Tools for using satellite data

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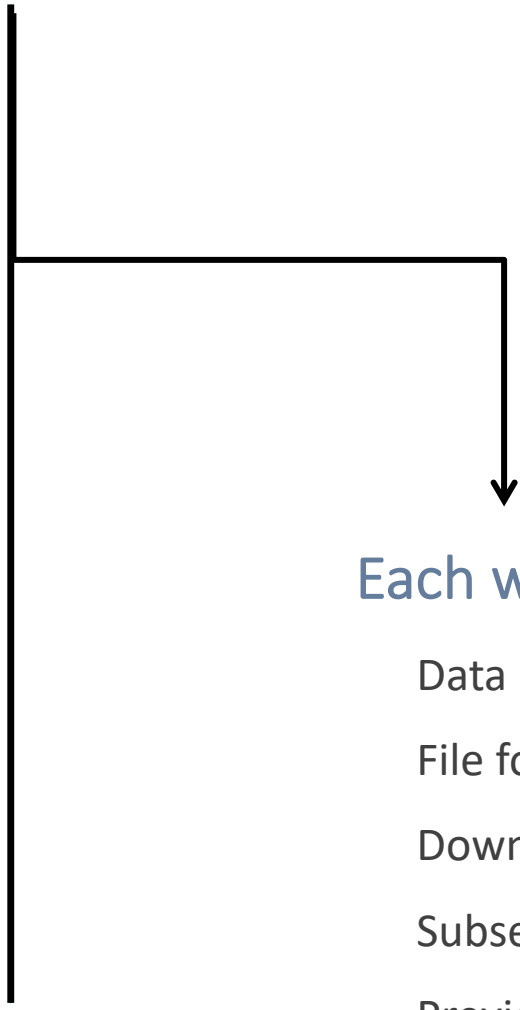
Versioning:
-Robinson, 2020
-Tomlinson and Vogel, 2018
-Abecassis and Howell, 2018
-Robinson, 2019

Accessing satellite data can be challenging

A short list of data servers

- NASA Jet Propulsion Laboratory PO.DAAC
- NASA Ocean Biology (OB.DAAC)
- NASA Goddard Space Flight Center
- NOAA Center for Satellite Applications and Res.
- NOAA CoastWatch Central Operations
- NOAA Office of Satellite and Products
- NOAA National Centers for Environmental Info.
- NOAA Comprehensive Large Array-data Stewardship System
- European Space Agency
- Japan Aerospace Exploration Agency



Each with its own

- Data products
- File formats
- Download protocols
- Subsetting abilities
- Previewing abilities

Getting data should not be difficult

The topics to cover in this presentation

Data viewers and file formats

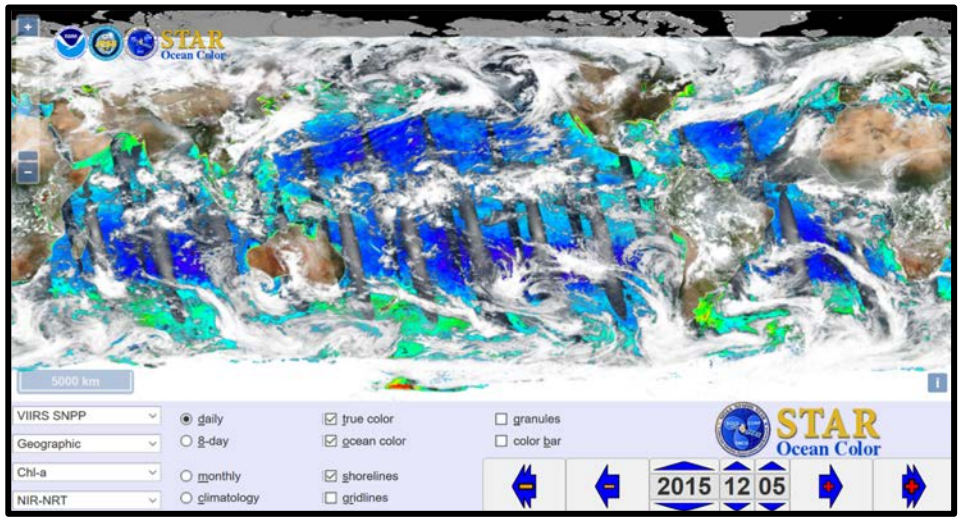
Introduction to tools for the course

Advanced tools

Class participation – Using the ERDDAP data server

Data Viewers are a good place to start for exploring data

OCView



CoastWatch Data Viewer

coastwatch.noaa.gov/cw_html/cwViewer.html

OCView (NOAA/NESDIS STAR)

star.nesdis.noaa.gov/sod/mecb/color/ocview/ocview.html

State of the Ocean - SOTO (NASA PO.DAAC)

podaac-tools.jpl.nasa.gov/soto/

Worldview (NASA EOSDIS)

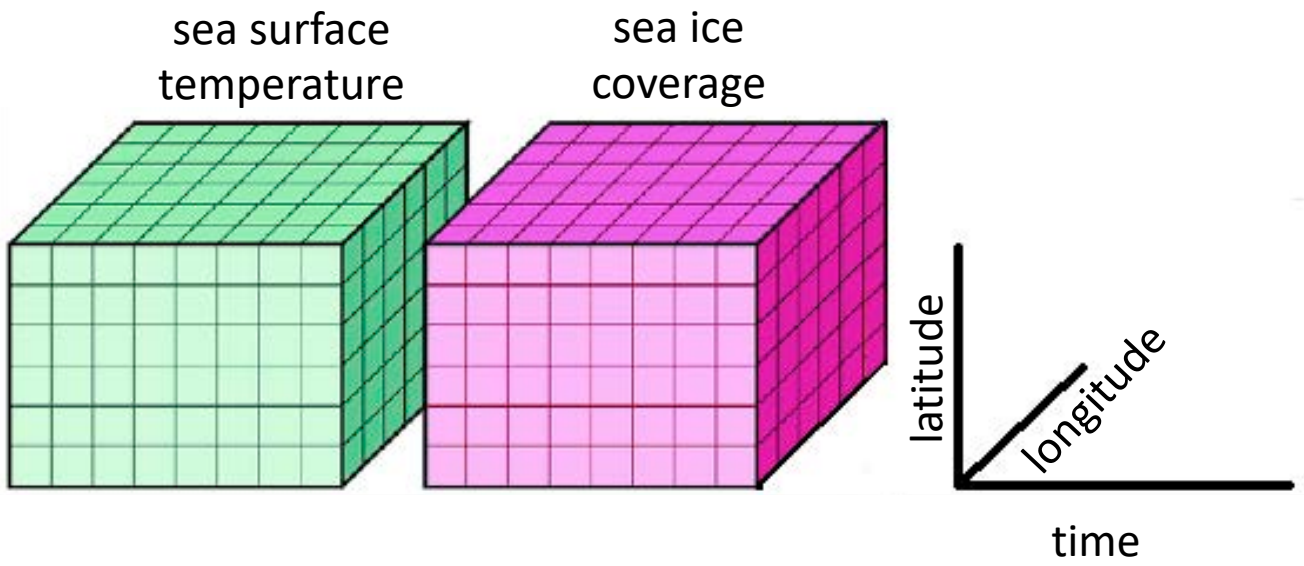
worldview.earthdata.nasa.gov/

OceanViewer (CoastWatch Caribbean/Gulf of Mexico Node)

cwcgom.aoml.noaa.gov/cgom/OceanViewer

NetCDF[1] file format: Most satellite data are distributed in NetCDF

WHY?



Self-Describing

Contains the information and metadata that you need to use the data

Portable

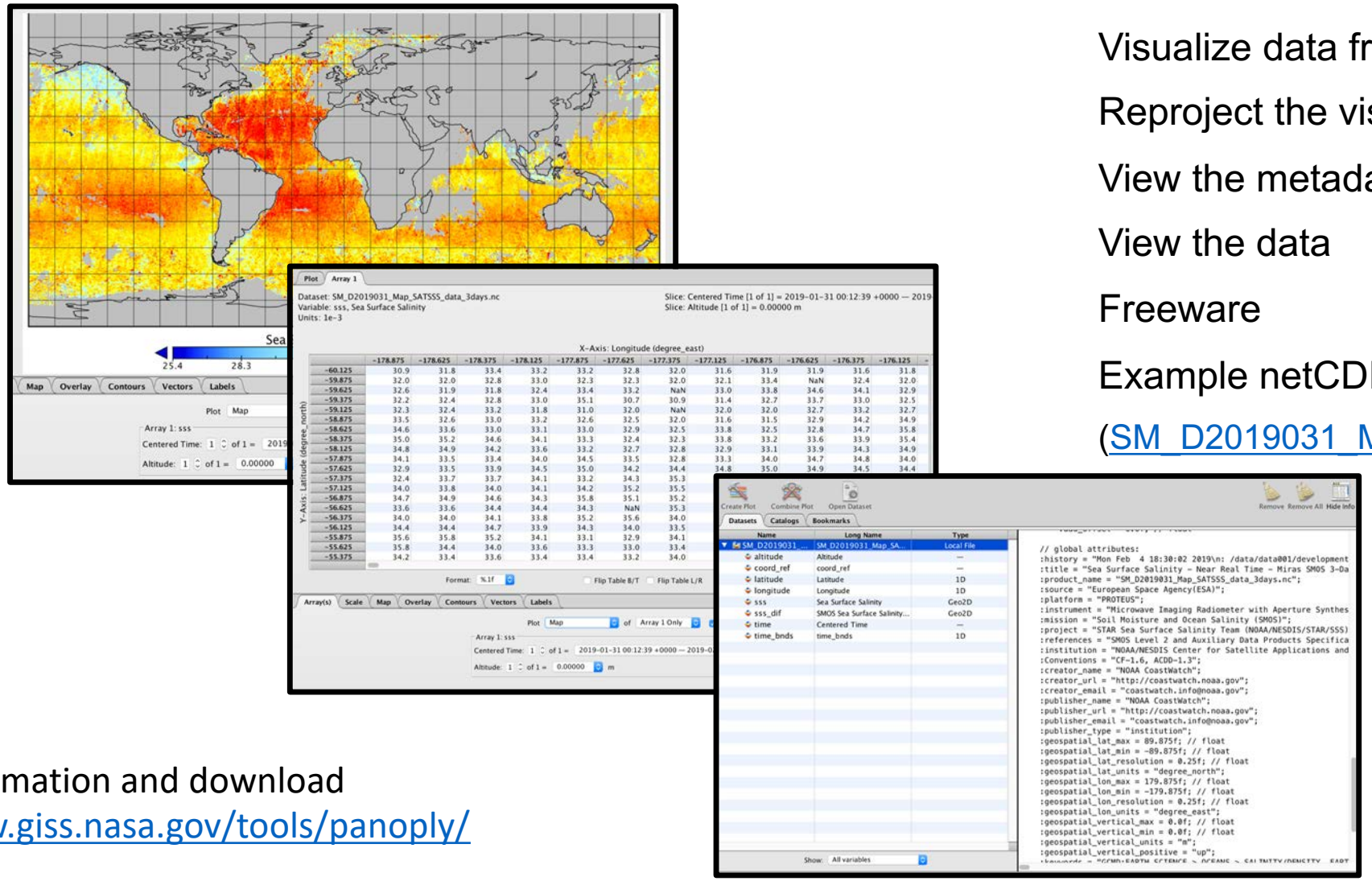
Can be used by all computer platforms (Mac, OC, Linux)

Compact

Binary data and compressible

[1]Network Common Data Format

Software for visualizing NetCDF files – NASA Panoply



Visualize data from netCDF and HDF files

Reproject the visualization

View the metadata

View the data

Freeware

Example netCDF salinity file

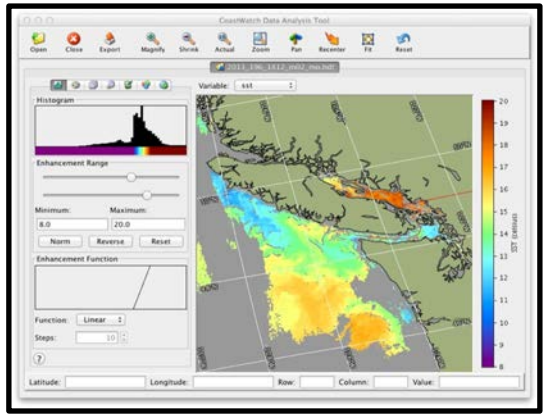
(SM_D2019031_Map_SATSSS_data_3days.nc)

Information and download
www.giss.nasa.gov/tools/panoply/

Advanced tools for data processing

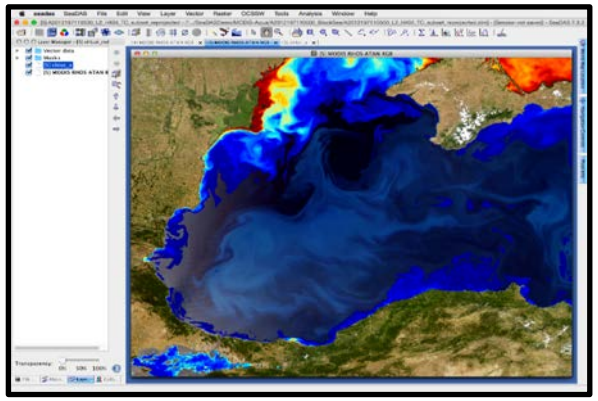
COMPREHENSIVE SOFTWARE PACKAGES

NOAA CoastWatch Utilities



coastwatch.noaa.gov/cw/user-resources/coastwatch-utilities.html

NASA SeaDAS



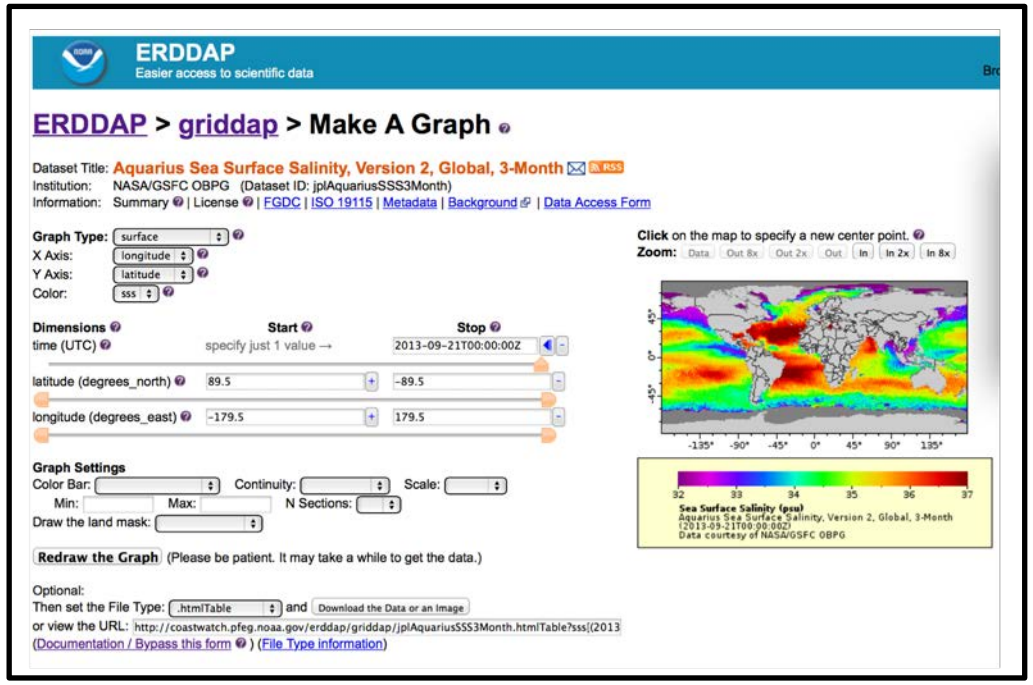
seadas.gsfc.nasa.gov

Comprehensive software packages for satellite data:

- Processing
- Graphics and Visualization
- Analysis
- Format conversions
- Quality control

NOAA COASTWATCH UTILITIES TRAINING SESSION THURSDAY

The ERDDAP data server simplifies data access



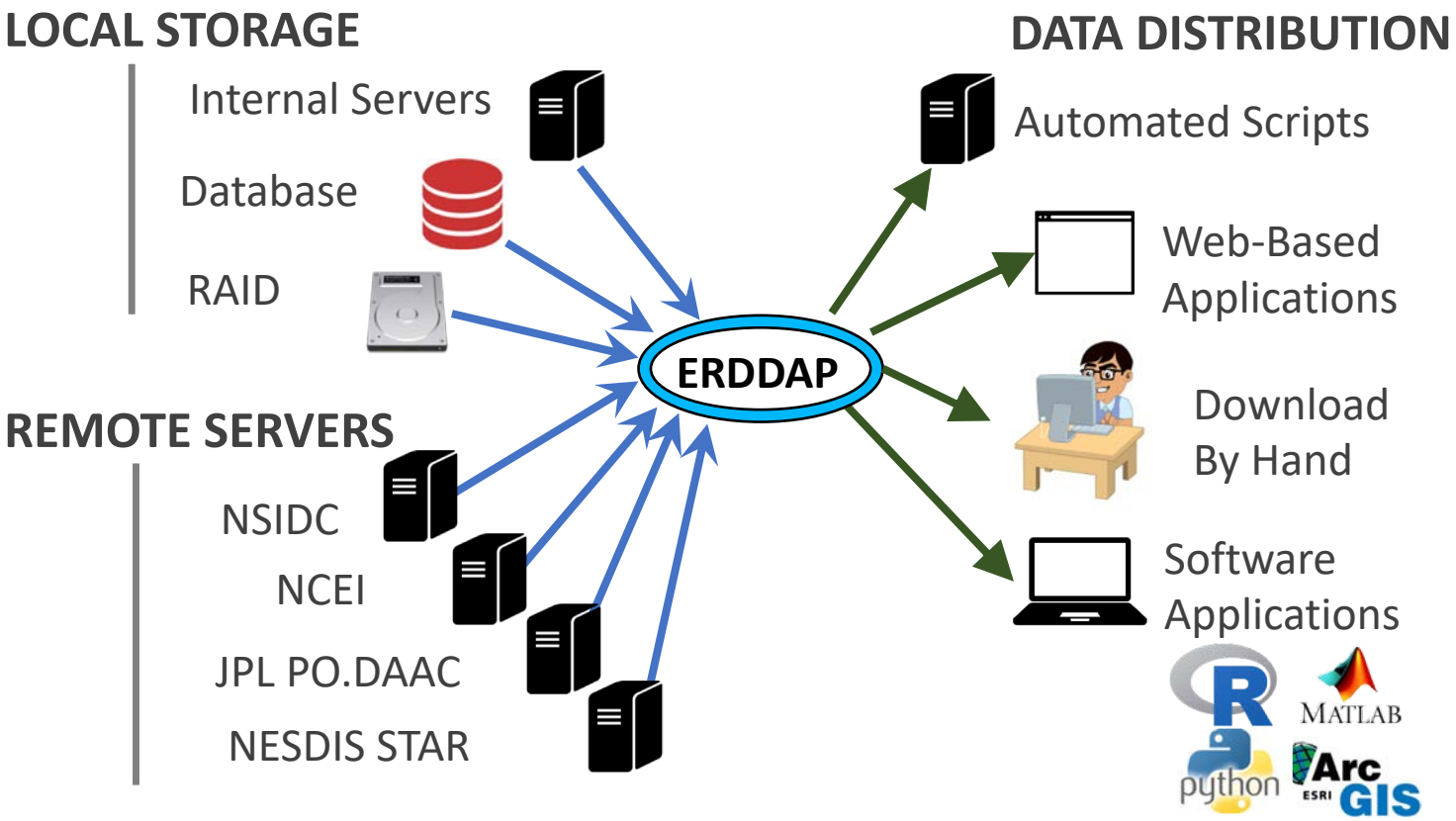
WC Node's ERDDAP server gives you:

A simple, consistent way to download data

- For the area and time period of interest
- In the format that works with your analysis tools

ERDDAP works for humans and machines

ERDDAP allows one-stop data shopping



FLEXIBLE DISTRIBUTION IS POSSIBLE BECAUSE DATA QUERIES ARE COMPLETELY DEFINED WITHIN A URL

Deconstructing the ERDDAP URL

griddap/erdVHsstaWS3day.largePng?sst[(2016-10-21T12:00:00Z):(2016-10-21T12:00:00Z)][0.0):(0.0)]

coastwatch.pfeg.noaa.gov/erddap/

[(41.7):(30.86)][(-128.25):(-114.75)]

Example of a URL data request

Base URL:	https://coastwatch.pfeg.noaa.gov/erddap/griddap/
Dataset ID:	erdVHsstaWS3day
File Type:	.largePng (.nc, .mat, .json, .geotif, .kml, .csv…)
Data Request Begins	?
Variable:	sst
Time range:	[(2016-10-21T12:00:00Z):(2016-10-21T12:00:00Z)]
Altitude range	[(0.0):(0.0)]
Latitude Range:	[(41.75):(30.86)]
Longitude Range:	[(-128.25):(-114.75)]

https://coastwatch.pfeg.noaa.gov/erddap/griddap/erdVHsstaWS3day.largePng?sst[(2016-10-21T12:00:00Z):(2016-10-21T12:00:00Z)][(0.0):(0.0)][(41.7):(30.86)][(-128.25):(-114.75)]

The structure of ERDDAP's URL makes it easy to build your own data request in any language

THIS EXAMPLE IS IN R

1. GENERATE URL PARTS WITH R (MATLAB, PYTHON…)

```
baseurl <- 'http://coastwatch.pfeg.noaa.gov/erddap/griddap/'
data_id <- 'erdVHsstaWS3day'
file_type <- '.nc'
Data_var <- '?sst'
time <- '[(2016-10-21T12:00:00Z):1:(2016-10-21T12:00:00Z)]'
alt <- [(0.0):(0.0)]
lat <- '[(41.75):1:(30.86)]'
lon <- '[(-128.25):(-114.75)]'
```

2. PUT TOGETHER PARTS TO BUILD CUSTOM URL

```
erddapURL <- paste(baseurl, data_id, data_var, time, alt, lat, lon, sep="")
```

3. SEND A REQUEST TO ERDDAP USING THE URL

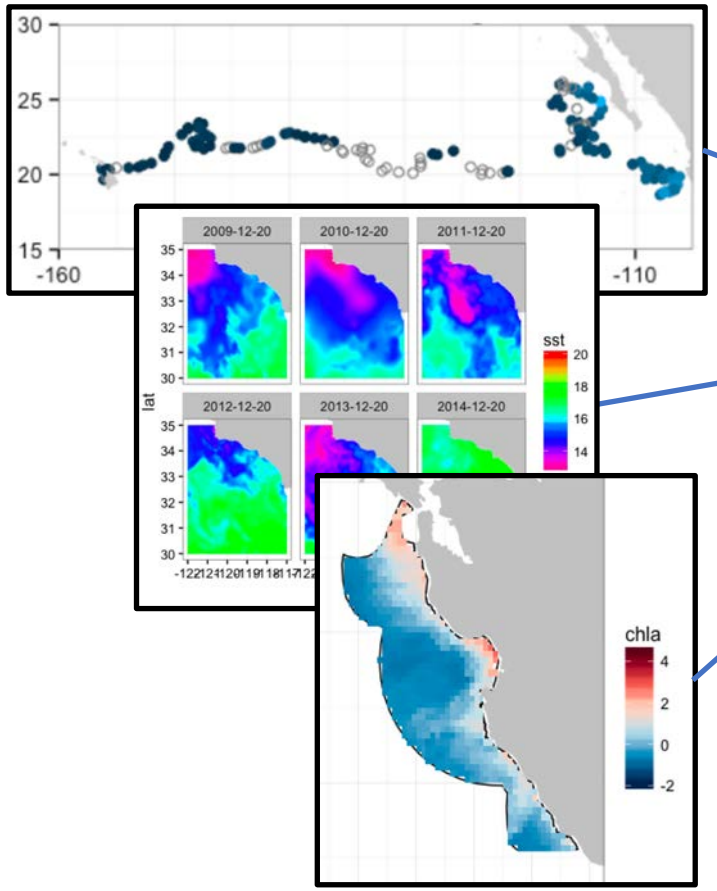
```
download.file(url=errdapURL, destfile="myDataFile.nc")
```

4. CREATE DATA OBJECT AND USE THE DATA

```
dataObject <- ncdf4::nc_open("myDataFile.nc")
```

Tools for the workshop – Xtractomatic R scripts talk to ERDDAP for you

CREATE AND EXECUTE ERDDAP DATA REQUESTS - DO COMMON TASKS



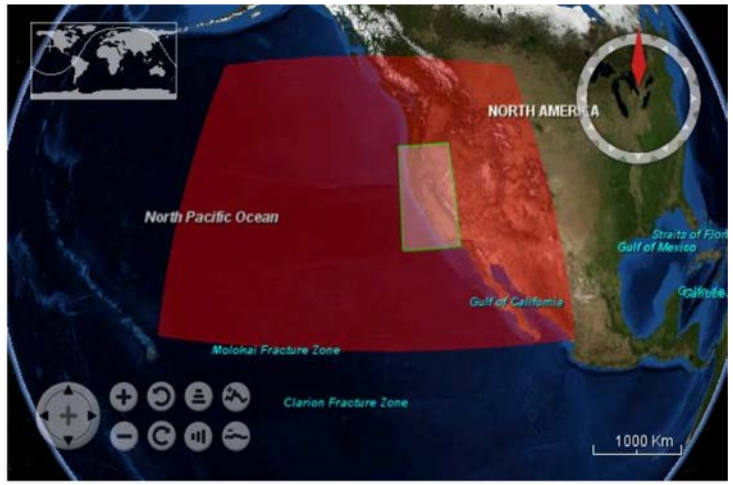
Premade scripts that perform common functions

- Extract data around ship stations or animal tracks
- Extract data for rectangular area over time
- Extract data for any area (polygon) over time

R XTRACTOMATIC TRAINING SESSION THURSDAY

PYTHON CODE EXAMPLES SESSION THURSDAY

Tools for the workshop – Plug-in for ArcGIS users



Environmental Data Connector: a Plug-in for ArcGIS

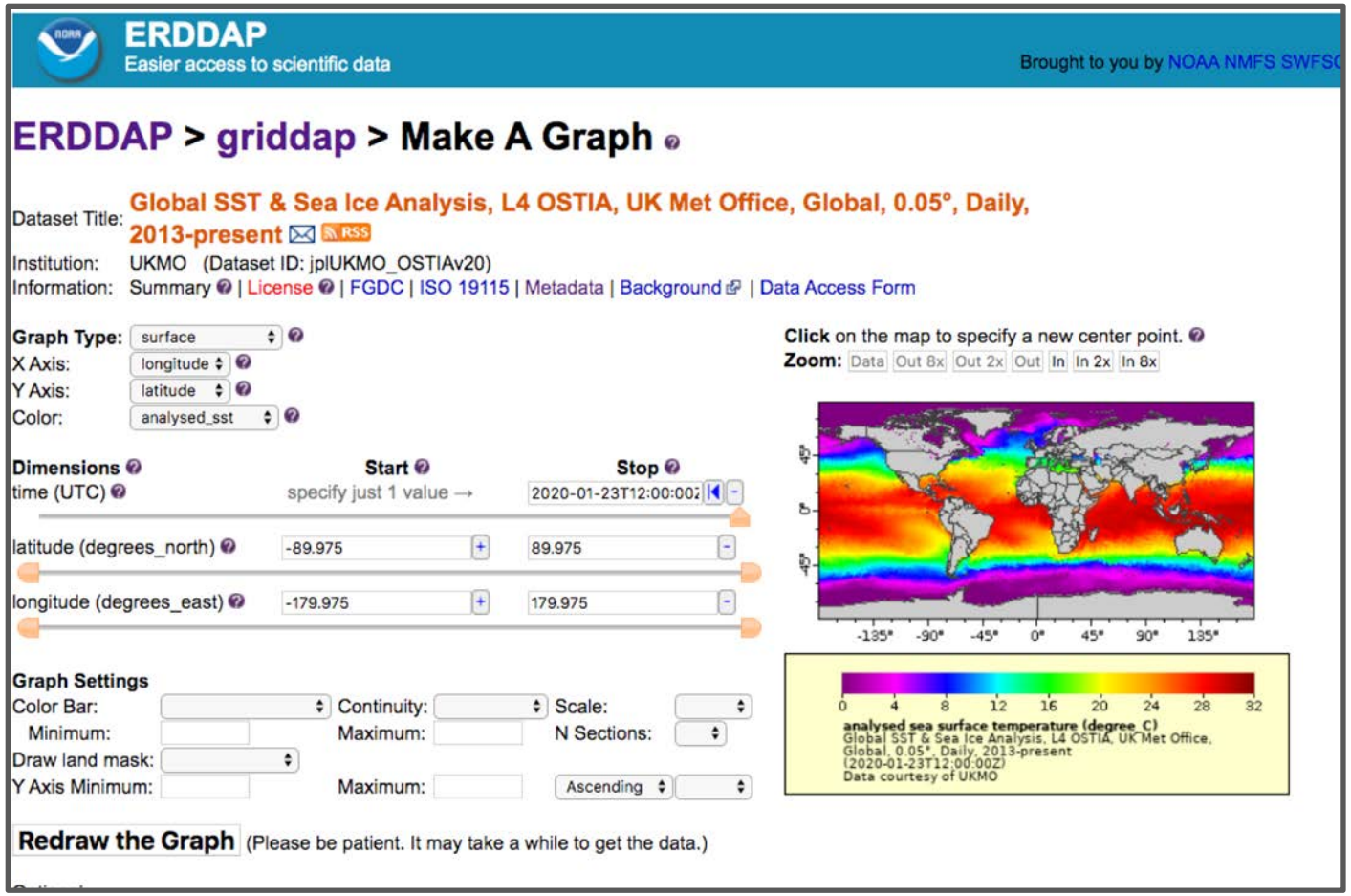
Free graphical interface for browsing, sub-setting, and downloading data from OPeNDAP, SOS, THREDDS, and ERDDAP

User guide and download
coastwatch.pfeg.noaa.gov/EDC/index.html

Tutorial
www.youtube.com/watch?v=czr6M0877gE

ARCGIS TRAINING SESSION THURSDAY

ERDDAP's interface for downloading data by hand



ERDDAP: live demo and hands-on session

Please do the following

OPEN UP A BROWSER AND BRING UP ERDDAP AT THIS URL

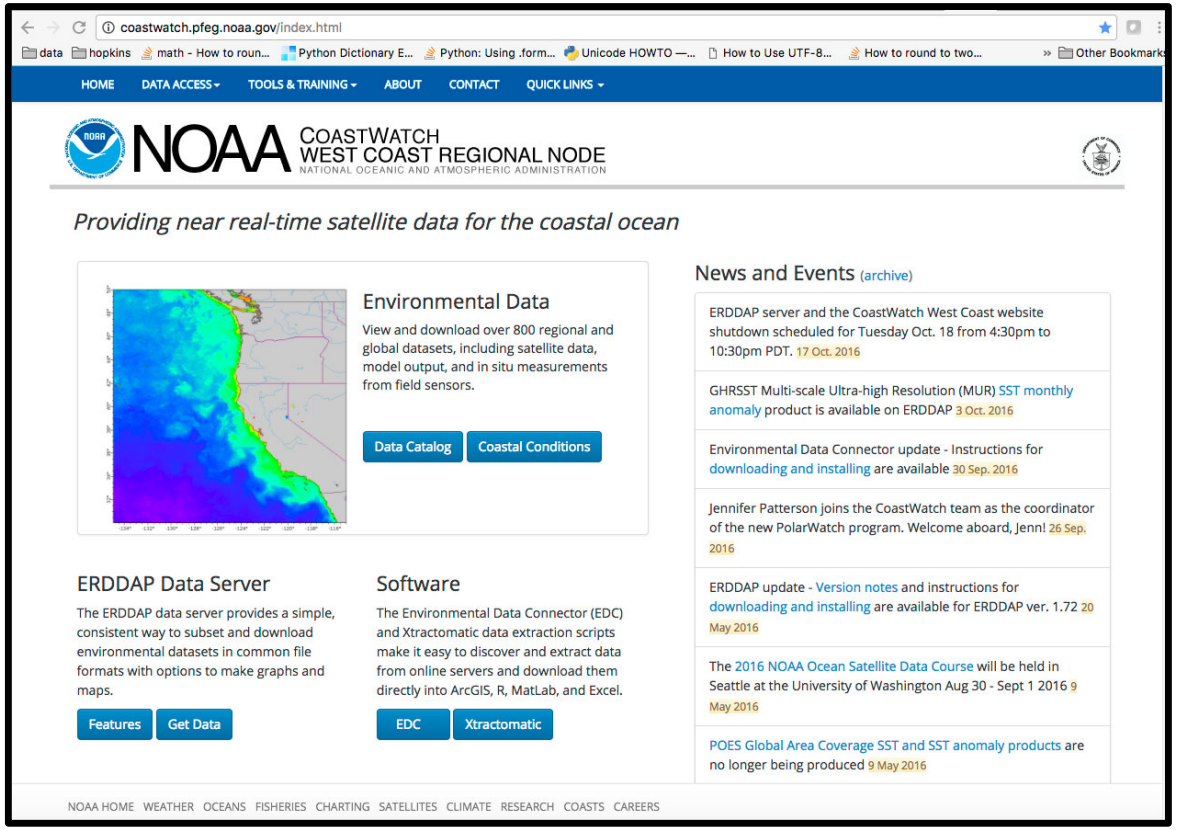
- http://coastwatch.pfeg.noaa.gov/erddap

IN A SECOND BROWSER WINDOW, OPEN THIS TUTORIAL

- http://coastwatch.pfeg.noaa.gov/projects/erddap
- We will work through chapters 2 and 3

Questions?

VISIT THE COASTWATCH WEST COAST WEBSITE FOR INFORMATION, TUTORIALS, SOFTWARE, AND MORE



coastwatch.pfeg.noaa.gov

Please do the following before the live demonstration

Please do the following

OPEN UP A BROWSER AND BRING UP ERDDAP AT THIS URL

- http://coastwatch.pfeg.noaa.gov/erddap
- Or Google it with “ERDDAP” “west coast”

IN A SECOND BROWSER WINDOW, OPEN ERDDAP TUTORIAL LOCATED AT THIS URL :

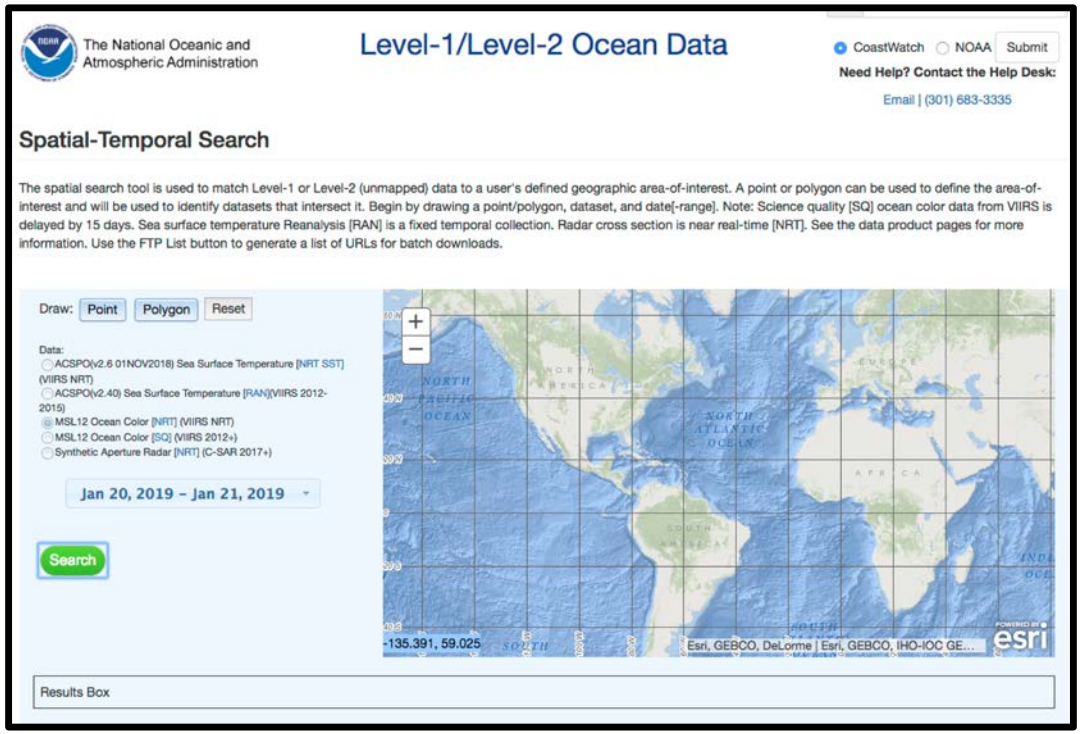
- http://coastwatch.pfeg.noaa.gov/projects/erddap

OPTIONAL: OPEN UP A TEXT EDITOR (NOT WORD)

- E.g. Mac – TextEdit or PC – WordPad

Advanced data discovery tools

COASTWATCH CENTRAL DATA DISCOVERY TOOLS



L1/L2 Data Data Search

coastwatch.noaa.gov/cw_html/cw_polygon_search.html

Level-1/Level-2 Granule Search

coastwatch.noaa.gov/cw_html/cw_granule_selector.html