Sea Surface Temperature Distribution from the Physical Oceanography DAAC

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http://podaac.jpl.nasa.gov

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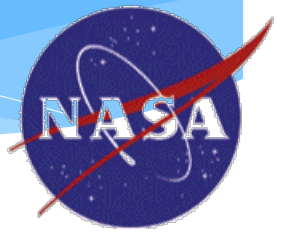
Columbia, MD
30 Apr 2014



Outline

* Physical Oceanography DAAC organization
* MODIS SST datasets
* Web site for dataset discovery
* Tools and web services
* Examples of use
* Summary and Future

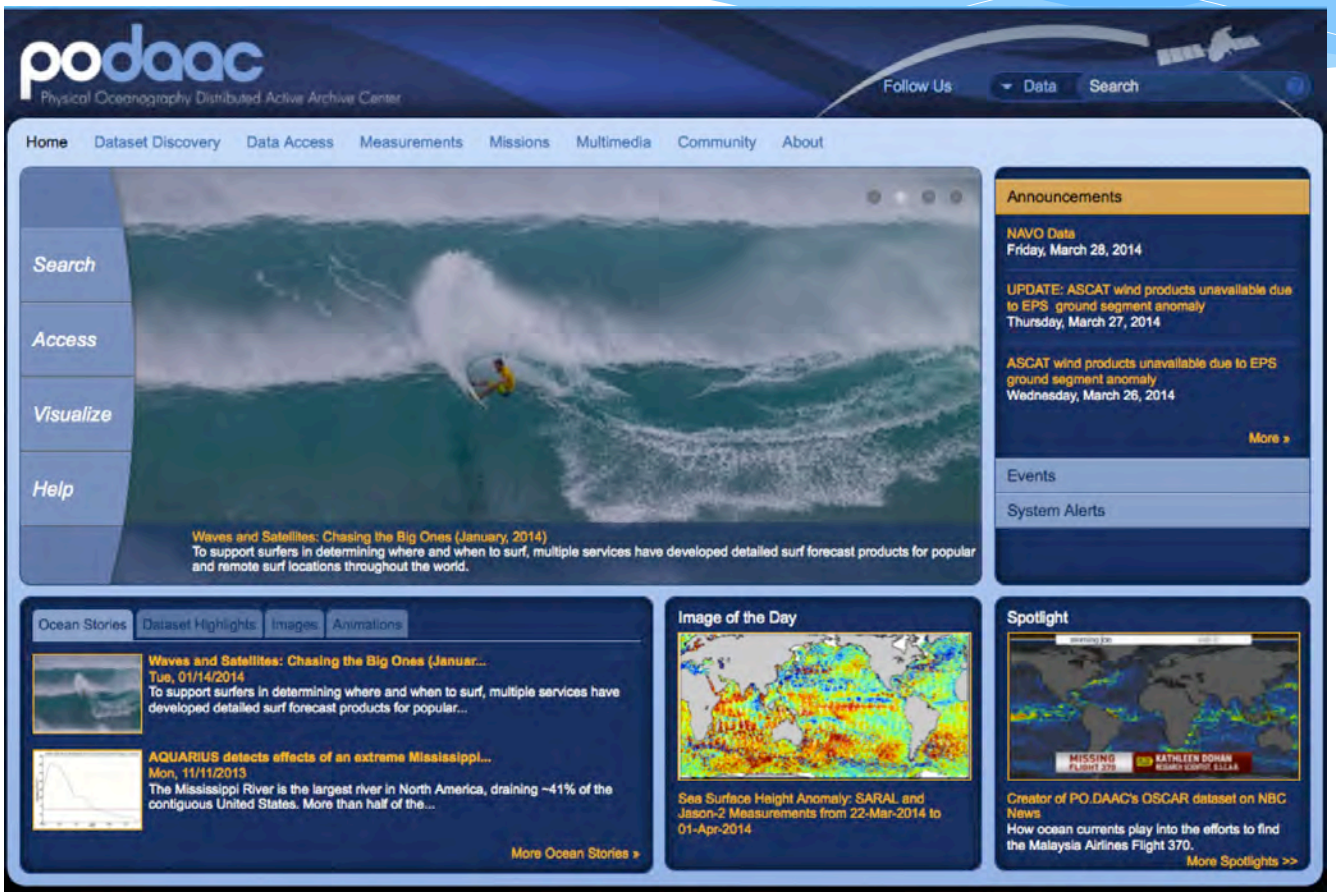
MODIS SST data

* Level 3
  * Daily/Weekly/Monthly/Annual 4km/9km 4µm/11µm SST from Aqua and Terra
  * Identical to SST datatsets distributed by NASA OBPG
  * Also ChlA from Aqua as “remote” dataset
* Level 2
  * GHRSST L2P Aqua/Terra 5 minute granules
  * Full suite of uncertainty statistics
  * Joint production via JPL/OBPG/RSMAS

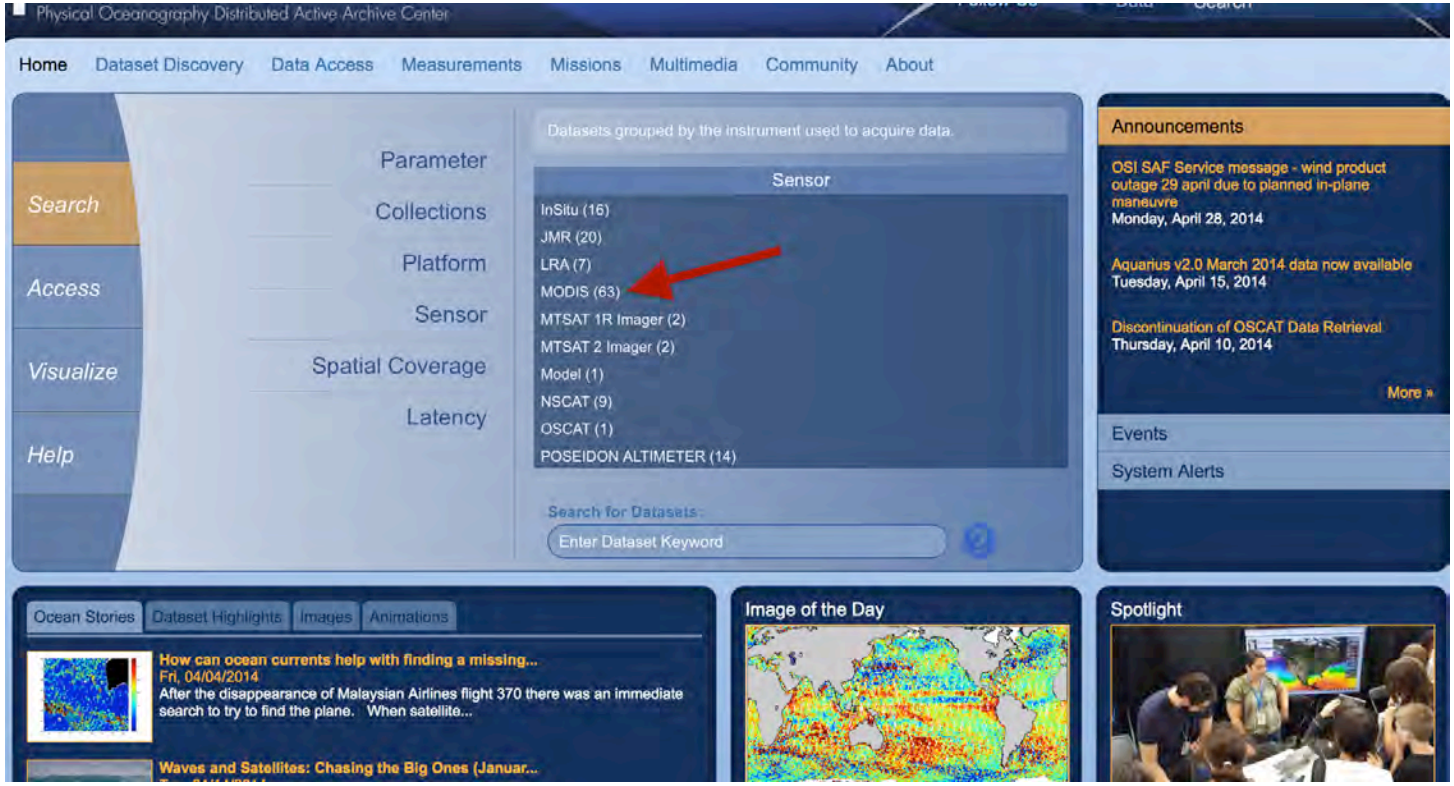
MODIS SST data

* Level 4
  * L2 MODIS SST appears in a number of daily global merged datasets
    * 1 km Multiscale Ultrahigh Resolution (MUR)
    * 9km REMMS mw+ir_oi
  * Different approaches to blending: optimal interpolation vs. resolution preserving wavelets (and others, e.g. 3D VAR etc.)
  * MODIS is the only sensor that gives 1 km global daily coverage

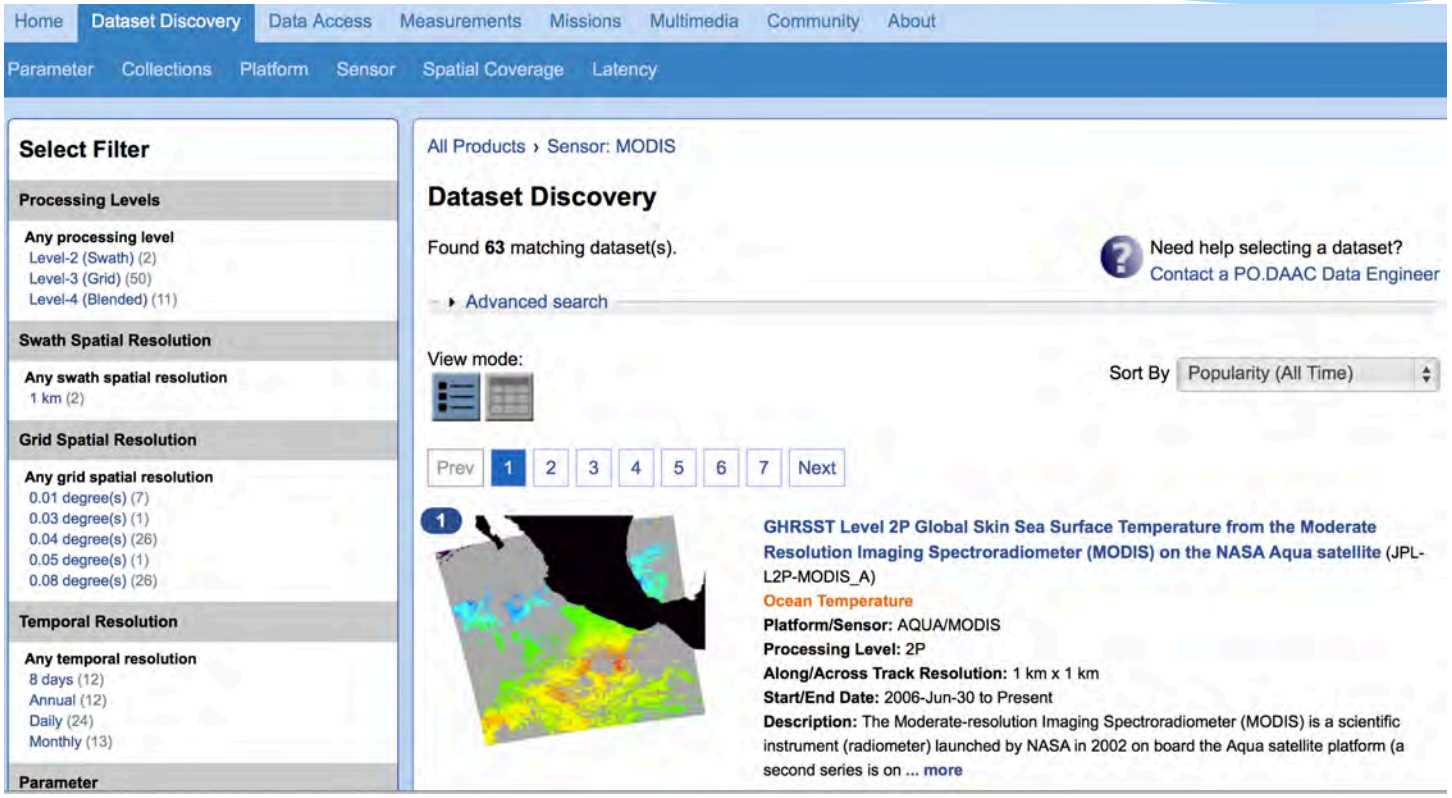
Redesigned Web portal



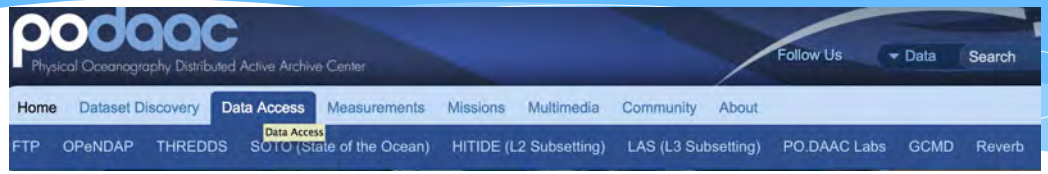
Web portal – Data discovery



Web portal – Data documentation

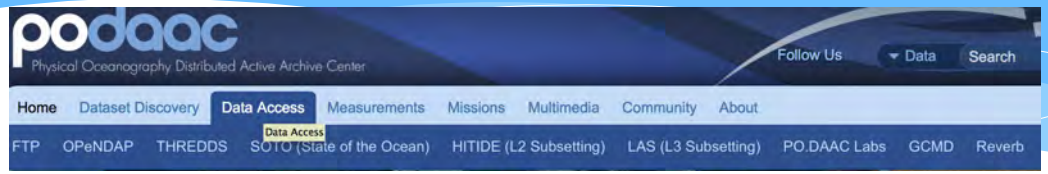


Distribution/Tools/Services



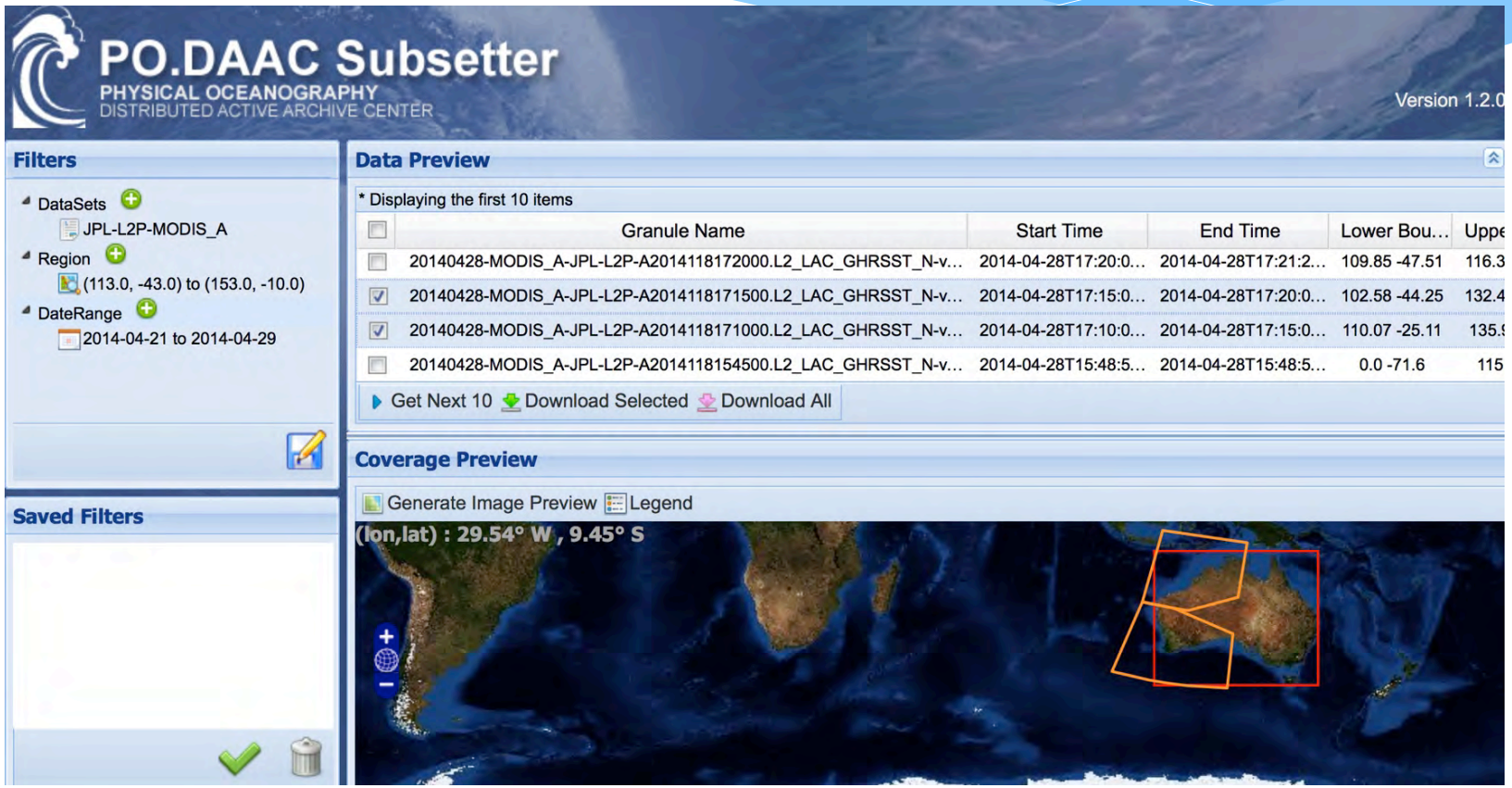
* FTP: still serves the majority of our users, although number of users are dropping
* OPeNDAP and THREDDS increasing users
* Web services are becoming more important, familiar and widely used

Other Tools and Services

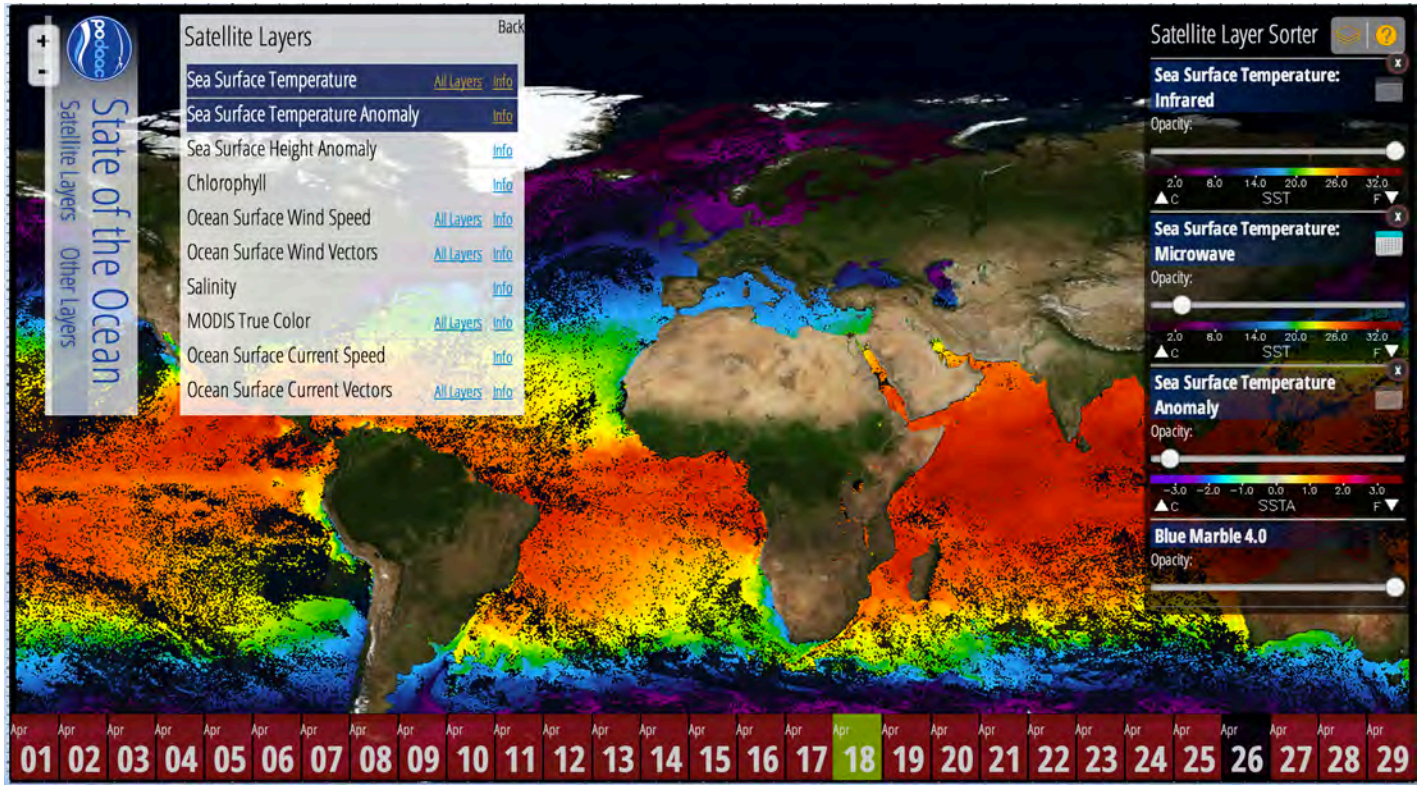


* Live Access Server (LAS) for L3/L4 subsetting
* HiTIDE for GUI-based L2 subsetting
* SOTO (State of the Ocean) for visualization
* "Chained" PO.DAAC Web Services of data discovery, metadata, extraction, subsetting and visualization
* Webification for data extraction (subset by value)
* …… upcoming technologies in PO.DAAC "Labs"

HiTIDE Level 2 Subsetter



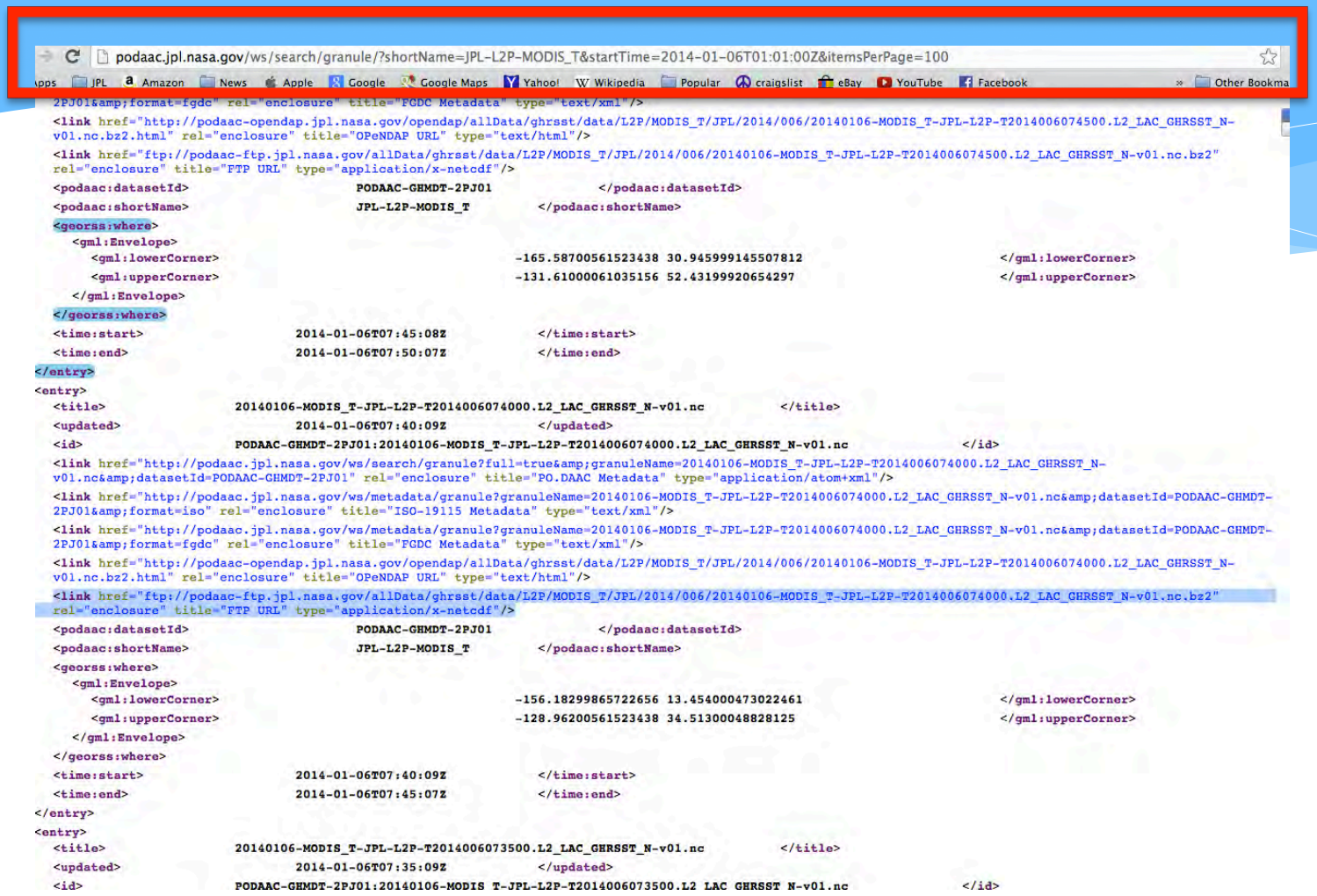
SOTO 2D -- Visualization



Web services

- PO.DAAC Web Services are for software interaction
  - Discover dataset info
  - Discover granules
  - Subset and extract granules
  - Visualize
- Through Application Programming Interface
- “Chained” ….so output of one service can input to the next

Example of a search return to find MODIS SST granules



http://podaac.jpl.nasa.gov/ws/search/granule/?shortName=JPL-L2P-MODIS_T&startTime=2014-01-08T01:01:00Z&itemsPerPage=100

Webification

Open specification:

http://w10n.org

Summary:

- Resource is viewed as a tree of nodes and leaves.
- They have semantic URLs, accessible through HTTP.
- Meta info exchange format is JSON, by default.
- Full ReSTful style request/response. Read/Write.

Disciplines:

Earth science (NetCDF, HDF 4/5, GRIB)

Planetary Science (VICAR/PDS)

Astronomy (FITS) and more

Use Case – Quality filtering the SST observations

* Subset a L2P granule (by value!)
  * http://host:port/path/2013/123/20130503-MODIS_T-JPL-L2P-T2013123065500.L2_LAC_GHRSST_N-v01.nc.bz2/sea_surface_temperature[**-130<lon<-120,35<lat<45**]?output=format
* Apply quality filter
  * http://host:port/path/2013/123/20130503-MODIS_T-JPL-L2P-T2013123065500.L2_LAC_GHRSST_N-v01.nc.bz2/sea_surface_temperature[**quality_flag>=4**]?output=format
* Quality filter, wind screen, subset all in one step !
  * http://host:port/path/2013/123/20130503-MODIS_T-JPL-L2P-T2013123065500.L2_LAC_GHRSST_N-v01.nc.bz2/sea_surface_temperature[**quality_flag>=4,wind_speed>6,-130<lon<-120,35<lat<45**]?output=format

Example 1: MODIS vs AVHRR gradient detection

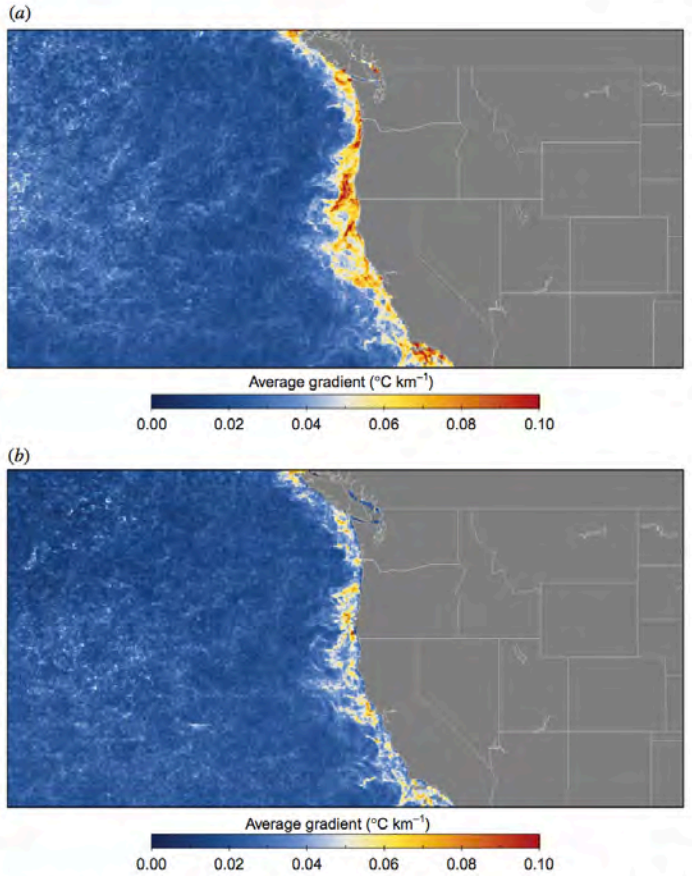
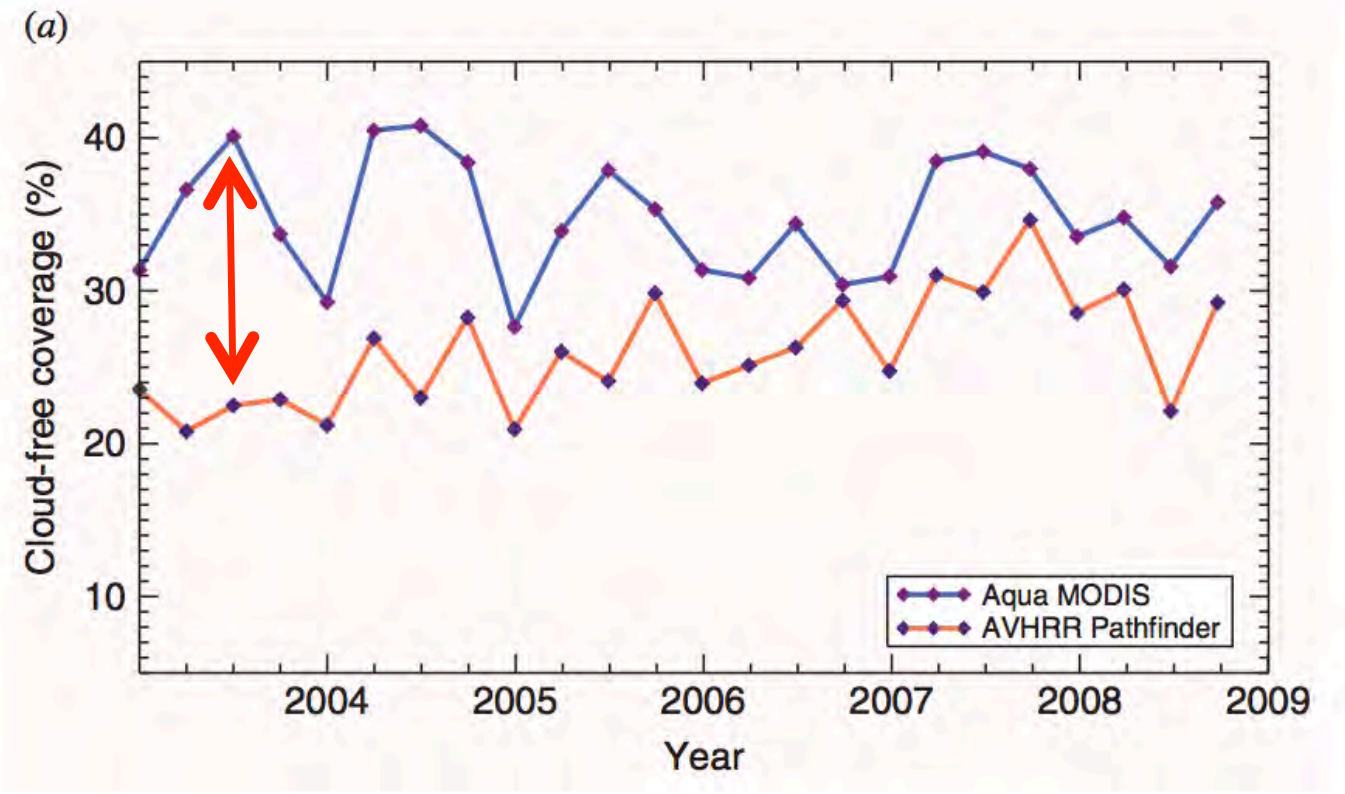


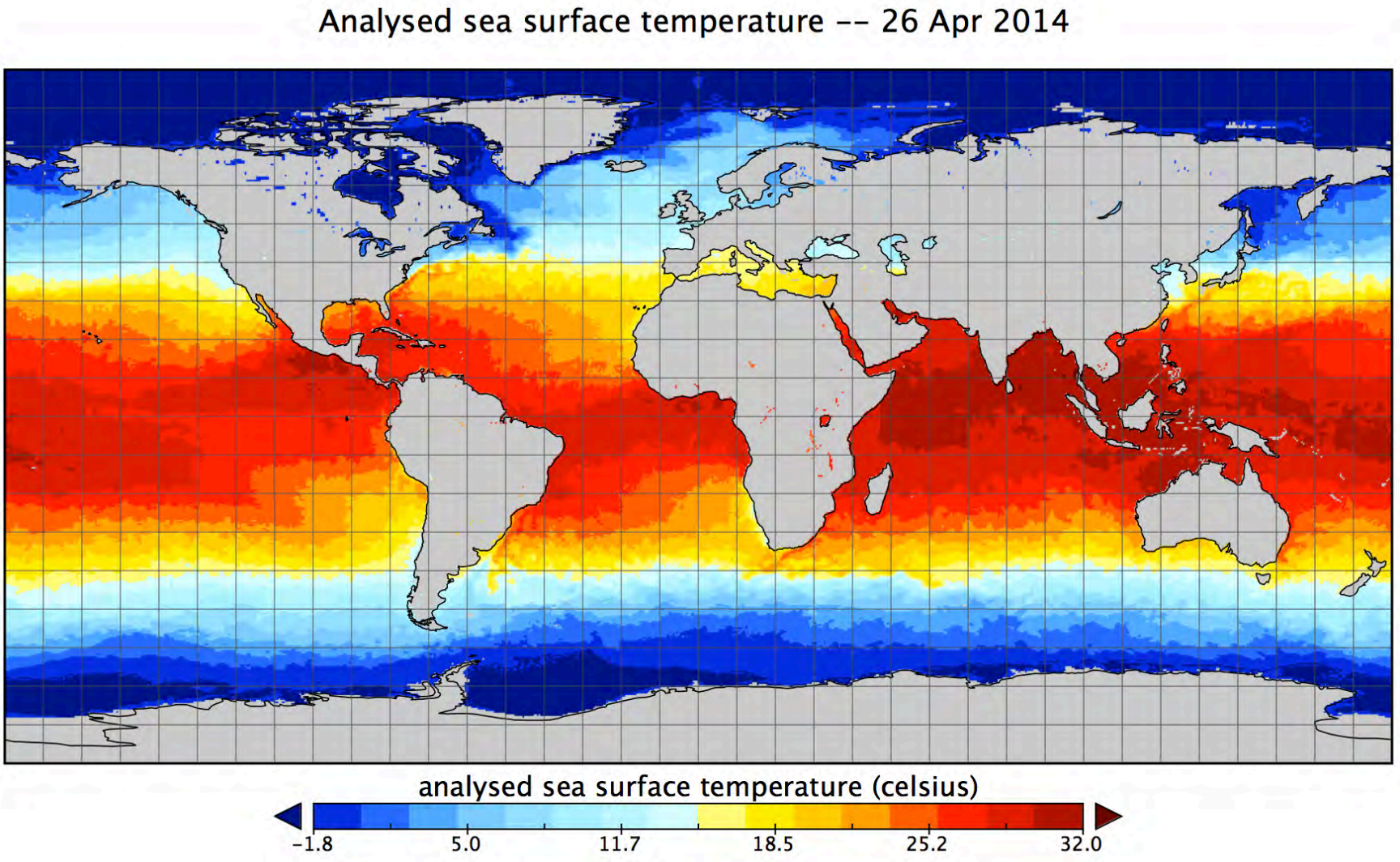
Figure 3. (*a*) CCS gradients in summer 2007 as seen from MODIS Aqua. (*b*) CCS gradients in summer 2007 as seen from Pathfinder AVHRR.

From Armstrong et al., 2012

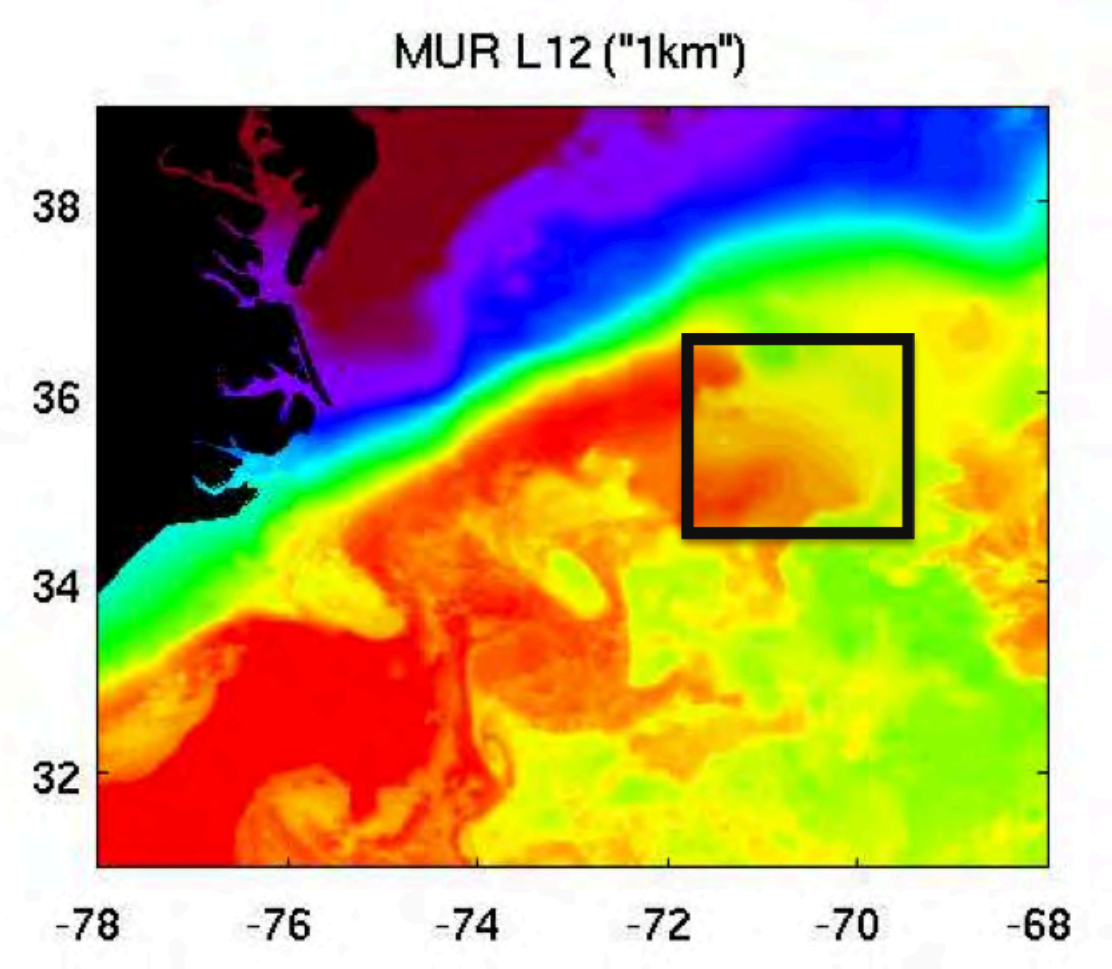
Improved MODIS cloud screening – California Current System



Example 2: MUR SST



MUR at various resolutions



Summary

* MODIS Aqua/Terra SST is one of the prominent SST datasets served by the PO.DAAC. All processing levels:
  * GHRSST L2P → GHRSST L4 data
    * MODIS is critical component to the popular MUR Level 4 dataset
  * MODIS L3: More useful than AVHRR.
* Integrated into a many tools and web services
  * Discovery/Metadata
  * Visualization
  * Subsetting/Extraction
  * Newer web service technologies such as webification
* Future:
  * Improved documentation and provenance
  * Improved support for interdisciplinary research with accessible data for all ocean parameters
  * VIIRS SST data….and many others

backup

MUR Level 4 SST

Multi-Resolution Variational Analysis (MRVA)

performs objective interpolation at different scales

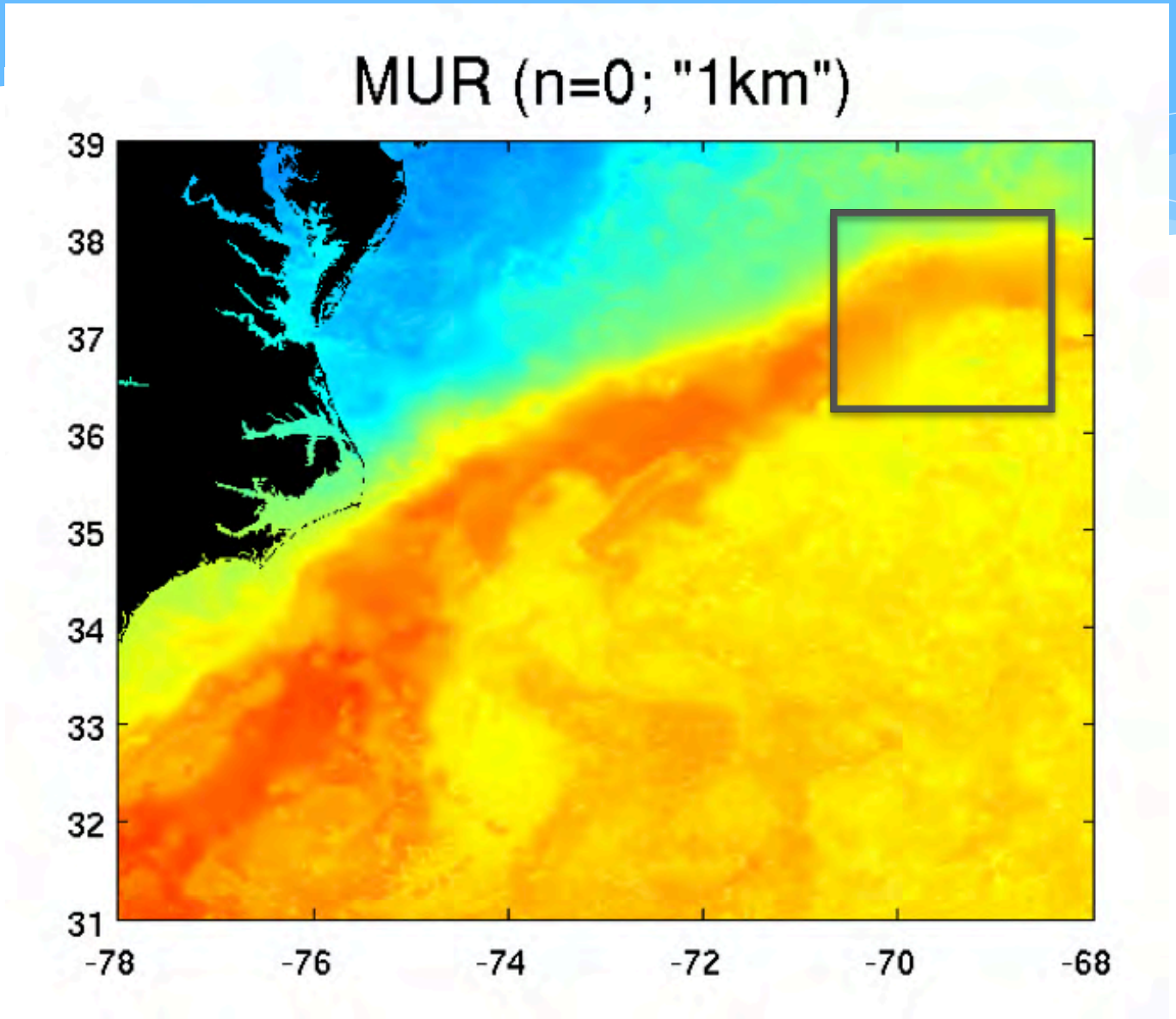
(20°, 10°, 5°, ... $4km$, $2km$, $1km$):

$$T_{\text{MRVA}} = \bar{T}_{20^\circ} + T'_{10^\circ} + \cdots + T'_{2km} + T'_{1km}$$

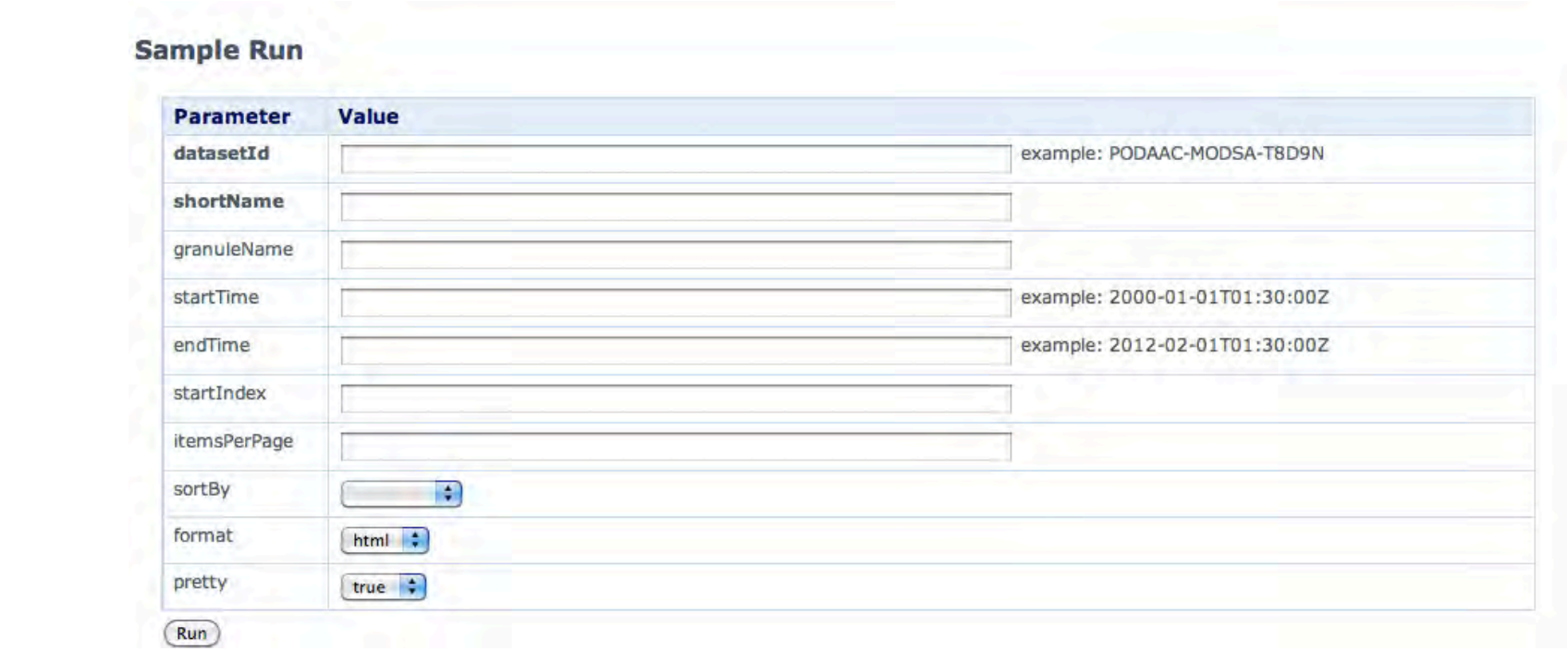
1. uses *orthonormal wavelet decomposition* (~bandpass filters) to expand the data into scale-dependent components.
2. fuses the multi-sensor data components in each scale.
3. sums (reconstructs) the analysis from each scale.

$\Longrightarrow$ Prevents over-fitting to sparsely sampled data.
$\Longrightarrow$ Facilitates inter-sensor bias correction.

MUR at various resolutions



API

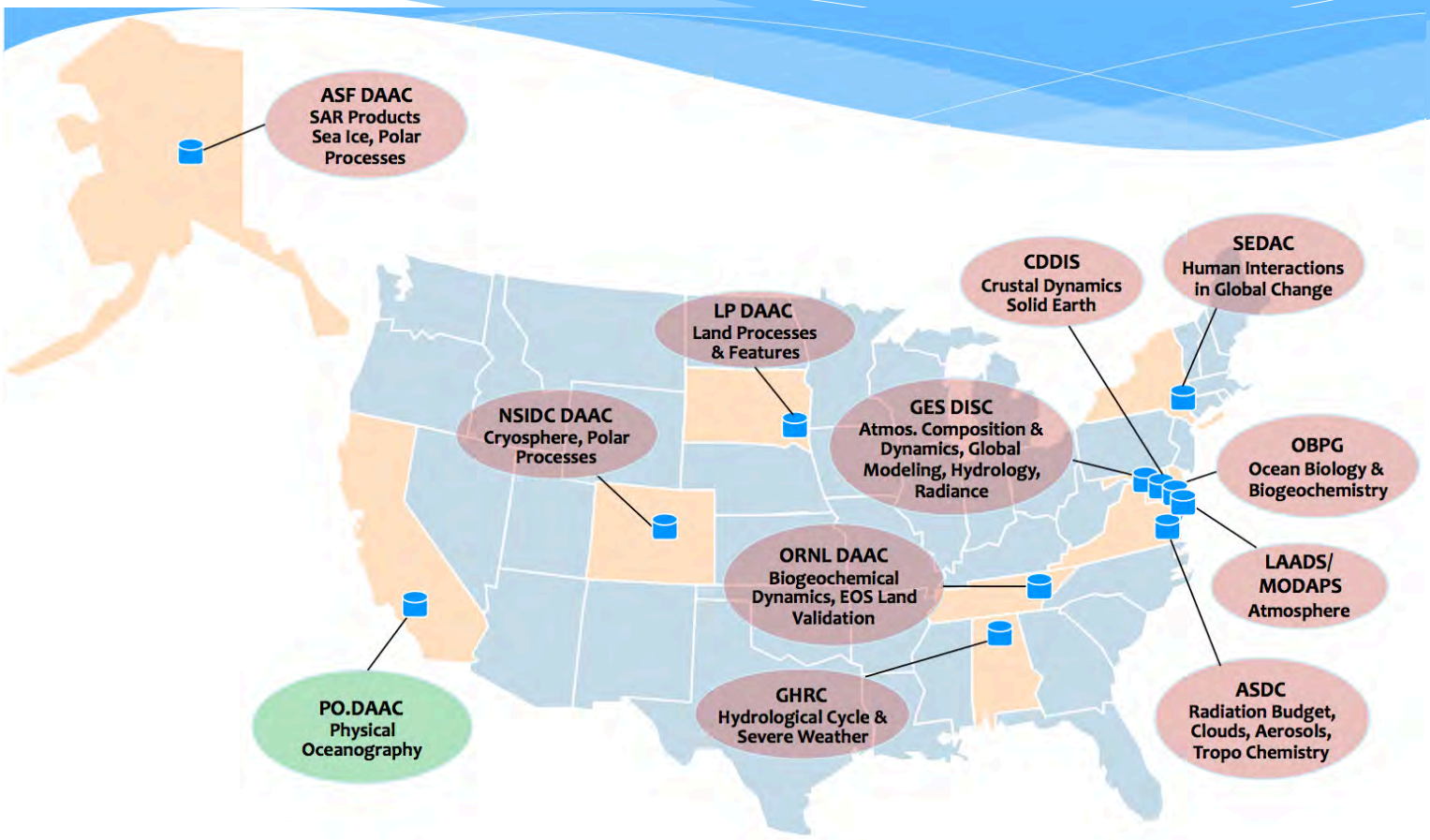


Sample Run

Parameter	Value	
datasetId		example: PODAAC-MODSA-T8D9N
shortName		
granuleName		
startTime		example: 2000-01-01T01:30:00Z
endTime		example: 2012-02-01T01:30:00Z
startIndex		
itemsPerPage		
sortBy		
format	html	
pretty	true	

Run

PO.DAAC is one of twelve NASA Data Centers



PO.DAAC Charter

"To maintain NASA's oceanographic and climate data for future generations and to make these, and synergistic datasets, easily accessible, usable, and understandable for a broad and diverse set of data consumers."