

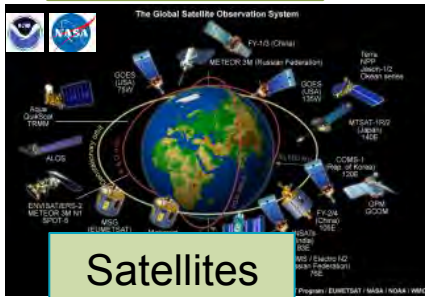
Access to IOOS Data Relevant to OOI

Kathleen Bailey
NOAA/NOS/IOOS
January 6, 2016

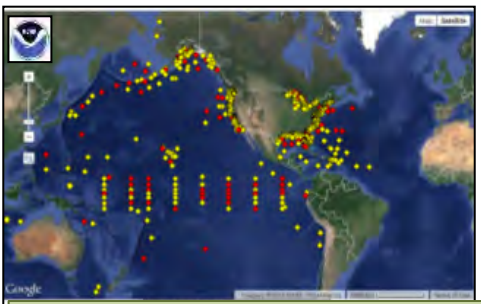


The U.S. Integrated Ocean Observing System (IOOS)

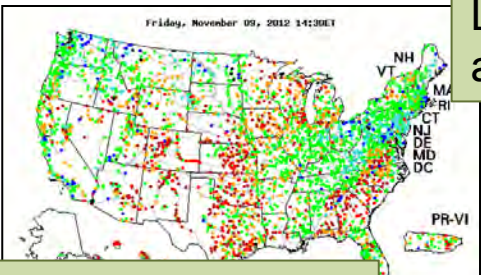
Federal



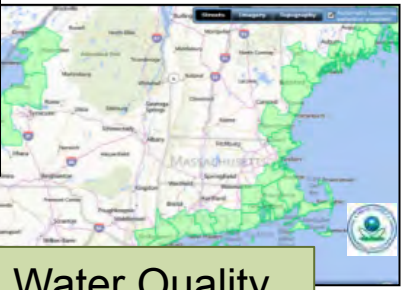
Satellites



600+: Buoys, Water Level stations, Coastal and Estuary stations



Stream Gauges



Water Quality



Research Infrastructure



PORTS®

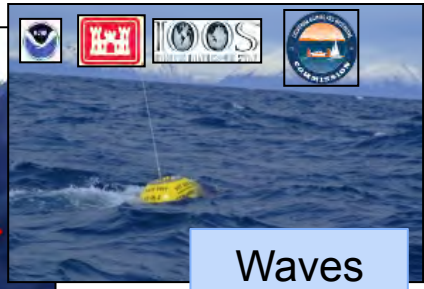
Regional



High Frequency Radar



450: Buoys, Water Level stations, Coastal and Estuary stations



Waves



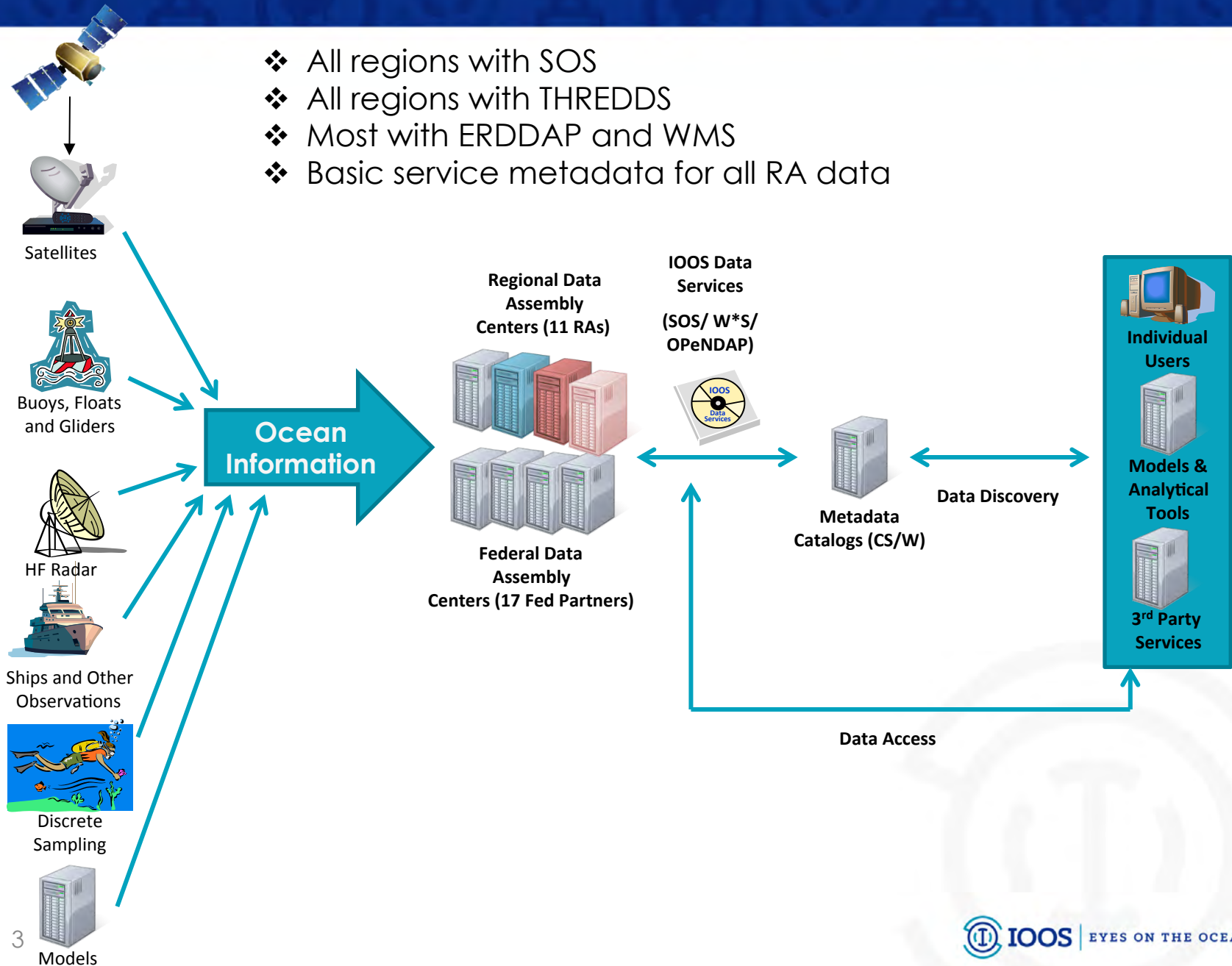
Tagging



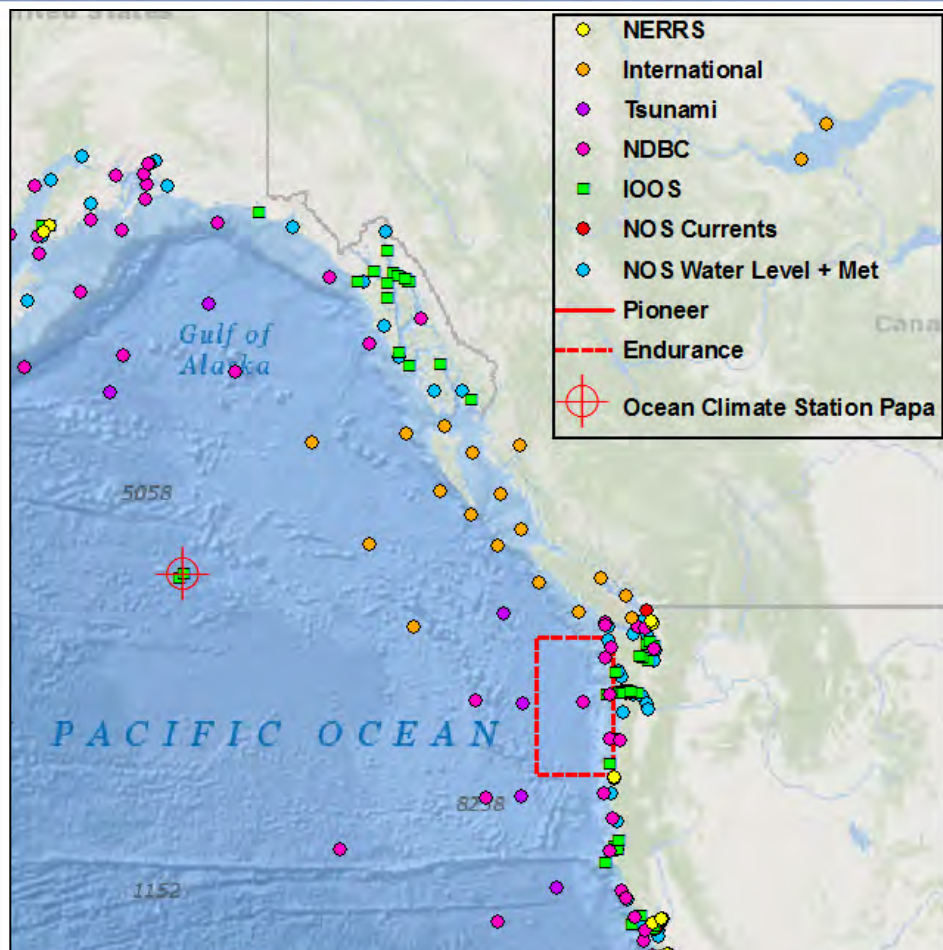
Gliders

IOOS DMAC: Distributed Data Network for Ocean Information

- ❖ All regions with SOS
- ❖ All regions with THREDDS
- ❖ Most with ERDDAP and WMS
- ❖ Basic service metadata for all RA data

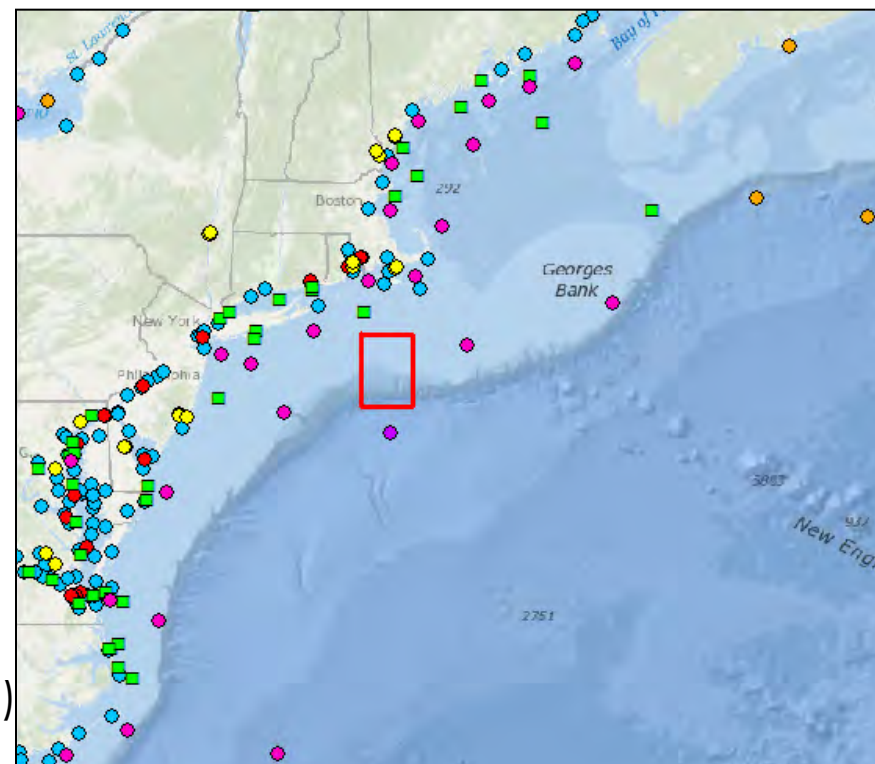


Nearby in-situ observations



- **IOOS** (11 Regional Associations)
 - Buoys, shore-based stations: water quality, weather, waves, water level, etc)
- **NOS** (Current meters, water levels, weather)

- **National Estuarine Research Reserve System** (Shore-based: Water quality and weather)
- **International** (Environment Canada buoys)
- **Tsunami** (DART buoys)
- **NDBC** (Coastal Weather Buoys, C-MAN)



Exposing Data – RA Data Portals



Functional DACs complement the regional footprint

NVS: NANOOS Visualization System

Apps Disclaimer Settings Log Out

NVS
DATA EXPLORER

mayorga

v4.1

Contact

NANOOS

<http://nvs.nanoos.org/Explorer>

Map

Asset List

Help

Lat: 49.4600 Lon: -124.7368

Terrain

Regions

Filters

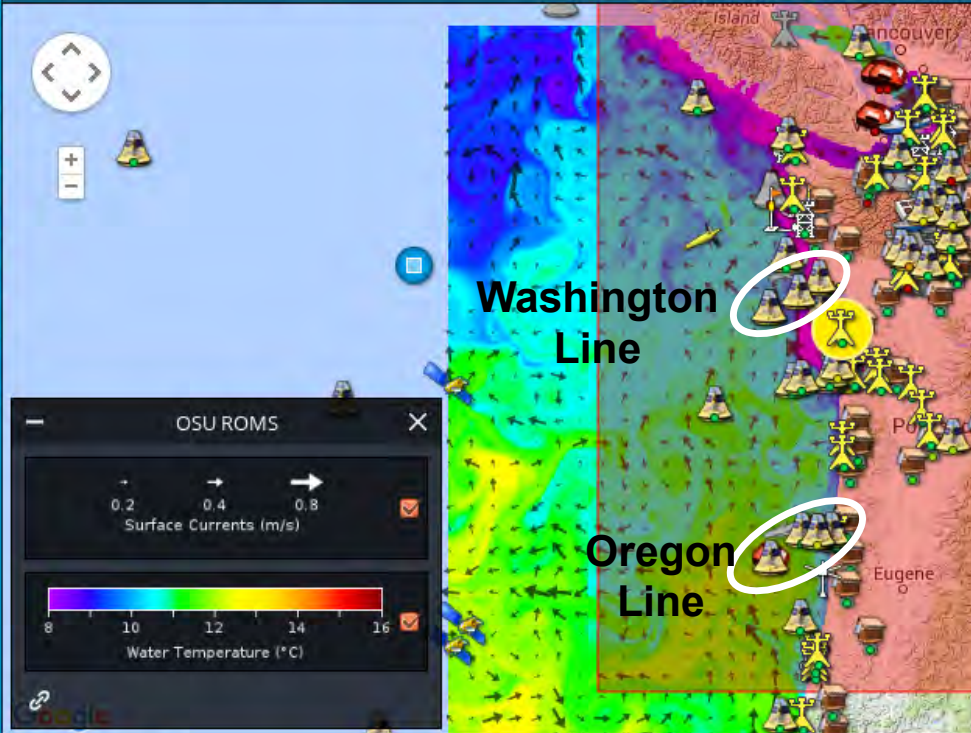
Fixed Platforms

Mobile Platforms

Remote Sensing

Models

Legend



PCSGA - Bay Center Port mooring, Willapa Bay

Observations Details History Credits

Data Updated: 4 Jan 2016 10:58 PST Provider: PSI

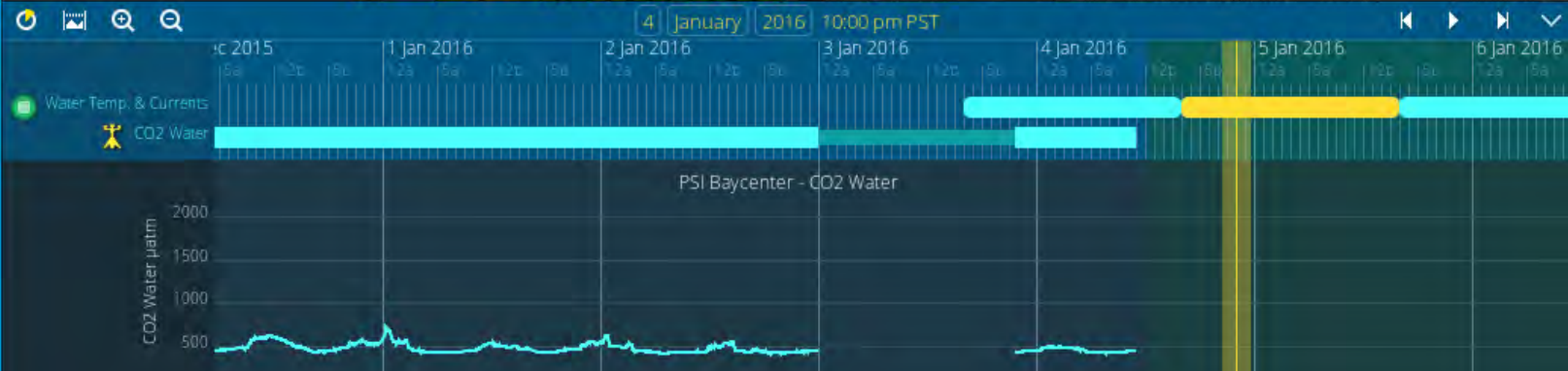
Alkalinity (total) (-0.3 m)	1483.8 $\mu\text{mol/kg}$
CO2 Water (-0.3 m)	458.9 μatm
Conductivity (-0.3 m)	2.7 S/m
Dissolved Inorganic Carbon (total) (-0.3 m)	
Omega - Aragonite Saturation (-0.3 m)	
Oxygen Concentration (-0.3 m)	11.6 mg/L
Oxygen Percent Sat. (-0.3 m)	99.7 %
pH (-0.3 m)	8
Salinity (-0.3 m)	16.3 PSU
Water Temperature (-0.3 m)	4.2 $^{\circ}\text{C}$

Link

OSU ROMS

Surface Currents (m/s)

Water Temperature ($^{\circ}\text{C}$)

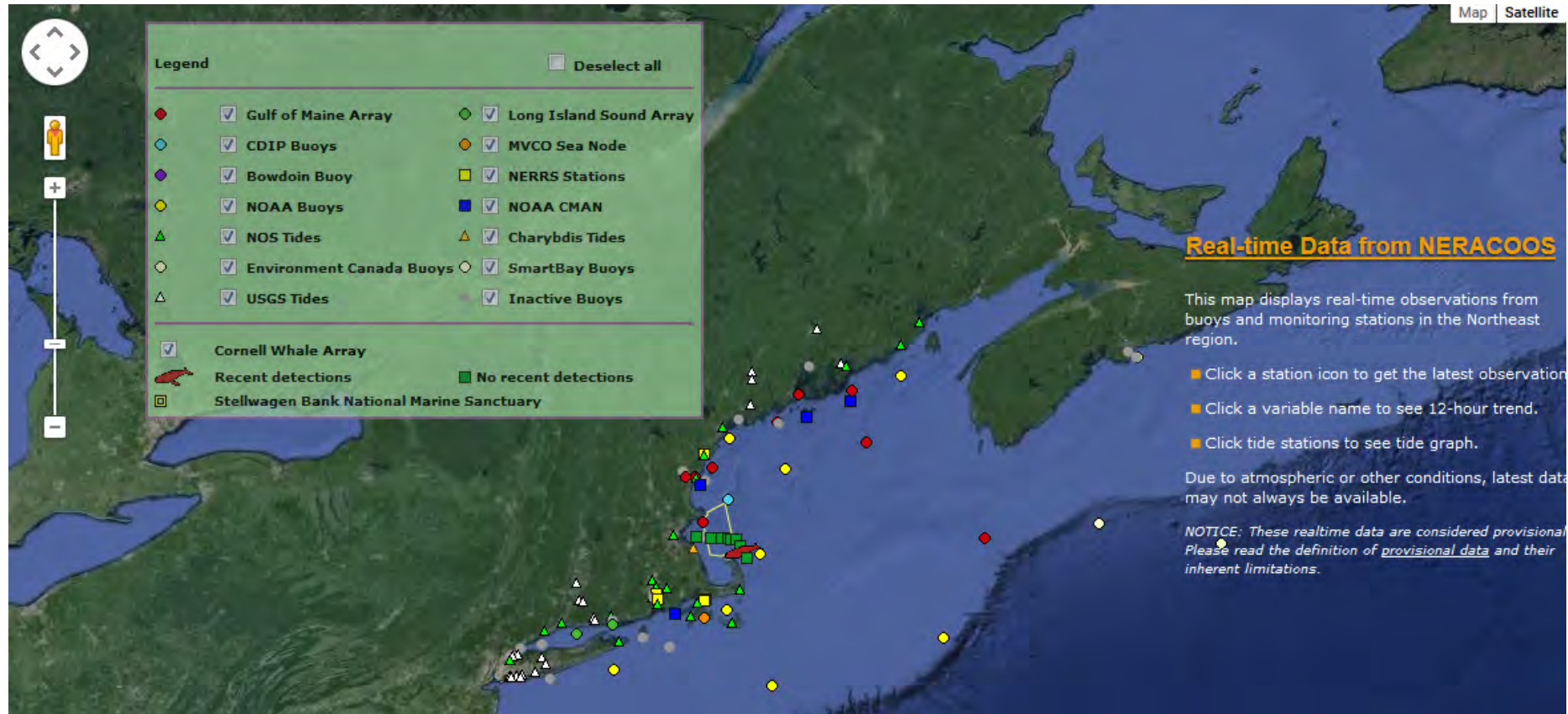


NVS: NANOOS Visualization System

Other apps:



NERACOOS Real-time Data Portal



Federal :

USGS Tides
NOAA Buoys
NOS Tides
NERRS
NDBC C-MAN

Regional:

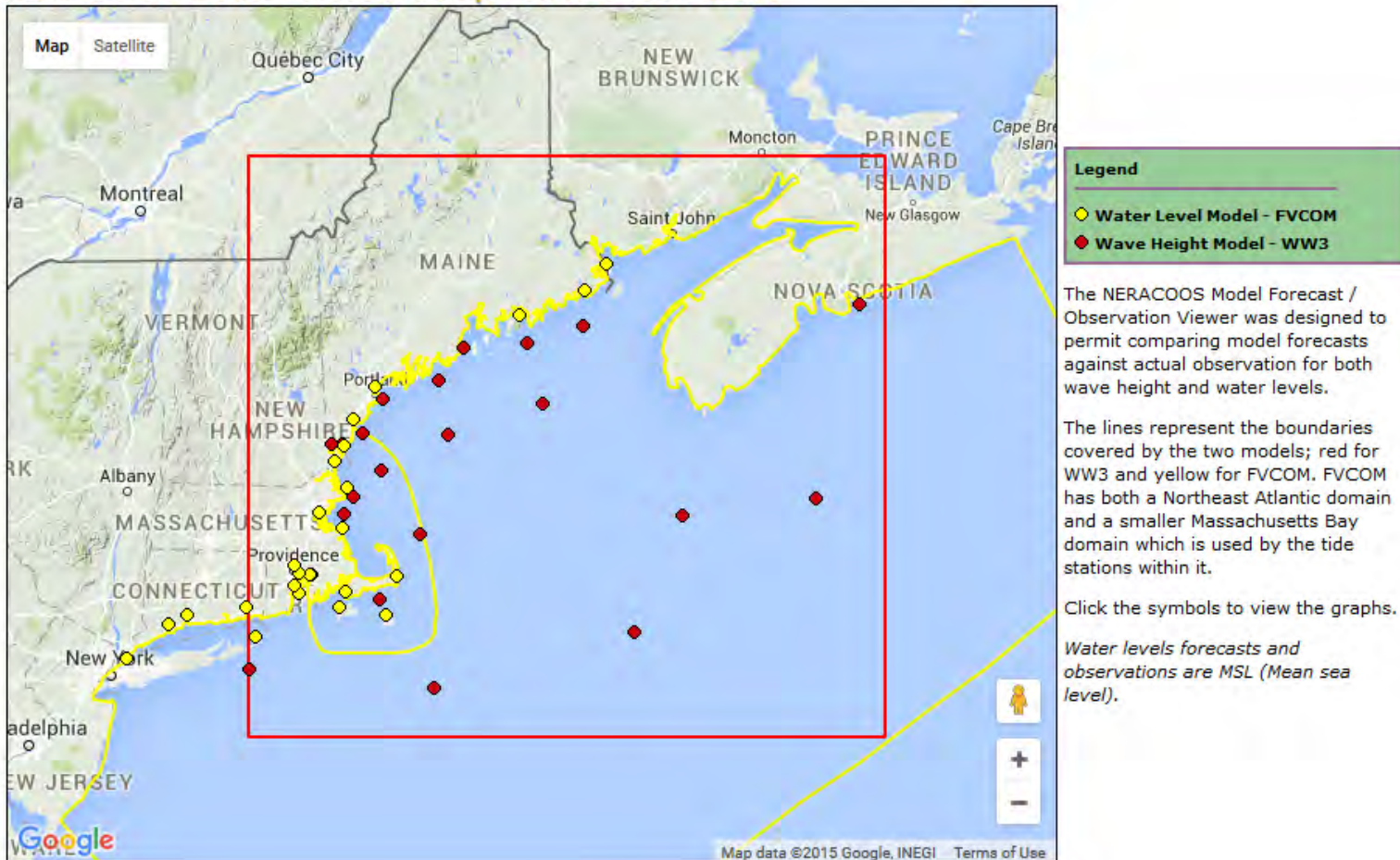
Gulf of Maine Array
CDIP Buoys
Long Island Sound Array
MVCO Sea Node

International :

Environment Canada Buoys

NERACOOS Model Forecast/Observation Tool

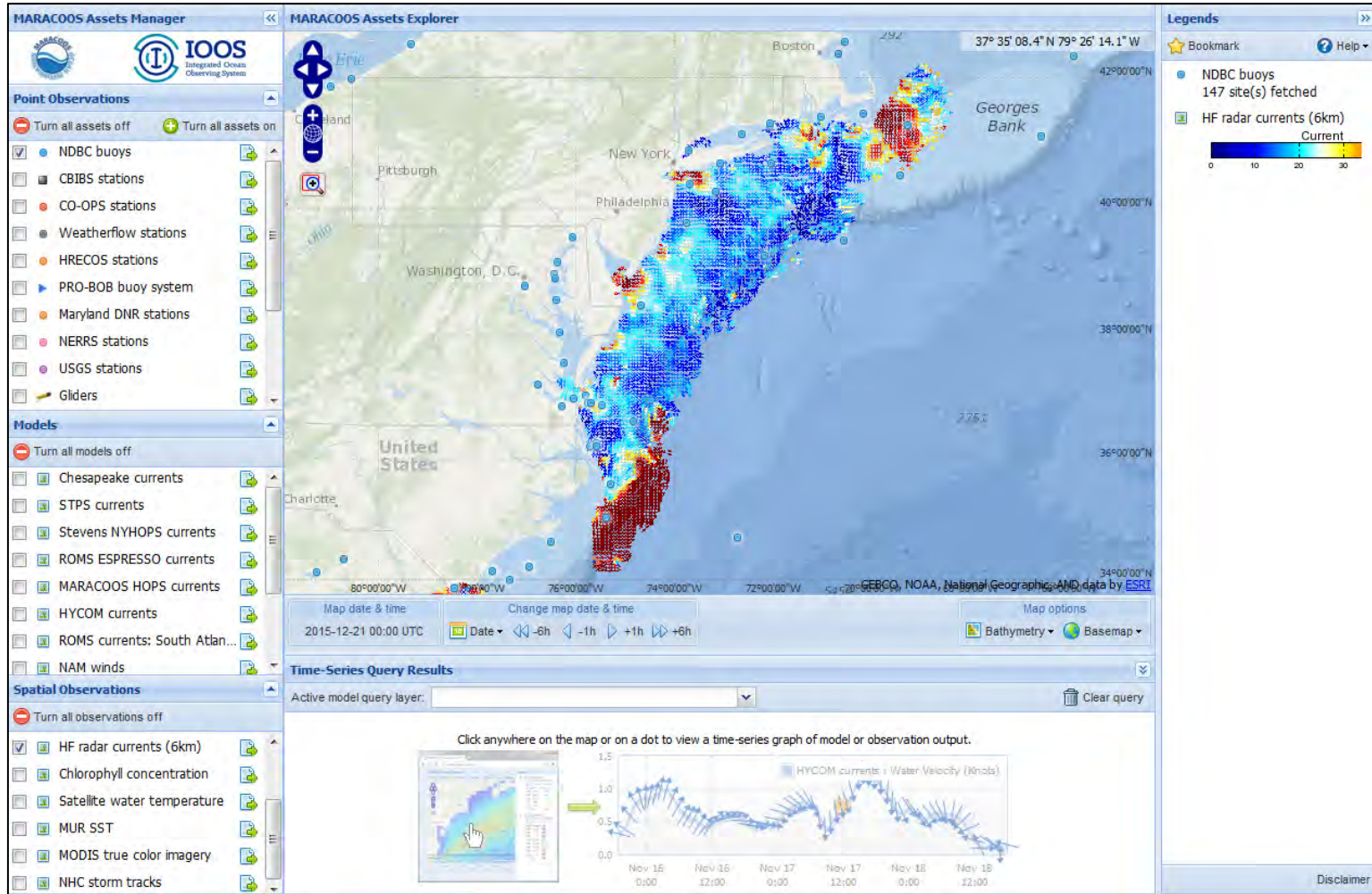
NERACOOS Model Forecast Compared to Observations



<http://www.neracoos.org/datatools/forecast/modelobs>

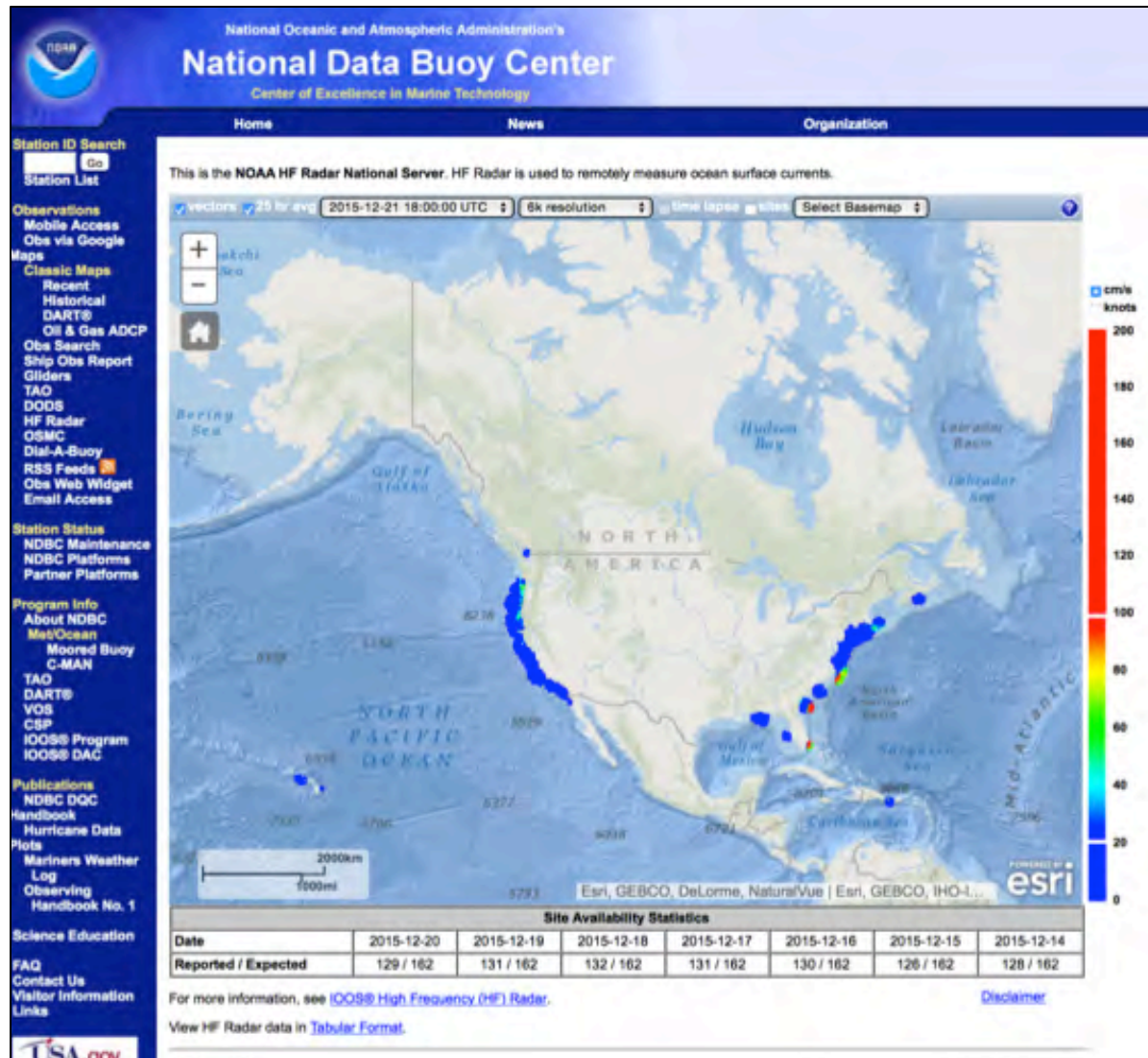
MARACOOS Asset Explorer

A view of HF Radar surface currents:
<http://assets.maracoos.org>



Numerous in-situ and spatial observations, model output available

NOAA National Network: HF Radar



<http://hfradar.ndbc.noaa.gov/>

NOAA National Network - THREDDS

Operational server for HF Radar:



National Data Buoy Center THREDDS Server

THREDDS Data Server

Catalog <http://sdf.ndbc.noaa.gov:8080/thredds/catalog.html>

Dataset: THREDDS-IDD WCS Data Server/US East Coast and Gulf of Mexico 6km resolution HF Radar data

- *Data format:* netCDF
- *Data type:* GRID
- *Naming Authority:* unidata.ucar.edu:
- *ID:* hfradar_usegc_6km

Access:

1. **OPENDAP:** [/thredds/dodsC/hfradar_usegc_6km](#)
2. **WCS:** [/thredds/wcs/hfradar_usegc_6km](#)
3. **NCML:** [/thredds/ncml/hfradar_usegc_6km](#)
4. **UDDC:** [/thredds/uddc/hfradar_usegc_6km](#)
5. **ISO:** [/thredds/iso/hfradar_usegc_6km](#)
6. **NetcdfSubset:** [/thredds/ncss/grid/hfradar_usegc_6km](#)

Viewers:

- [NetCDF-Java ToolsUI \(webstart\)](#)
- [Integrated Data Viewer \(IDV\) \(webstart\)](#)

[http://sdf.ndbc.noaa.gov:8080/thredds/catalog.html?
dataset=hfradar_usegc_6km](http://sdf.ndbc.noaa.gov:8080/thredds/catalog.html?dataset=hfradar_usegc_6km)

MARACOOS Glider Access

<http://data.ioos.us/gliders/erddap/index.html>

<http://data.ioos.us/gliders/thredds/catalog.html>

The screenshot displays the MARACOOS Glider Access web interface. On the left, under "All Available Datasets", there are filters for "Number of Datasets" (86), "Inclusive Years" (4), and "Participating Institutions" (15). Below these is a "Zoom All" button and a map of Rhode Island Sound with a glider track. The central plot shows a depth profile from 0 to 90 meters, with multiple colored lines representing different glider profiles. On the right, the "Current Dataset" section is highlighted with a red circle, showing options for "RSS", "ERDDAP", "ERDDAP", and "TDS". Below this, the dataset details are listed: DatasetID: blue-2015062711242, Institution: University of Massachusetts Dartmouth, Start Date: 2015-06-27T12:54:58Z, End Date: 2015-07-17T13:02:45Z, Min Depth: -3.04 meters, Max Depth: -99.83 meters, and # Profiles: 1061. The "Plotting Parameters" section shows "Sensor" set to "Temperature", "Start Time" as "2015-07-04", and "End Time" as "2015-07-10". A blue bar indicates "240 Profiles Selected" and a "Plot Profiles" button is visible.

Machine-Machine Data Discovery and Access

Discovery:

- The Open Geospatial Consortium Catalog Service for the Web (CSW) provides standardized services for search.
 - Primary interface standard in use across IOOS/DMAC participants.
 - Query a CSW using a geographical bounding box, a time range, and a variable of interest
- CSWs: NCEI geoportal, GEOSS, NASA GCMD
 - NCEI Geoportal: <http://www.ngdc.noaa.gov/geoportal/csw>
- Data can be easily queried and accessed using Python tools
- Tutorial provided:
https://ioos.github.io/system-test/blog/2015/10/12/fetching_data/

Access:

- OPeNDAP+CF conventions
- Sensor Observation Service (SOS)

NCEI Catalog – discover assets

www.ngdc.noaa.gov/geoport/catalog/main/home.page

NOAA NATIONAL GEOPHYSICAL DATA CENTER (NGDC)
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

SEARCH BROWSE

Search

Search metadata content, including title, abstract, and keywords

(NECOFS OR SOS) AND *temperature*

Records: NOAA National Geophysical Data Center
Select site or configure search.

Advanced Search Options
Clear

WHERE
 Anywhere Intersecting Fully within

Map showing the North Atlantic Ocean region with a red bounding box indicating the search area.

Results 1-4 of 4 record(s)

Expand results [Zoom To Results](#) [Zoom To Searched Area](#)

NECOFS GOM3 (FVCOM) - Northeast US - Latest Forecast
Latest forecast from the FVCOM Northeast Coastal Ocean Forecast System using a newer, higher-resolution GOM3 mesh (GOM2 was the preceding mesh)
[Details](#) [Metadata](#) [Download](#) [OPeNDAP](#) [Zoom To](#)

NOAA NDBC SOS - sea water temperature
The NOAA NDBC SOS server is part of the IOOS DIF SOS Project. The stations in this dataset have sea_water_temperature data. Because of the nature of SOS requests, requests for data MUST include constraints for the longitude, latitude, time, and/or stati...
[Details](#) [Metadata](#) [Download](#) [Zoom To](#)

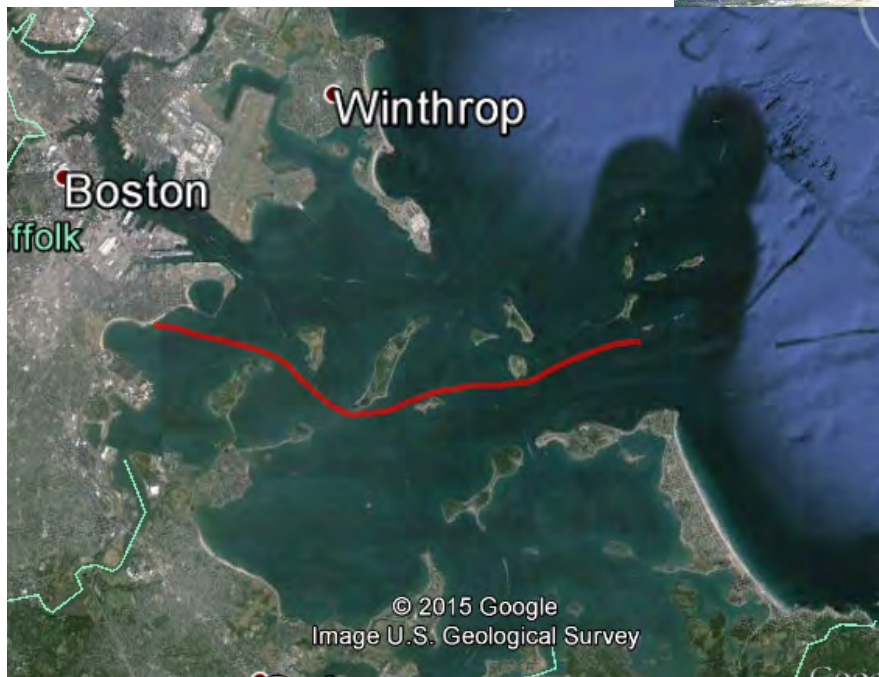
National Data Buoy Center SOS
National Data Buoy Center SOS
[Open](#) [Preview](#) [Details](#) [Metadata](#) [SOS](#) [Download](#) [Zoom To](#)

NECOFS Massachusetts (FVCOM) - Massachusetts Coastal - Latest Forecast
Latest forecast from the FVCOM Northeast Coastal Ocean Forecast System using high-resolution mesh covering the Massachusetts coastal region
[Details](#) [Metadata](#) [Download](#) [OPeNDAP](#) [Zoom To](#)

See results through REST
API: [GEORSS](#) [ATOM](#) [HTML](#) [FRAGMENT](#) [KML](#) [JSON](#) [CSV](#)

Maintained by NOAA's [National Geophysical Data Center](#). Please read the [Disclaimer](#) and [Privacy](#) or [Contact Us](#).

Use Case: 2015 Boston Light Swim, Aug 15, 7:00 am, 8 miles, no wet suit



How cold will the water be?

-- Look for SST model output near stations

IPython Notebook - Data Discovery and Access

```
In [2]: import os
try:
    import cPickle as pickle
except ImportError:
    import pickle

import iris
from datetime import datetime, timedelta
from utilities import CF_names, CF_units

# Today +/- 4 days
today = datetime.utcnow()
today = today.replace(hour=0, minute=0, second=0, microsecond=0)

start = today - timedelta(days=4)
stop = today + timedelta(days=4)

# Boston harbor.
spacing = 0.25
bbox = [-71.05-spacing, 42.28-spacing,
        -70.82+spacing, 42.38+spacing]

# CF-names.
sos_name = 'sea_water_temperature'
name_list = CF_names[sos_name]
```

Out[11]:

	station	sensor	lon	lat
name				
Boston, MA	8443970	E1	-71.0534	42.3548
Boston 16 Nm East Of Boston	44013	watertemp1	-70.69	42.35
Buoy A01	44029	ct1	-70.57	42.52

Create a filter for the search

Set bounding box, timeframe, find observations in a CSW (Geoportal).
https://github.com/ocefpaf/boston_light_swim

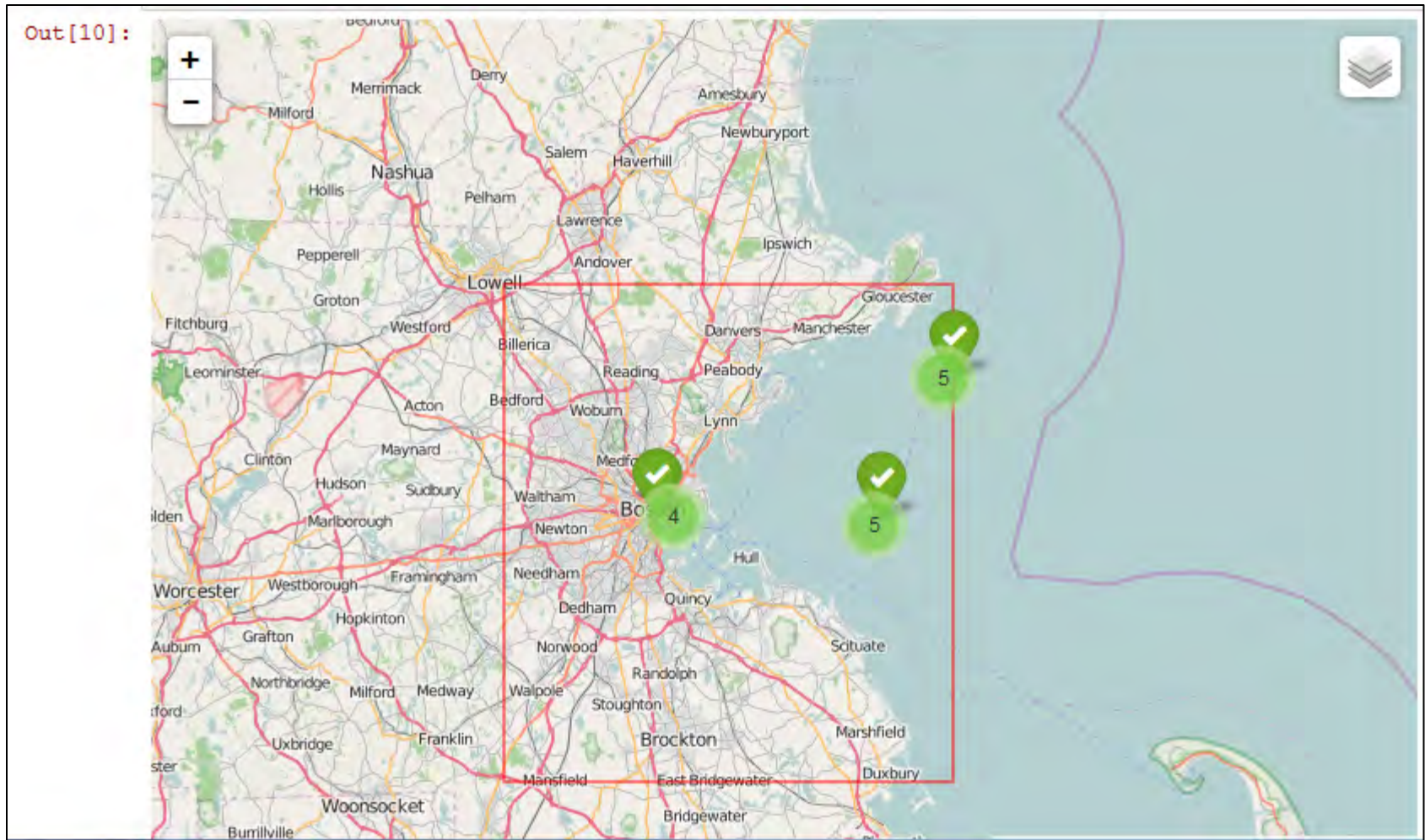
```
In [4]: from owslib.csw import CatalogueServiceWeb

endpoint = 'http://www.ngdc.noaa.gov/geoportal/csw'
csw = CatalogueServiceWeb(endpoint, timeout=60)
csw.getrecords2(constraints=filter_list, maxrecords=1000, esn='full')

fmt = '{:.*^64}'.format
log.info(fmt(' Catalog information '))
log.info("URL: {}".format(endpoint))
log.info("CSW version: {}".format(csw.version))
log.info("Number of datasets available: {}".format(len(csw.records.keys())))
```

Search the catalog for available services (SOS and OPeNDAP)

IPython Notebook - Data Discovery and Access



Geographical locations of select stations and nearby model outputs matching the search criteria

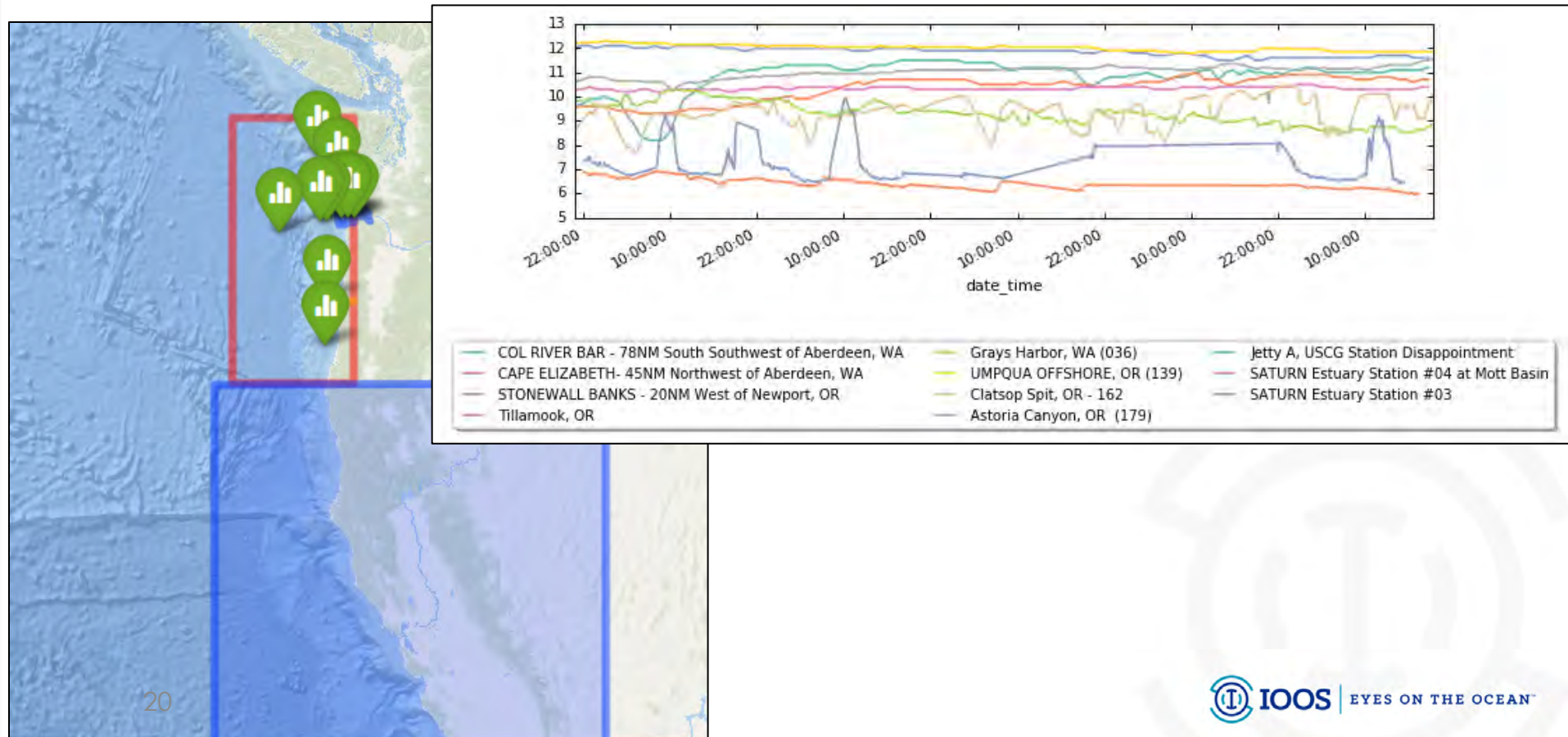
IPython Notebook - Data Discovery and Access



IPython Notebook: Data near the Endurance array?

Can we get data near the Endurance Array?

- Create a filter: Define bounding box for the Endurance array, time span of 5 days, variable (SST)
- Search the NCEI Geoportal (CSW) for available SOS and OPeNDAP services with filter criteria
- Access via NDBC SOS, and display NDBC partner data
- Interactive map with results



How to install IPython, tutorials

IOOS GitHub Pages:

- ioos.github.io/
- <https://github.com/ioos/conda-recipes>

The screenshot shows the GitHub Pages interface for the repository 'ioos / conda-recipes'. At the top, there are navigation options: 'Unwatch' (18), 'Star' (7), and a search icon. Below this is the 'Home' section, indicating it was edited by Rich Signell on Mar 24 with 21 revisions. The main heading is 'The IOOS Python Environment'. The content explains that the recipes create conda packages for the IOOS community, shared on Binstar.org. It recommends the Anaconda Scientific Python Distribution for users. The page is organized into sections: 'Install' (with links for Linux 64-bit, Windows 64-bit, and Mac OS X 64-bit), 'Test' (with a link to the testing wiki), and 'Customize' (with a link to the notebook settings wiki). A right-hand sidebar lists other pages, including 'Home', 'Conda Build Notes', 'Customizing the notebook settings', 'Setting up the IOOS Anaconda Python environment for MacOS64', 'Setting up the IOOS Python environment for Linux64', 'Setting up the IOOS Python Environment for Win64', 'Testing the IOOS environment', 'Updating an IOOS binstar package', 'Using Obvious CI to build IOOS binaries', and 'Why we use and recommend Anaconda'. At the bottom, there is a '+ Add a custom sidebar' button.

Conclusion

- IOOS Regional Associations near Pioneer, Endurance:
 - NERACOOS (Northeast)
 - MARACOOS (Mid-Atlantic)
 - NANOOS (Pacific Northwest)
- IOOS integrates numerous oceanographic datasets and model output
- **Discover** via real-time data portals, RA websites, CSW
- **Access** via SOS, THREDDS, ERDDAP, data portals
- **Use** via client software (Matlab, Python, etc)

ioos_tech@googlegroups.com

ioos.github.io

github.com/ioos

- System Integration Test project– test cases presented as IPython notebooks
- Pyoos – Python library for collecting met-ocean observations
- Conda-recipes (for IOOS packages)

https://github.com/ocefpaf/boston_light_swim