Access to IOOS Data Relevant to OOI

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NOAA/NOS/IOOS
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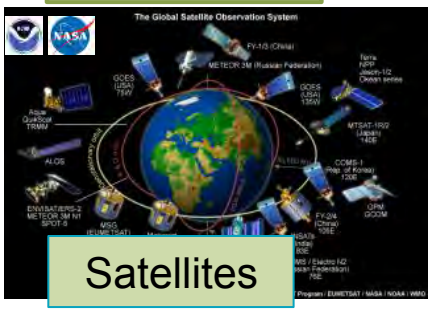
IOOS | EYES ON THE OCEAN™

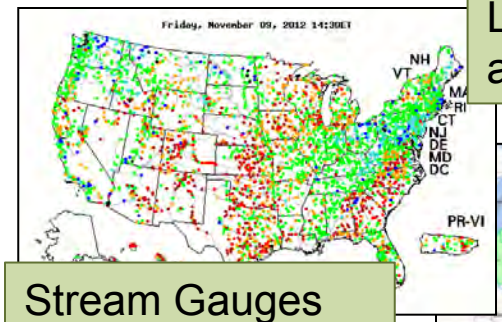
The U.S. Integrated Ocean Observing System (IOOS)

Federal

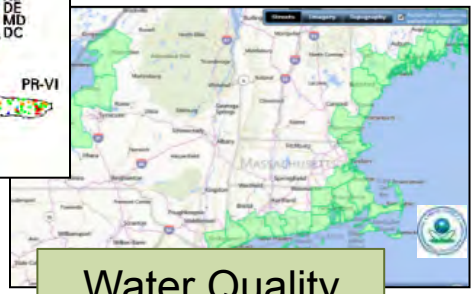


Satellites

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



Stream Gauges



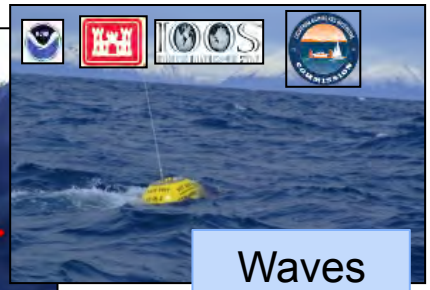
Water Quality

Research Infrastructure

PORTS®

Regional

High Frequency Radar



Waves

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

Tagging

Gliders

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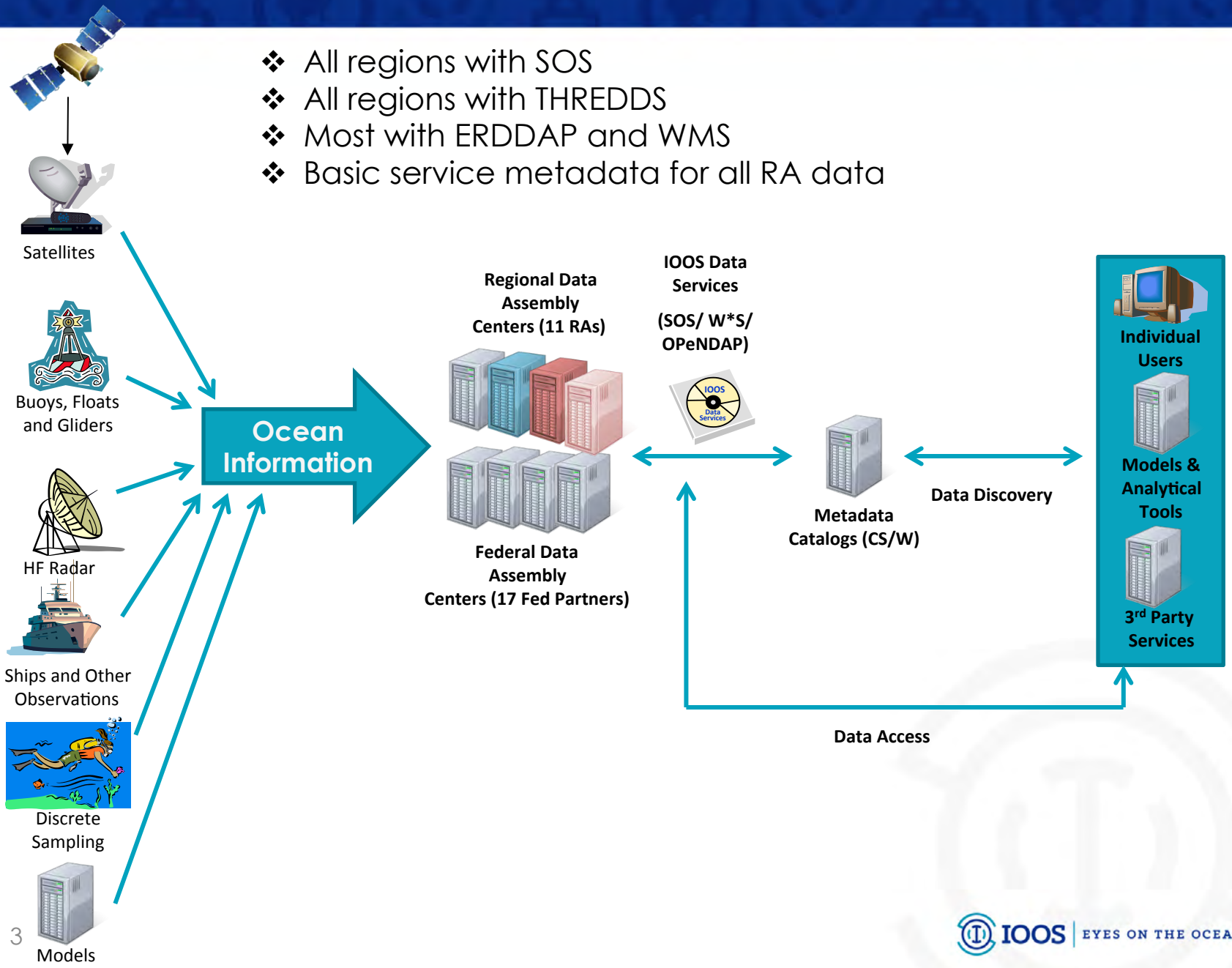
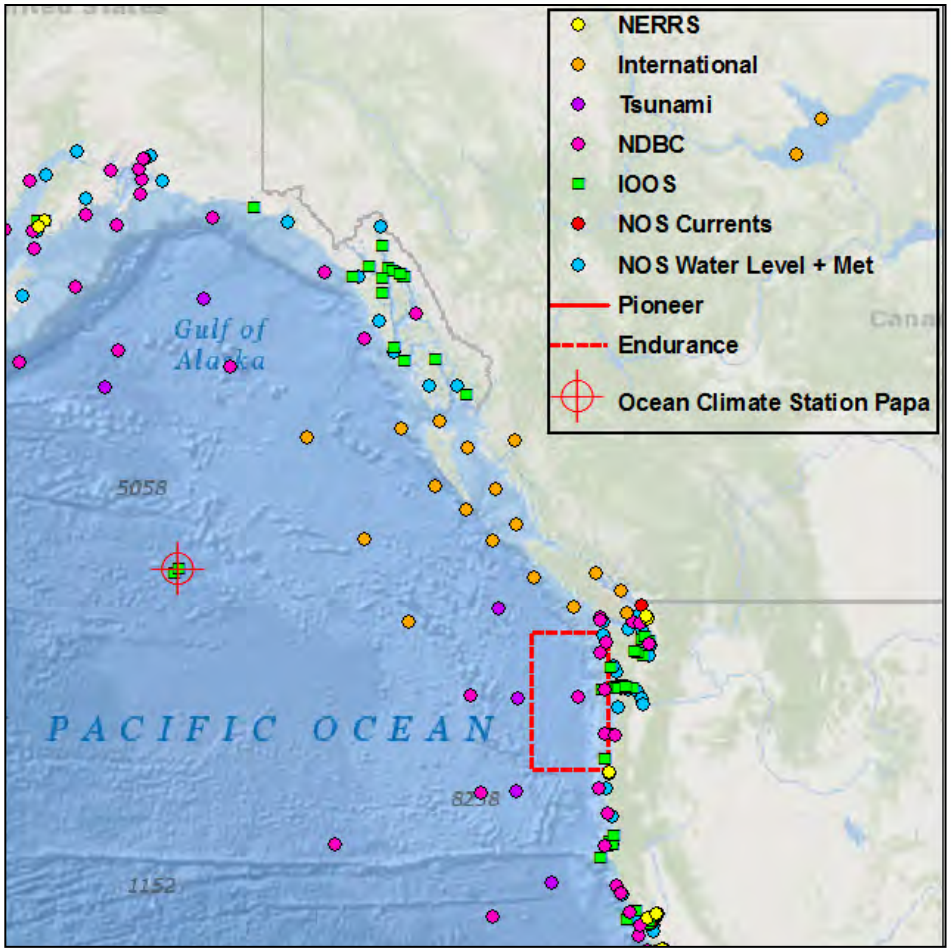
IOOS DMAC: Distributed Data Network for Ocean Information

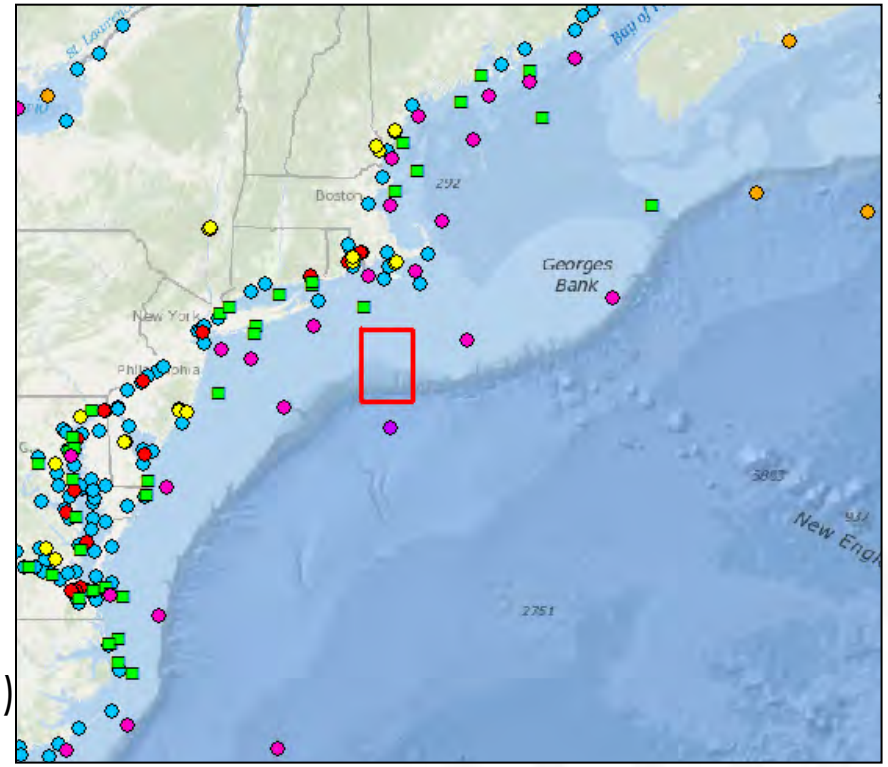
- All regions with SOS
- All regions with THREDDS
- Most with ERDDAP and WMS
- Basic service metadata for all RA data



Nearby in-situ observations

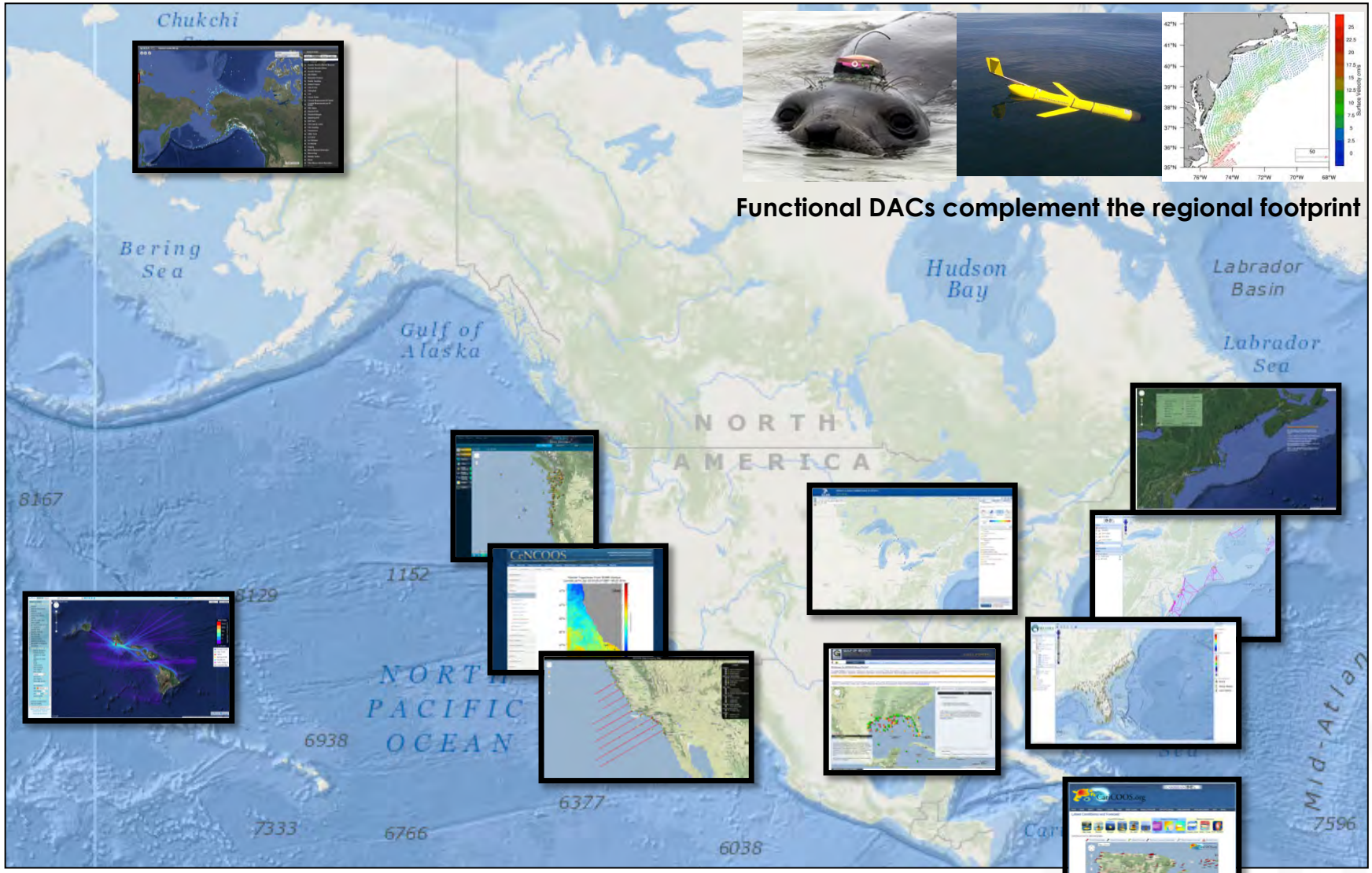


- **National Estuarine Research Reserve System** (Shore-based: Water quality and weather)
- **International** (Environment Canada buoys)
- **Tsunami** (DART buoys)
- **NDBC** (Coastal Weather Buoys, C-MAN)



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

Exposing Data – RA Data Portals



Functional DACs complement the regional footprint

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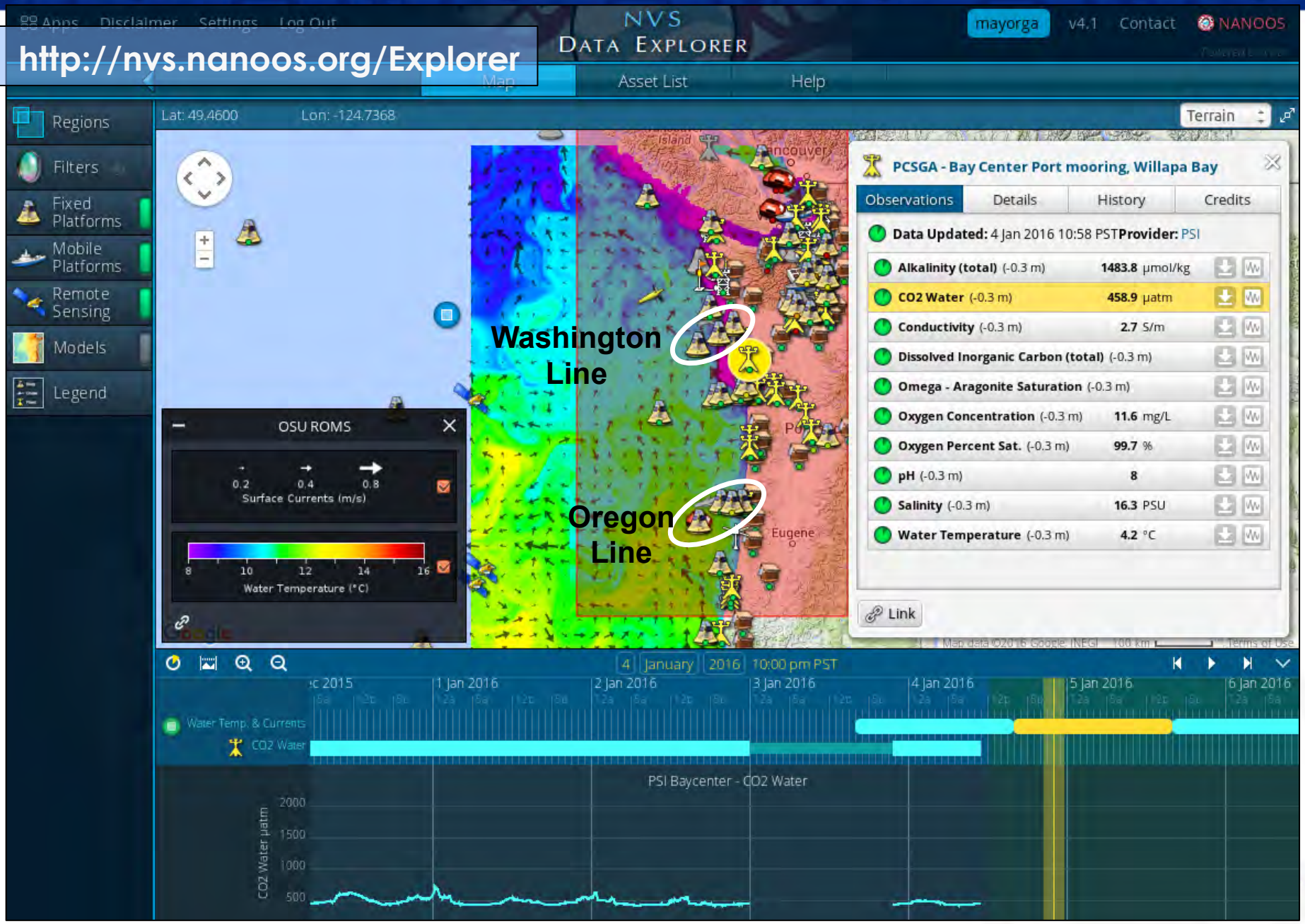
NVS: NANOOS Visualization System

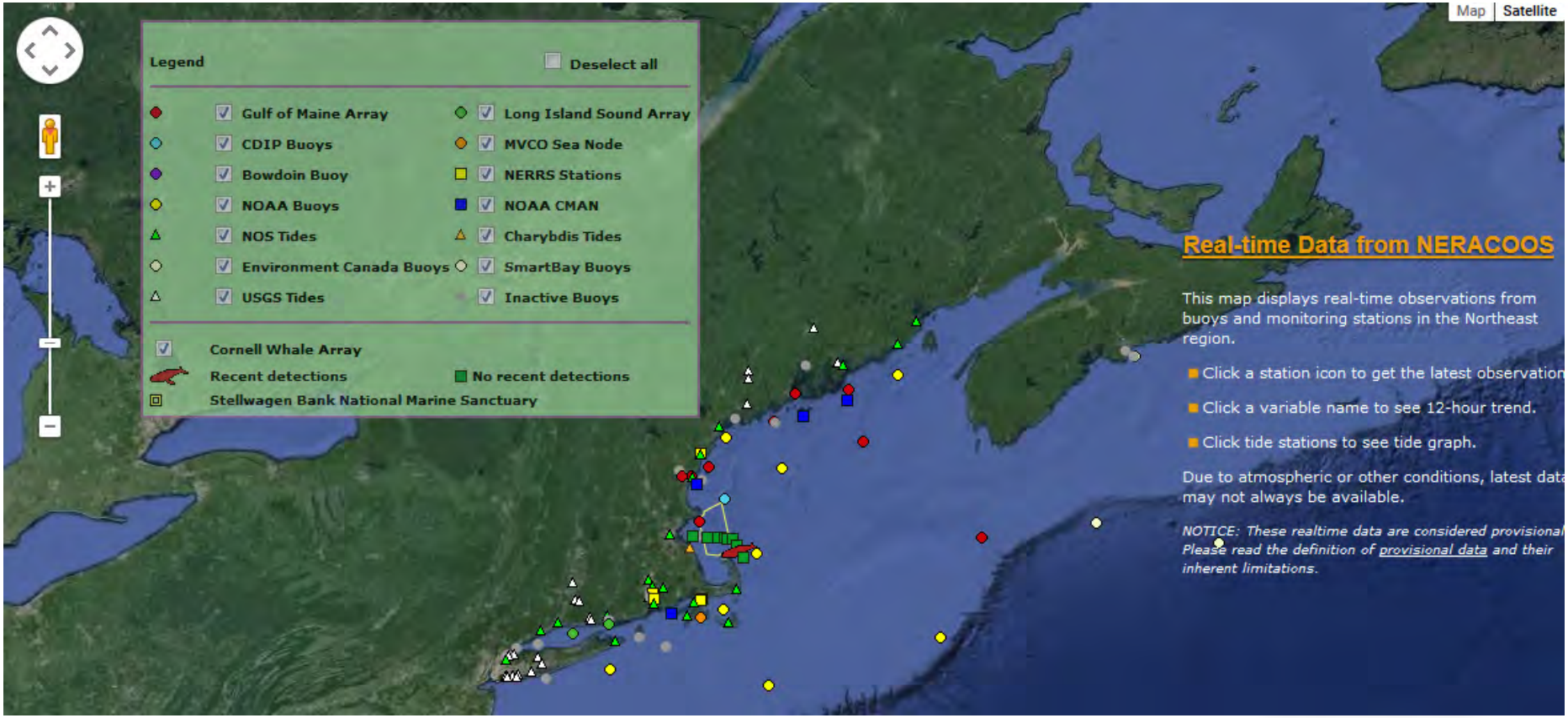
http://nvs.nanoos.org/Explorer



NVS: NANOOS Visualization System

Other apps:

NERACOOS Real-time Data Portal

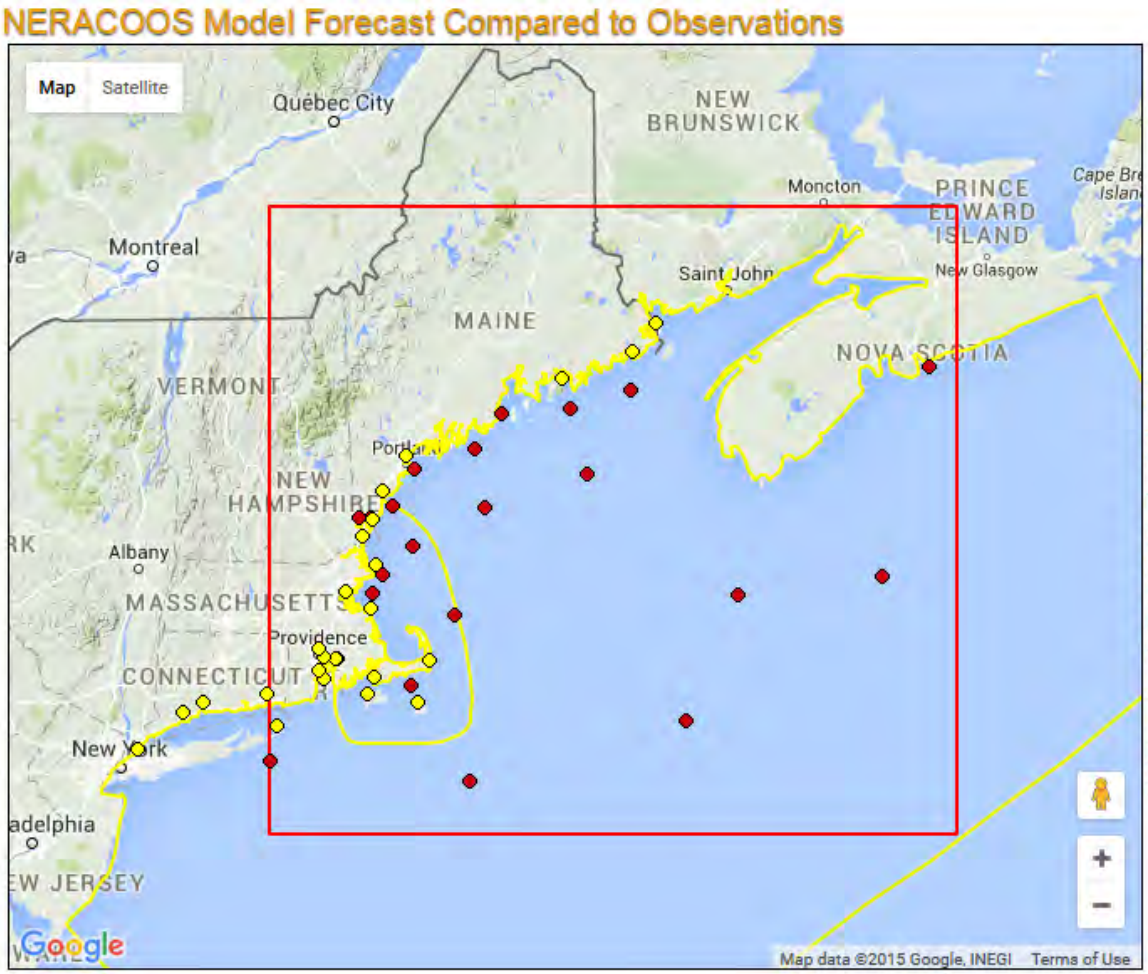


Federal :
USGS Tides
NOAA Buoys
NOS Tides
NERRS
NDBC C-MAN

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

International :
Environment Canada Buoys

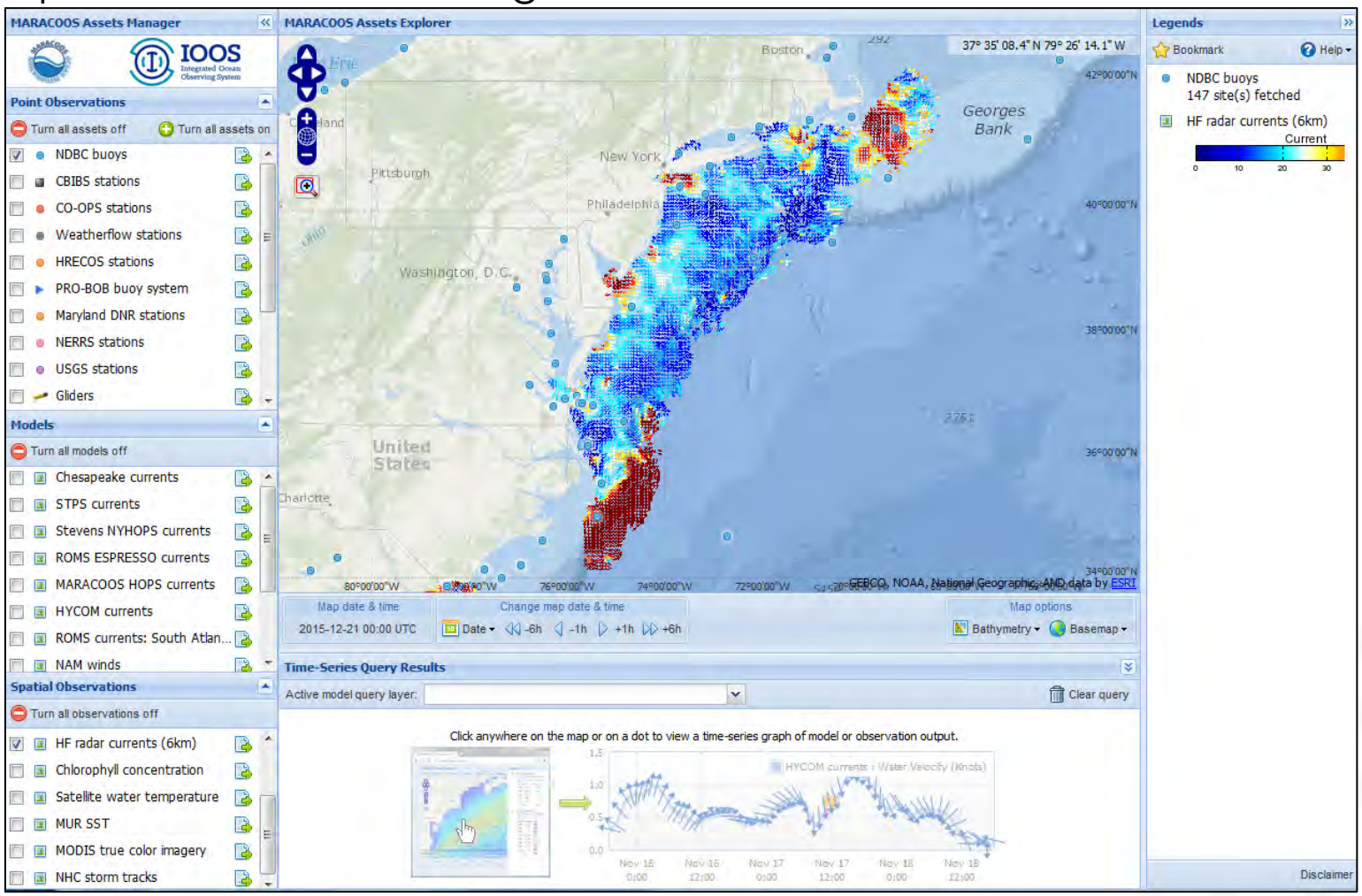
NERACOOS Model Forecast/Observation Tool



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

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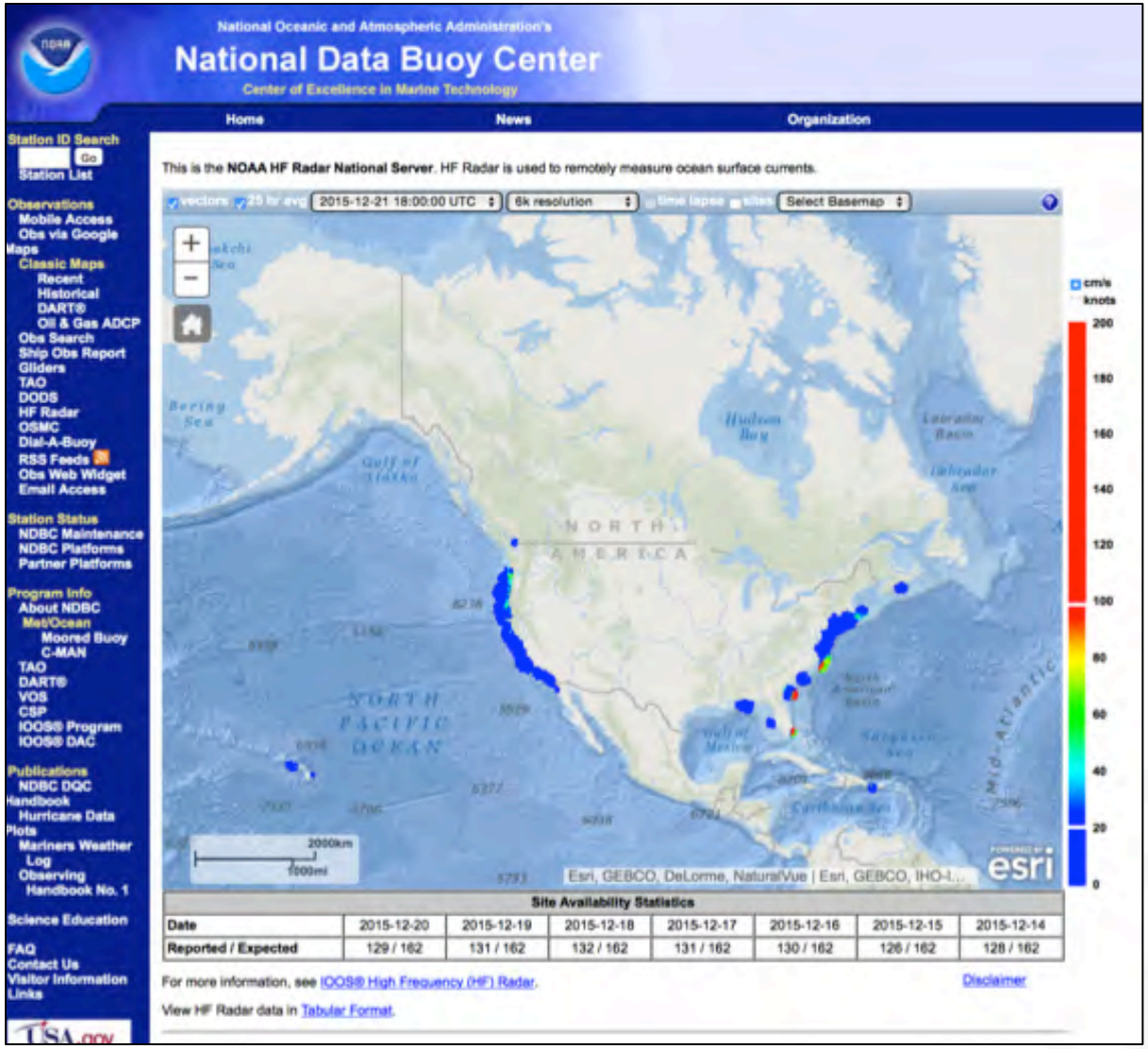
NOAA National Network: HF Radar



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

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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

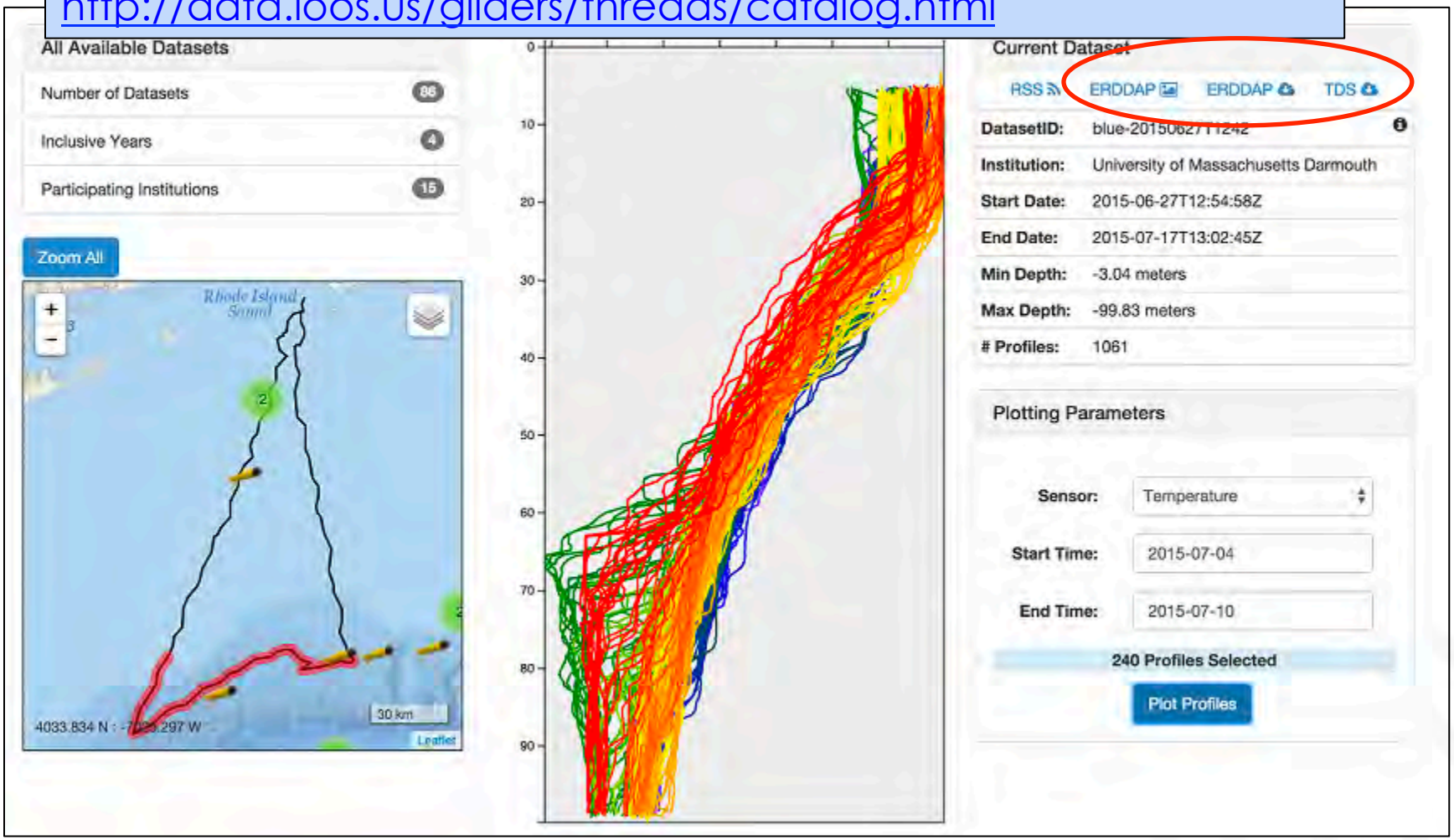
Viewers:

- NetCDF-Java ToolsUI (webstart)
- Integrated Data Viewer (IDV) (webstart)

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

MARACOOS Glider Access

http://data.ioos.us/gliders/erddap/index.html
http://data.ioos.us/gliders/thredds/catalog.html



Machine-Machine Data Discovery and Access

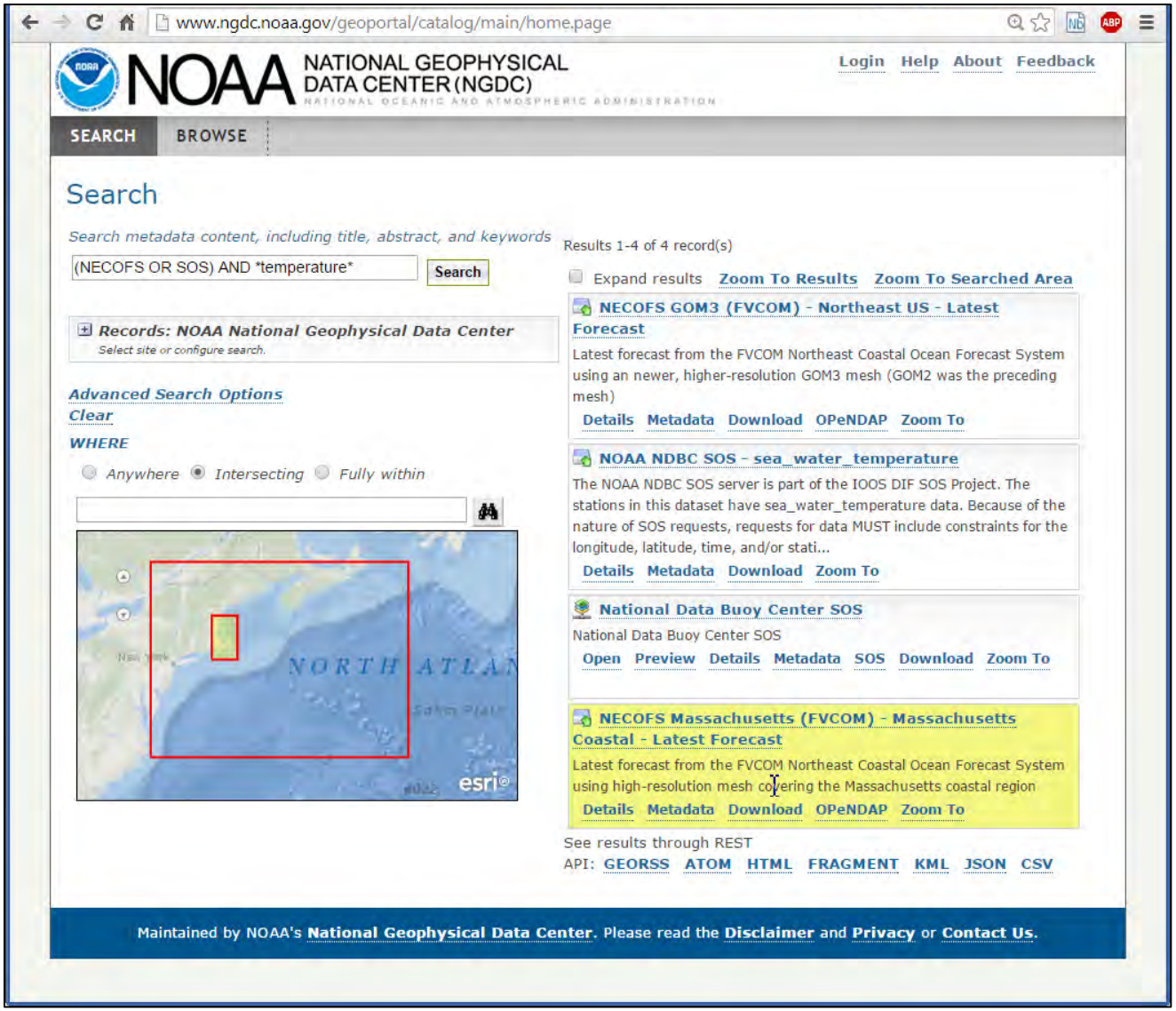
Discovery:

- 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:

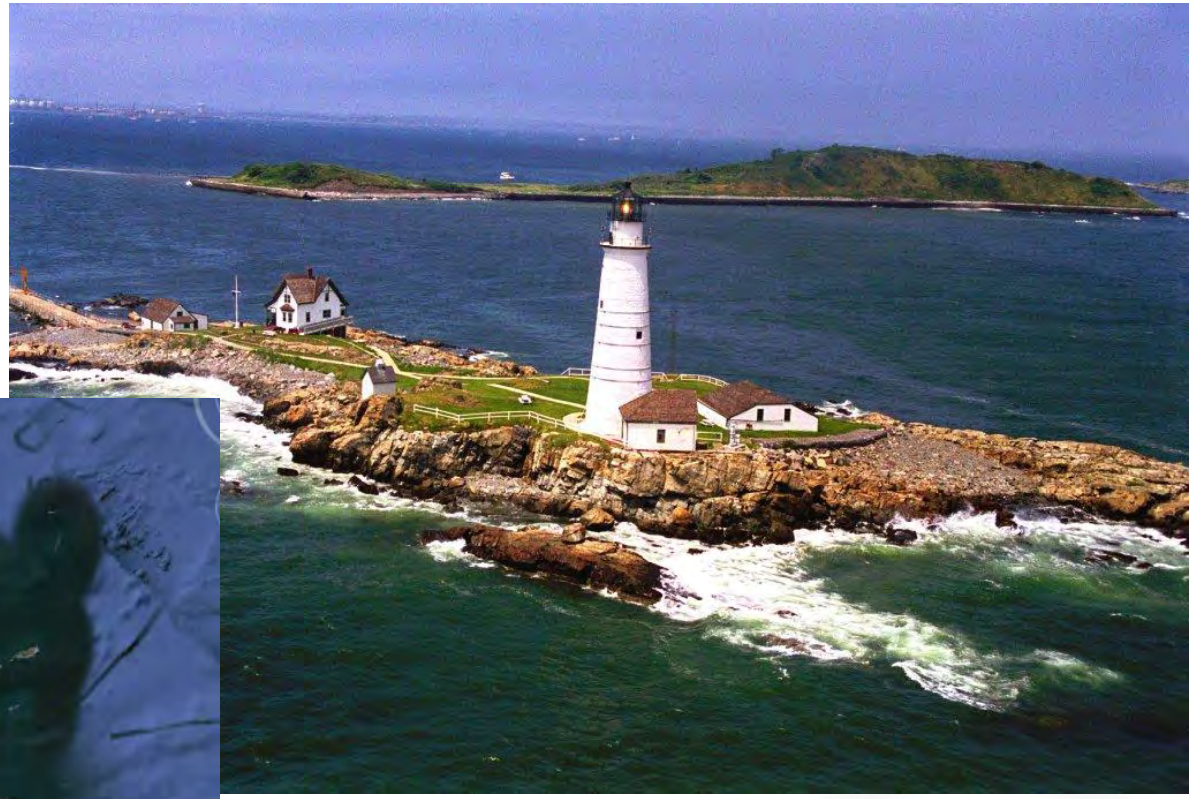
- OPeNDAP+CF conventions
- Sensor Observation Service (SOS)

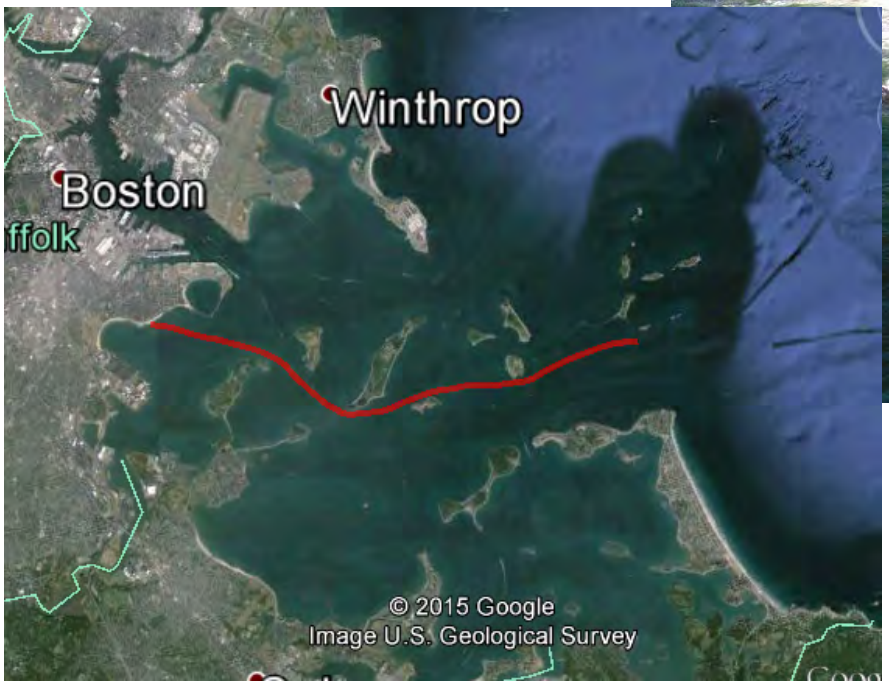
NCEI Catalog – discover assets



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

"The Granddaddy of American Open-water Swims"
Boston Light Swim





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, t
        from utilities import CF_names,

        # 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)

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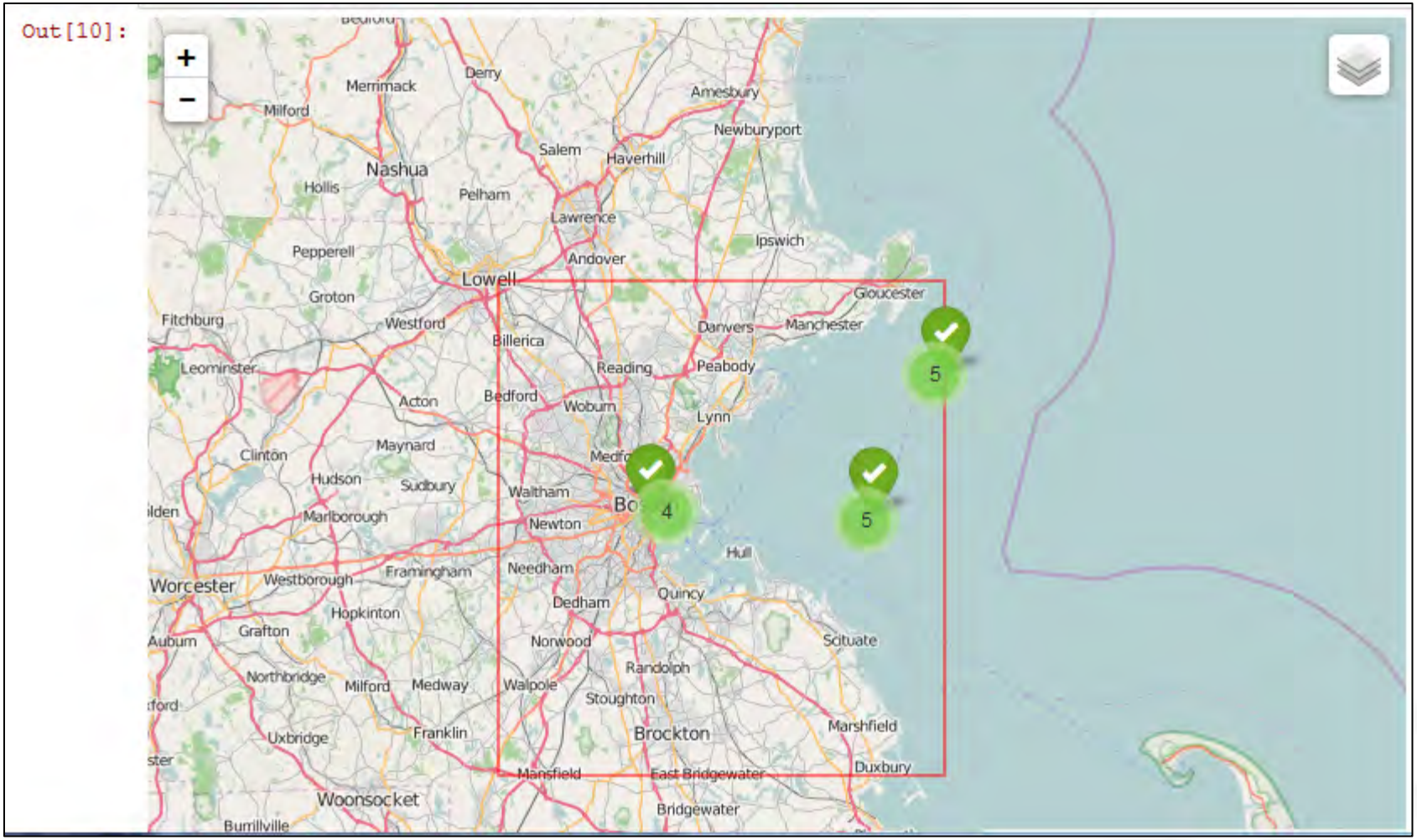
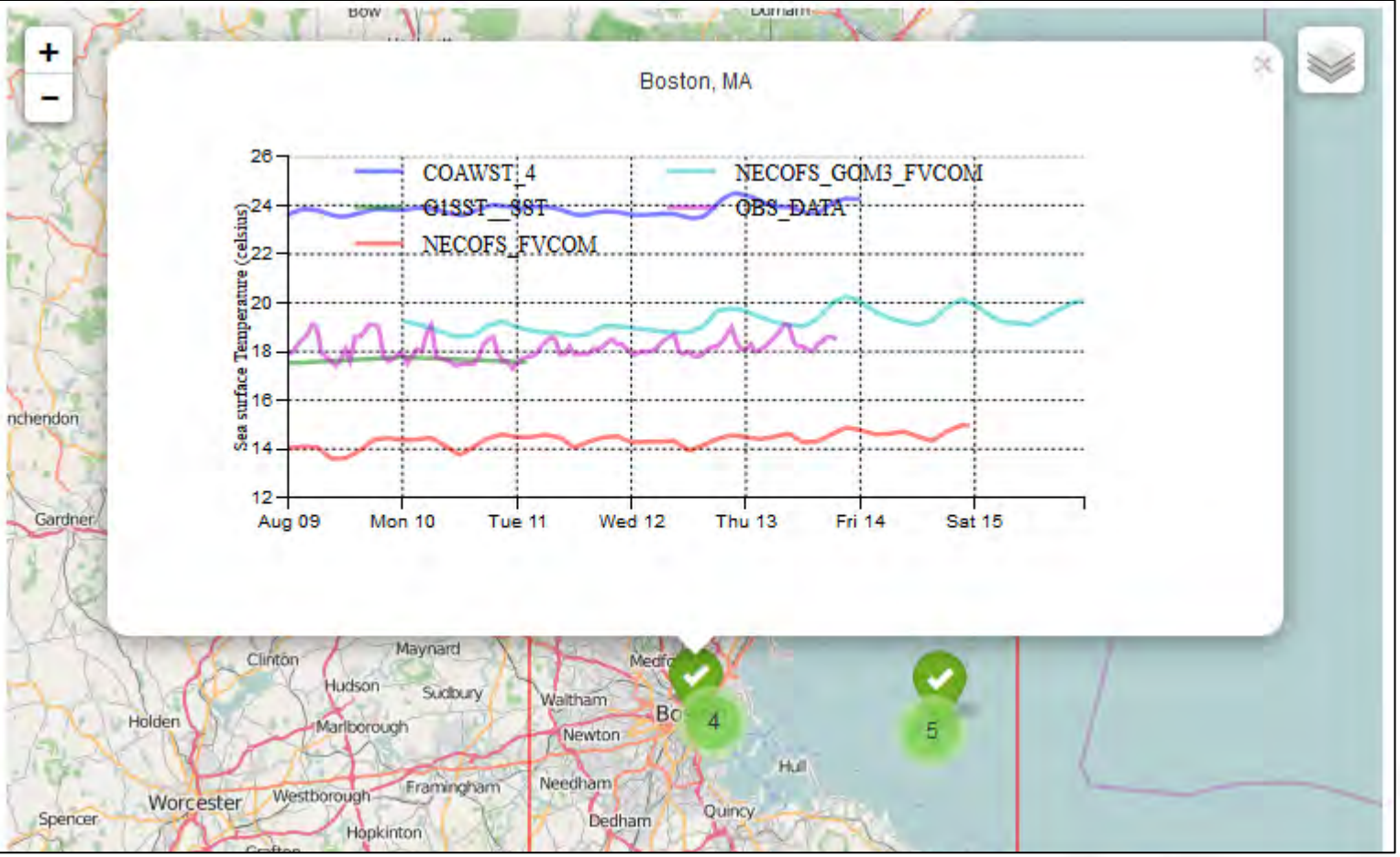
IPython Notebook - Data Discovery and Access



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

IPython Notebook - Data Discovery and Access

Out[10]:



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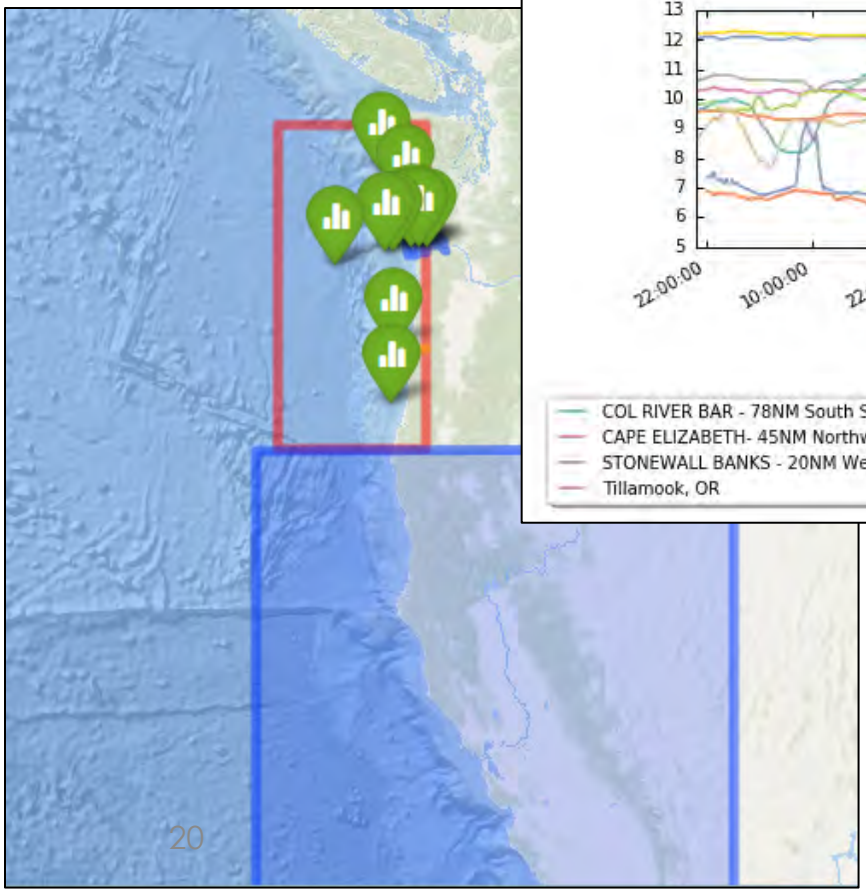
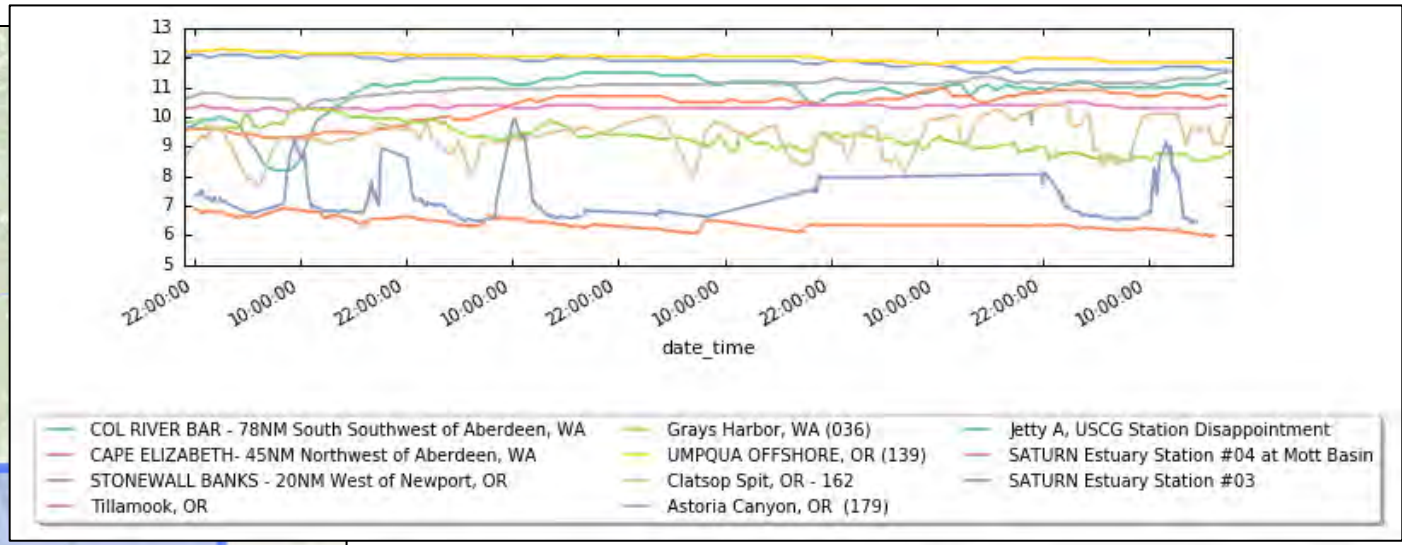
IPython Notebook: Data near the Endurance array?

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

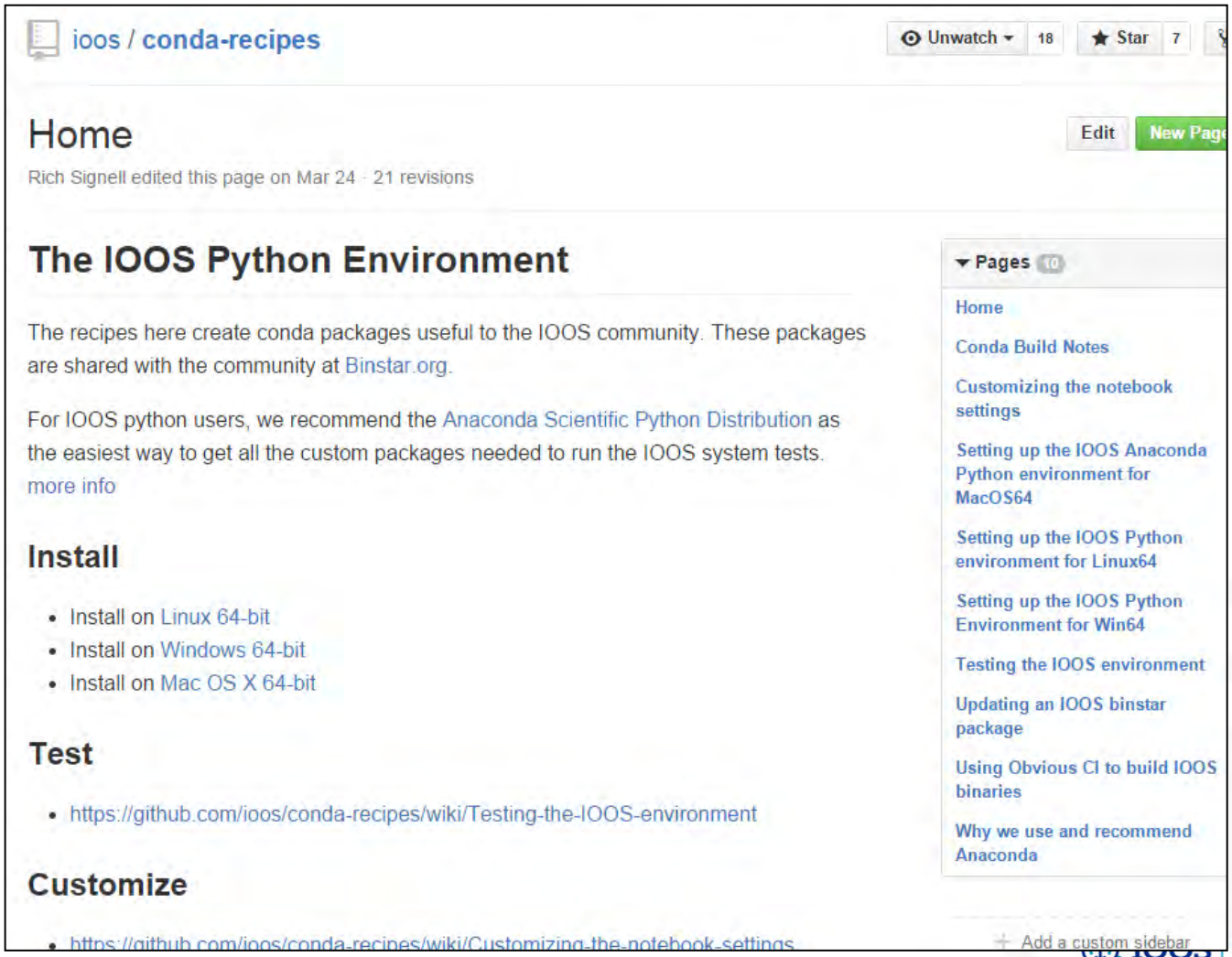




How to install IPython, tutorials

IOOS GitHub Pages:

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



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)

More information

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