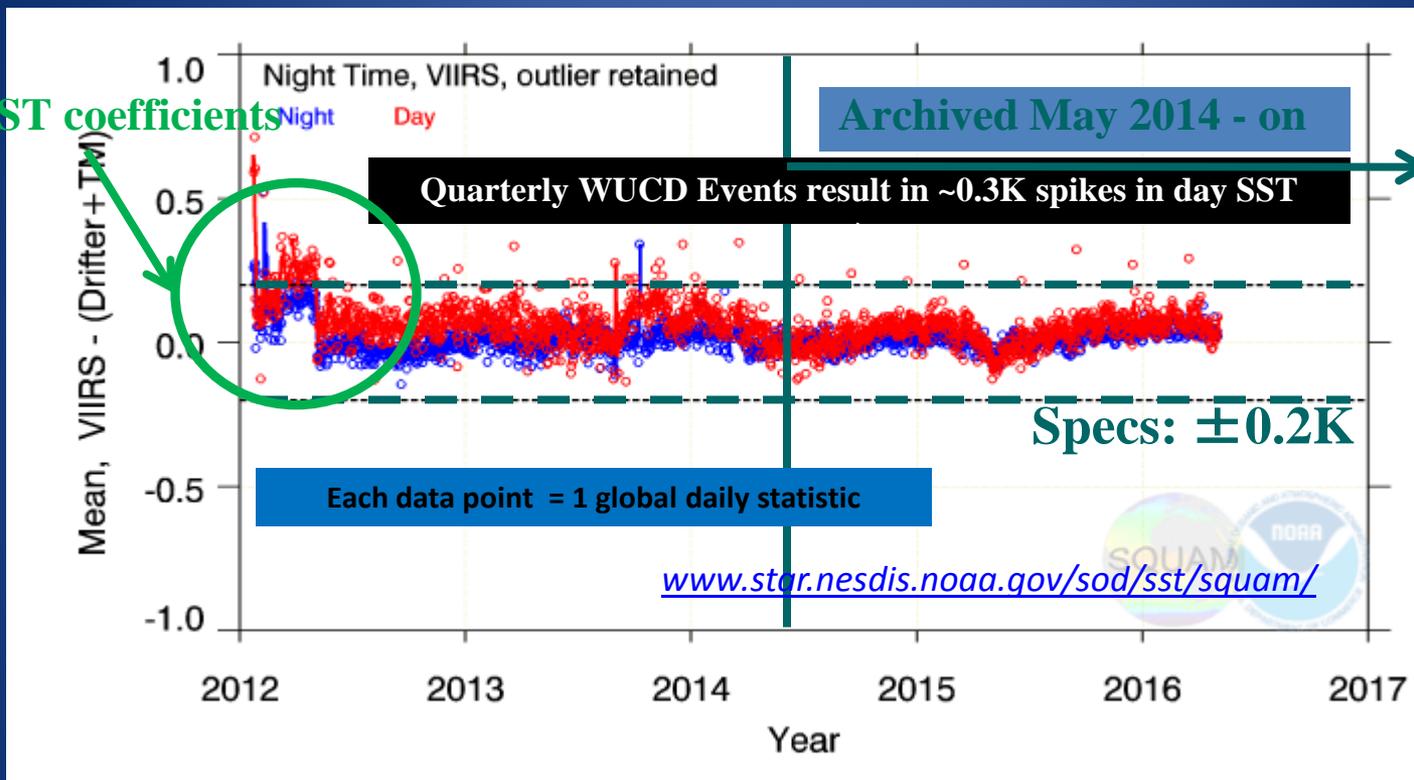




Global VAL BIAS VIIRS L2 vs. *i*Quam *in situ* SSTs

Real Time

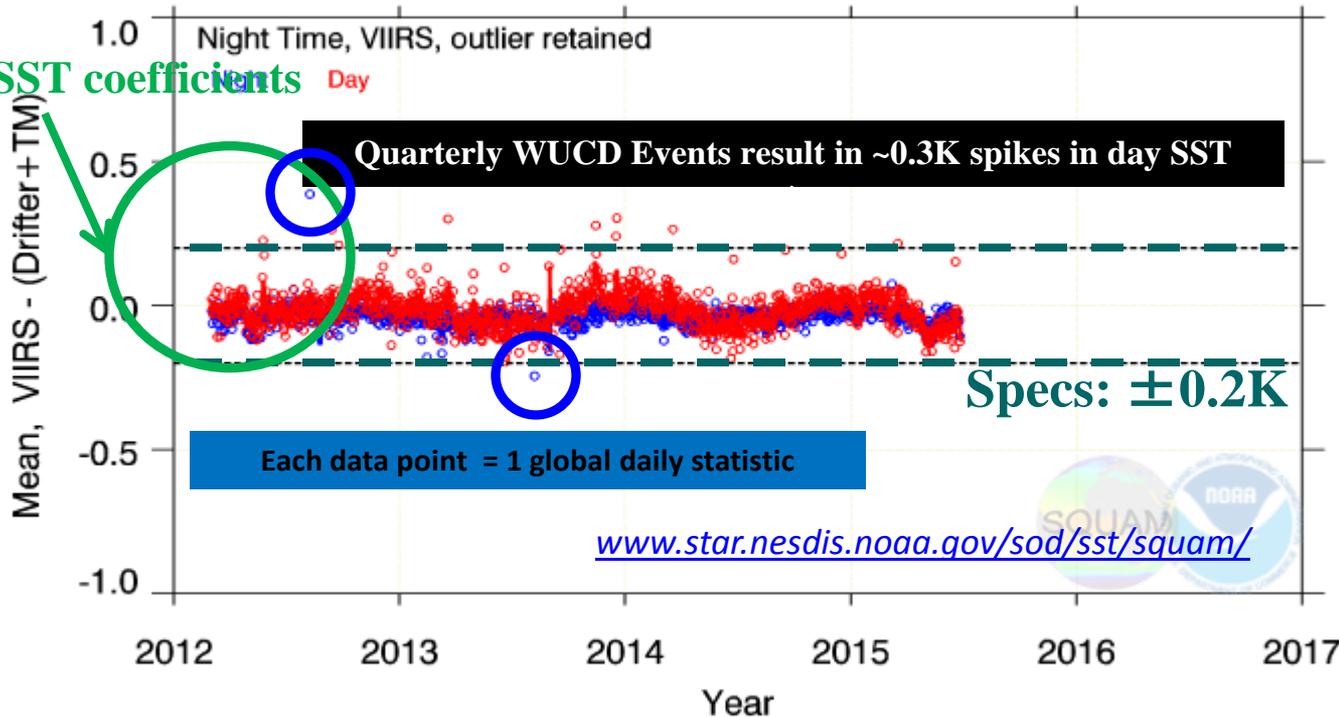
Initial SST coefficients



Day
Night

Advanced Clear-Sky Processor for Oceans (ACSP0)
Near real time data

Consistent SST coefficients



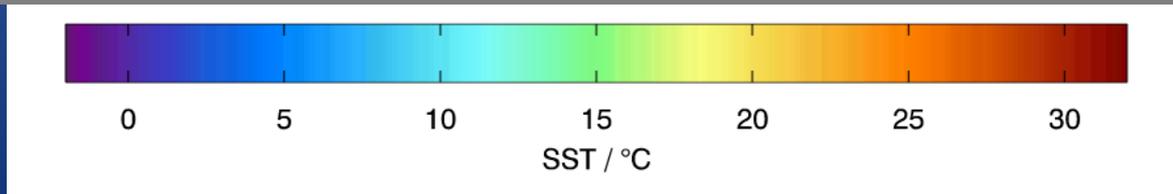
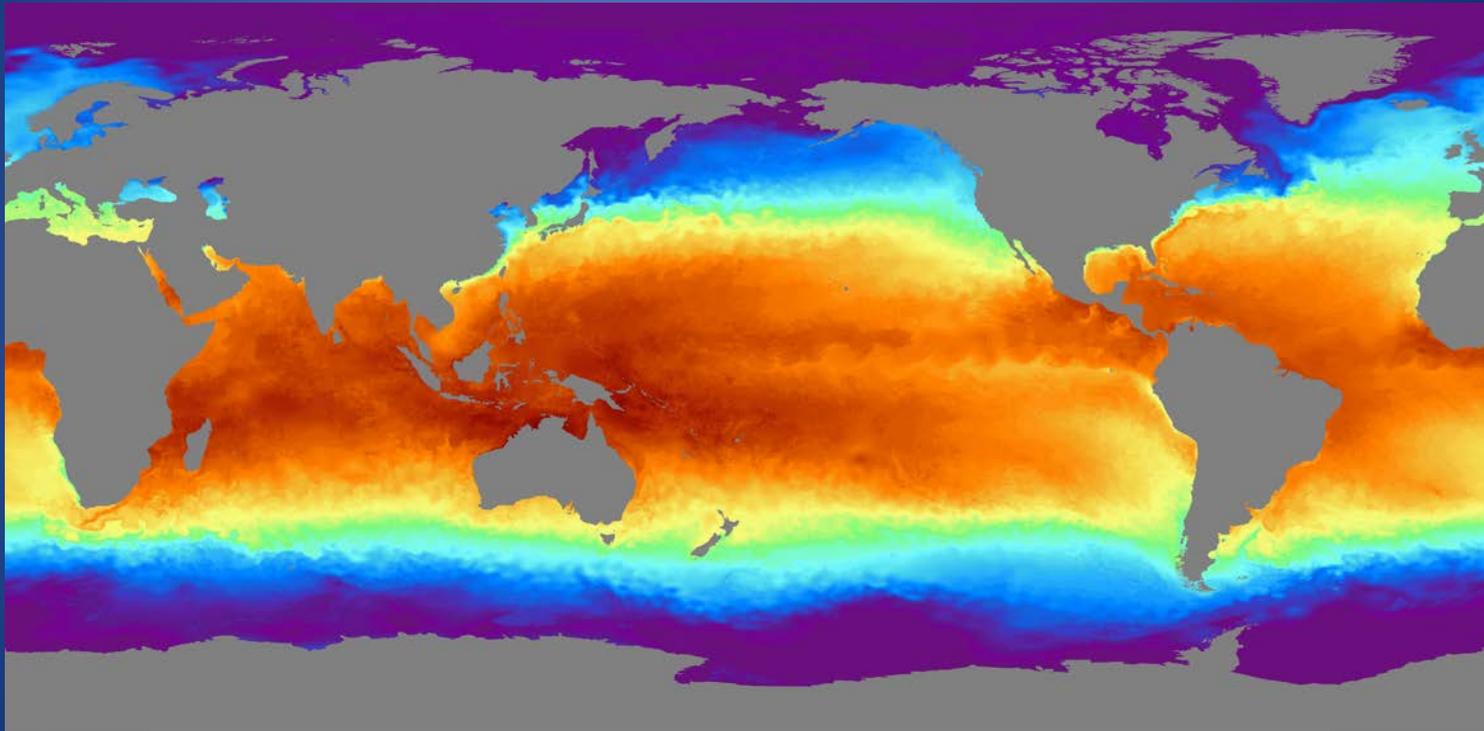
Day

Night

Advanced Clear-Sky Processor for Oceans (ACSPO) reprocessed long term science quality data

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5-km Global Blended SST Analysis (includes VIIRS)





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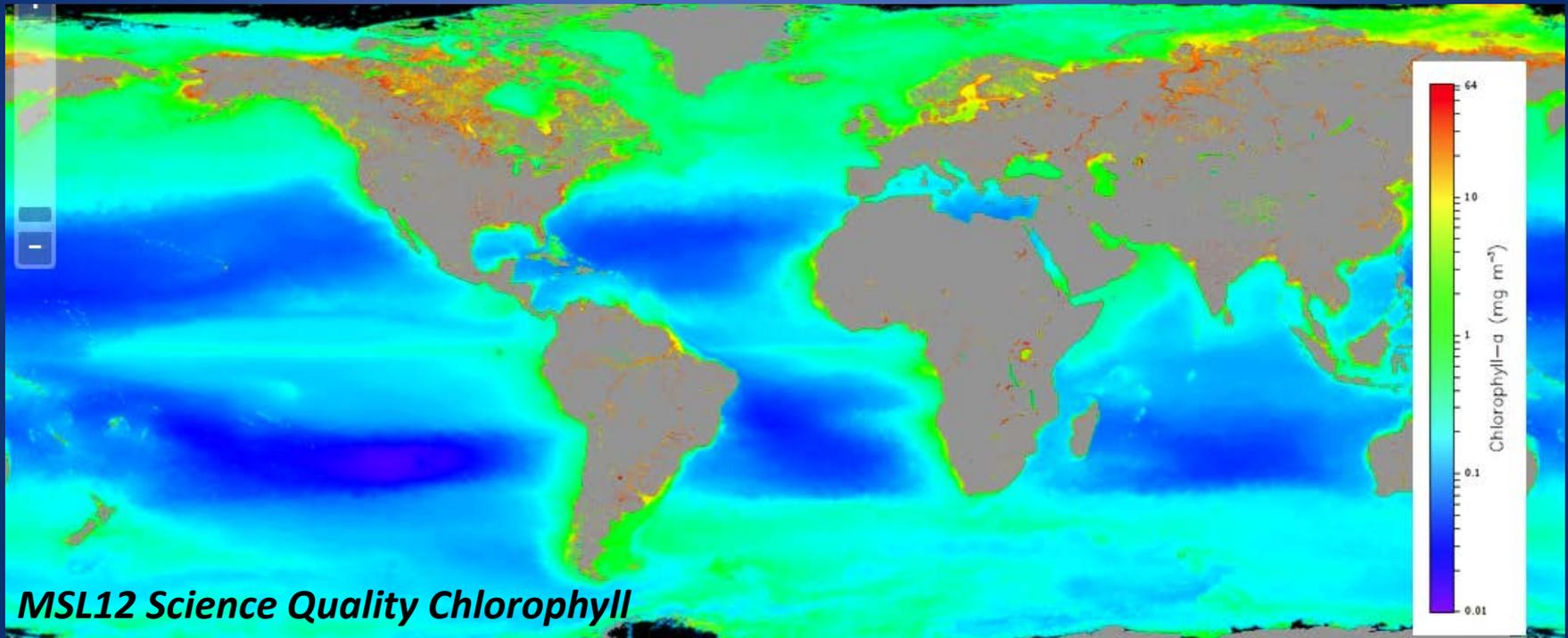
Highlights from VIIRS Ocean Color



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VIIRS SNPP MSL12 mission-long science quality climatology



*Including greatly improved retrievals for high
altitude lakes*



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**Multi-Sensor
Level 1 to
Level 2
Processing
System
(MSL12)
Both NRT and
mission -long
science
quality data**

Attribute	Near-Real Time	Science Quality Delayed Mode
<i>Processing System</i>	MSL12	MSL12
<i>Latency:</i>	Best effort, as soon as possible (~12-24h)	Best effort, ~1-2 week delay
<i>SDR:</i>	IDPS Operational SDR	OC-improved IDPS SDR
<i>Ancillary Data:</i>	Global Forecast System (predicted)	Science quality (assimilated)
<i>Spatial Coverage:</i>	May be gaps due to various issues	Complete global coverage
<i>Processed by:</i>	CoastWatch, transferring to OSPO	NOAA/STAR
<i>Distributed by:</i>	CoastWatch	CoastWatch, NCEI
<i>Archive Plans:</i>	Yes, NCEI, via OSPO	Yes, NCEI, via CoastWatch
<i>Reprocessing:</i>	No	Yes, ~2-3 years or as needed

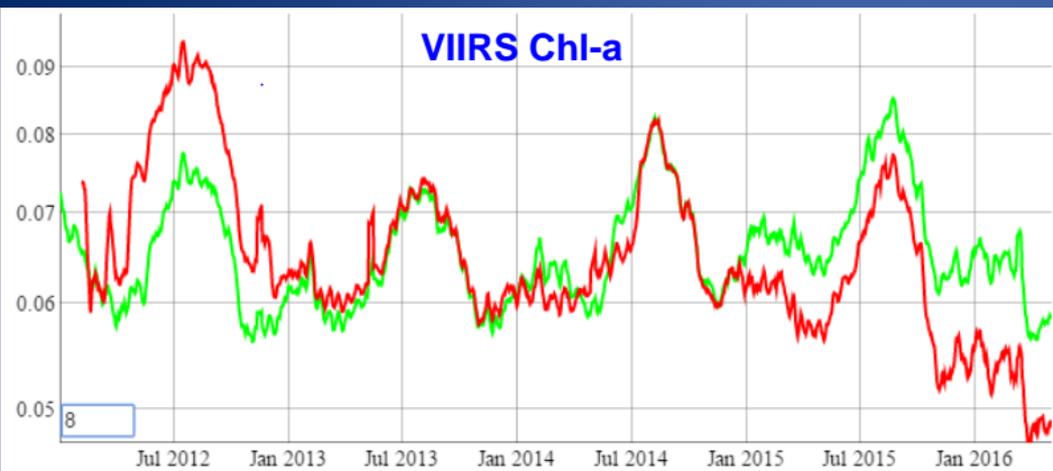




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Global Oligotrophic Waters



Red: VIIRS IDPS-SDR Near-real-time data
Green: VIIRS OC-SDR Science quality data

Both data are reprocessed using the same MSL12!

Statistics of VIIRS Data vs. In Situ (MOBY)
(2012-01-01 ~ 2016-04-27)

	IDPS-SDR MSL12 (ver. 1.10) (Near-Real-Time Data)				OC-SDR MSL12 (ver. 1.10) (Science Quality Data)			
	AVG	MED	STD	No	AVG	MED	STD	No
$nL_w(400)$	1.0083	1.0065	0.0961	463	1.0164	1.0157	0.0956	509
$nL_w(551)$	1.0191	1.0005	0.1733	475	1.0083	1.0062	0.0899	509
$nL_w(671)$	1.0258	0.9991	0.1861	475	1.0110	1.0103	0.0846	509
$Chl-a$	1.0604	0.9809	0.4910	475	1.0148	1.0004	0.1338	509
$K_d(490)$	1.3366	1.0059	2.1345	487	1.1762	1.1053	0.5393	505
$Chl-a$	1.0508	0.9764	0.4254	468	1.0141	1.0041	0.1647	509
$K_d(490)$	1.0135	0.9826	0.2437	471	0.9842	0.9760	0.1007	505

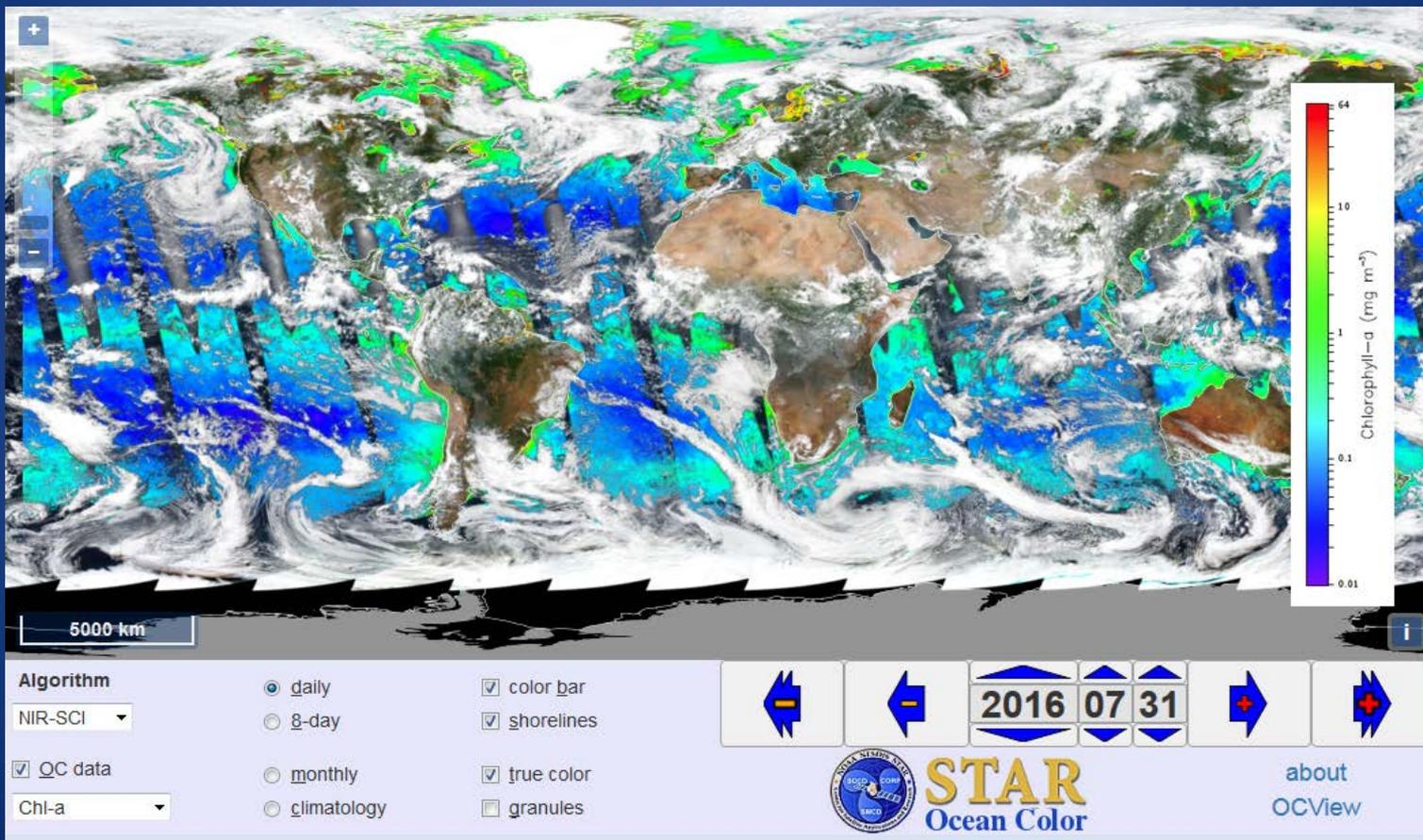
NIR Gain 8 = [0.979954, 0.974892, 0.974685, 0.965832, 0.979042, 0.982065, 1.00000, 1.01812, 0.994676, 1.20252]

MOBY



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*VIIRS Ocean color EDR Team: Introduced
OCView tool for easy, interactive image monitoring*



<http://www.star.nesdis.noaa.gov/sod/mecb/color/>



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NOAA CoastWatch/OceanWatch Data Dissemination of VIIRS Ocean Color and SST



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Science Quality 'Life-of-Mission'



CoastWatch Level-2 Granule Viewer

The [NOAA CoastWatch](#) The granule selector enables a user to select a Level-2 dataset by selecting a date and clicking covers the user's area of interest. Clicking a granule will open an information window containing a link to the preview file. If multiple files are desired, clicking on the download icon (↓) will add the selected granule to a list that can be used to retrieve files.

Sensor: VIIRS on S-NPP Layers: MGRS Grid for S-2 regions CoastWatch Regions Remove all

<ftp://ftp.star.nesdis.noaa.gov/pub/socd1/mecb/coastwatch/viirs/science/L2/>

- FTP OC 2012 to [Present – 15 days]:
- Integrated with the same L2 Granule Selector tool
 - Present – 15 days: NRT Granules
 - 15 days old and prior: Science Quality
 - Includes data preview and data cart
- VIIRS SST Science Quality will be included when ready

http://coastwatch.noaa.gov/cwn/cw_granule_selector.html

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Example of VIIRS OC Data Cart

Science Quality (forward processing)

Near real-time

S-NPP VIIRS Granule: Science Quality

Date: 2016-07-22 Time: T18:40:40Z
 Download Science Quality Data:
[VIIRS L2 Ocean Color Data \(CW NetCDF\)](#)
[View in THREDDS](#)

Zoom to

S-NPP VIIRS Granule Near real-time
ID: 2016216181536B

Date: 2016-08-03 Time: 1815
 Download near real-time Data:
[True Color Image \(PNG\)](#)
[VIIRS L2 Ocean Color Data \(CW NetCDF\)](#)
[VIIRS Ocean Color Channel Data \(CW HDF\)](#)
[THREDDS access](#)

Zoom to

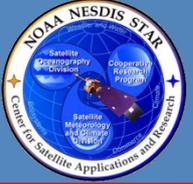
Data Cart FTP List

Item	Data
1	VRSVCW.B2016216.181536.nc
2	V2016204184040_NPP_SCINIR_L2.nc

Clear Cart *Removes all items

For batch download

L2_wget_list.txt



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The case for Reprocessing

- **WHY”?** ALL NOAA Line Offices have expressed a need for consistent, fit-for-purpose quality, long-term time series ocean satellite observations to do their part in support of the NOAA Mission.
- **Reprocessing is essential** for the production of science quality time series data for earth and ocean observations and is expected by satellite data product user communities both within and external to NOAA.





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- **Operational:**
- **Science:**
- **Requirements:**
- **Measurement-Based:**
- **Integrated:**





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- **Operational:** Redefine
Not just Near Real Time
- **Science:**
- **Requirements:**
- **Measurement-Based:**
- **Integrated:**





STAR JPSS Oceans



- **Operational:** Redefine
Not just Near Real Time
- **Science:** Crucial at every step
Not just product development
- **Requirements:**
- **Measurement-Based:**
- **Integrated:**





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- **Operational:** Redefine
Not just Near Real Time
- **Science:** Crucial at every step
Not just product development
- **Requirements:** Allow to Evolve
Not etched in stone tablets
- **Measurement-Based:**
- **Integrated:**



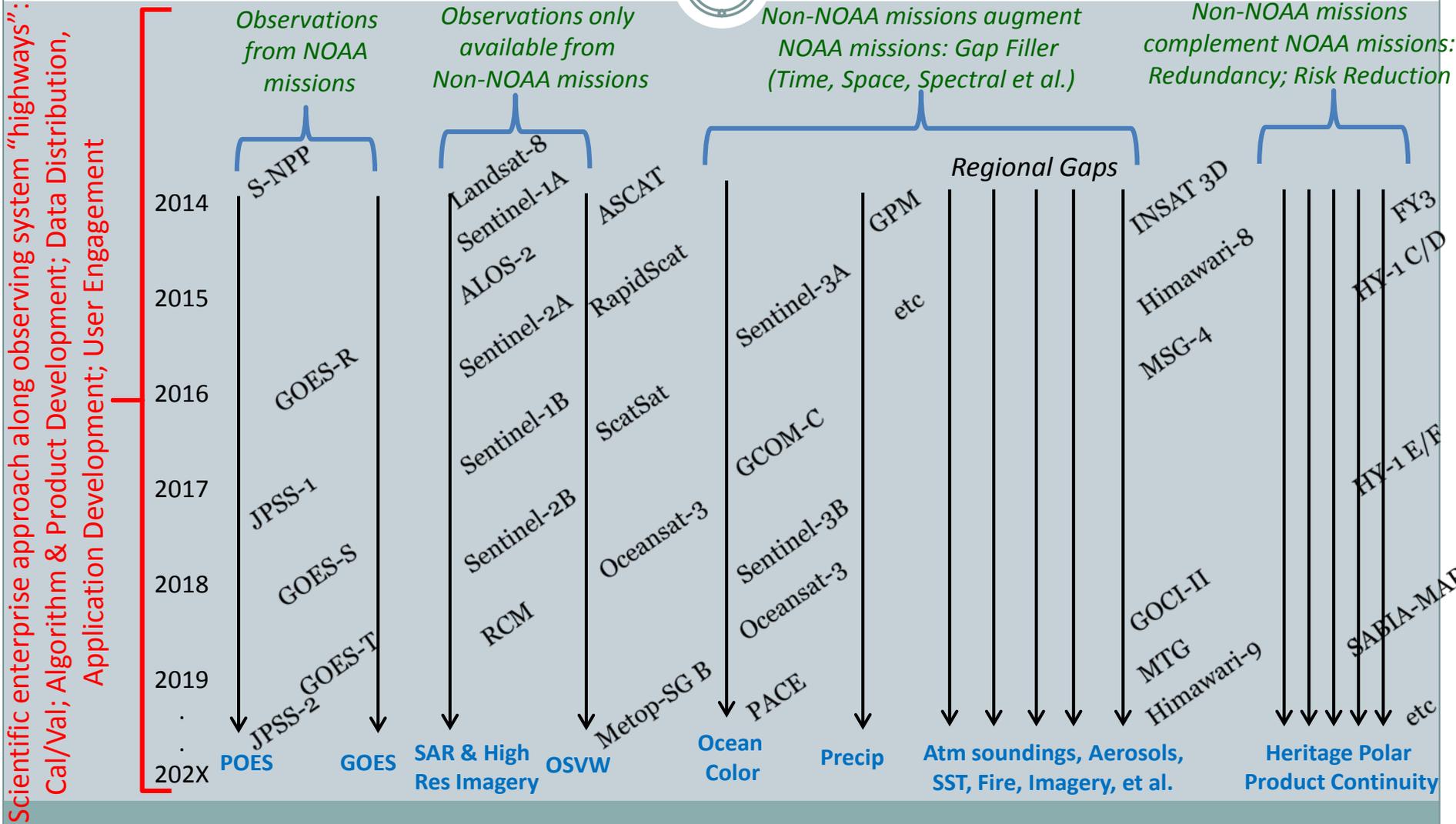


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- **Operational:** Redefine
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- **Requirements:** Allow to Evolve
Not etched in stone tablets
- **Measurement-Based:** Mission agnostic
approach
- **Integrated:**



Measurement-based approach in support of users: Ensuring continuity & coverage
Observing System Highways: Utilize satellite data from NOAA & non-NOAA missions
 Leverages existing science, technical, programmatic et al. infrastructure in NESDIS





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approach
- **Integrated:** Fundamentally integrate
non-NOAA observations,
including reprocessing





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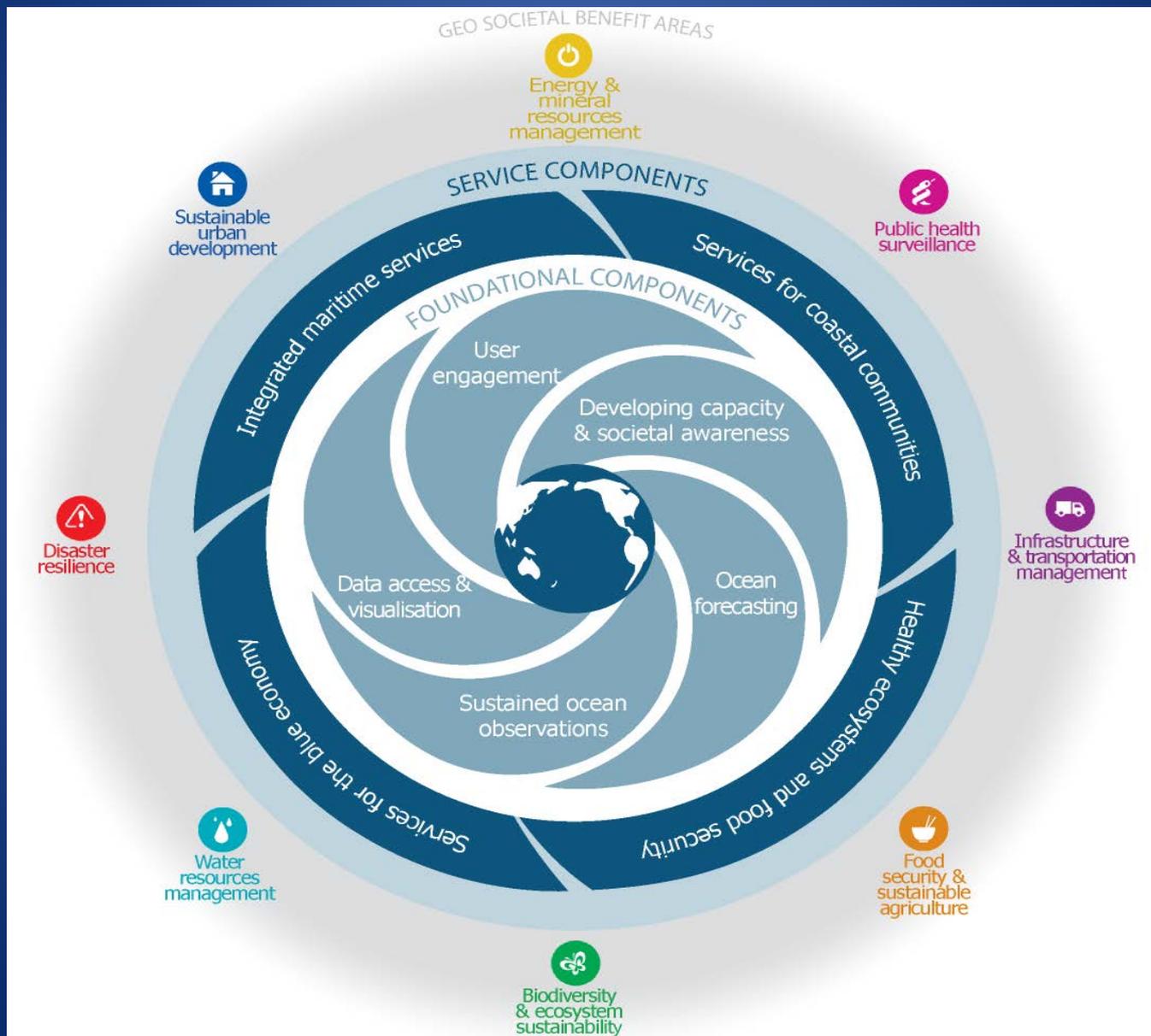


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GEO Blue Planet Initiative





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Thank you - Questions?



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