Model Skill Assessment Project

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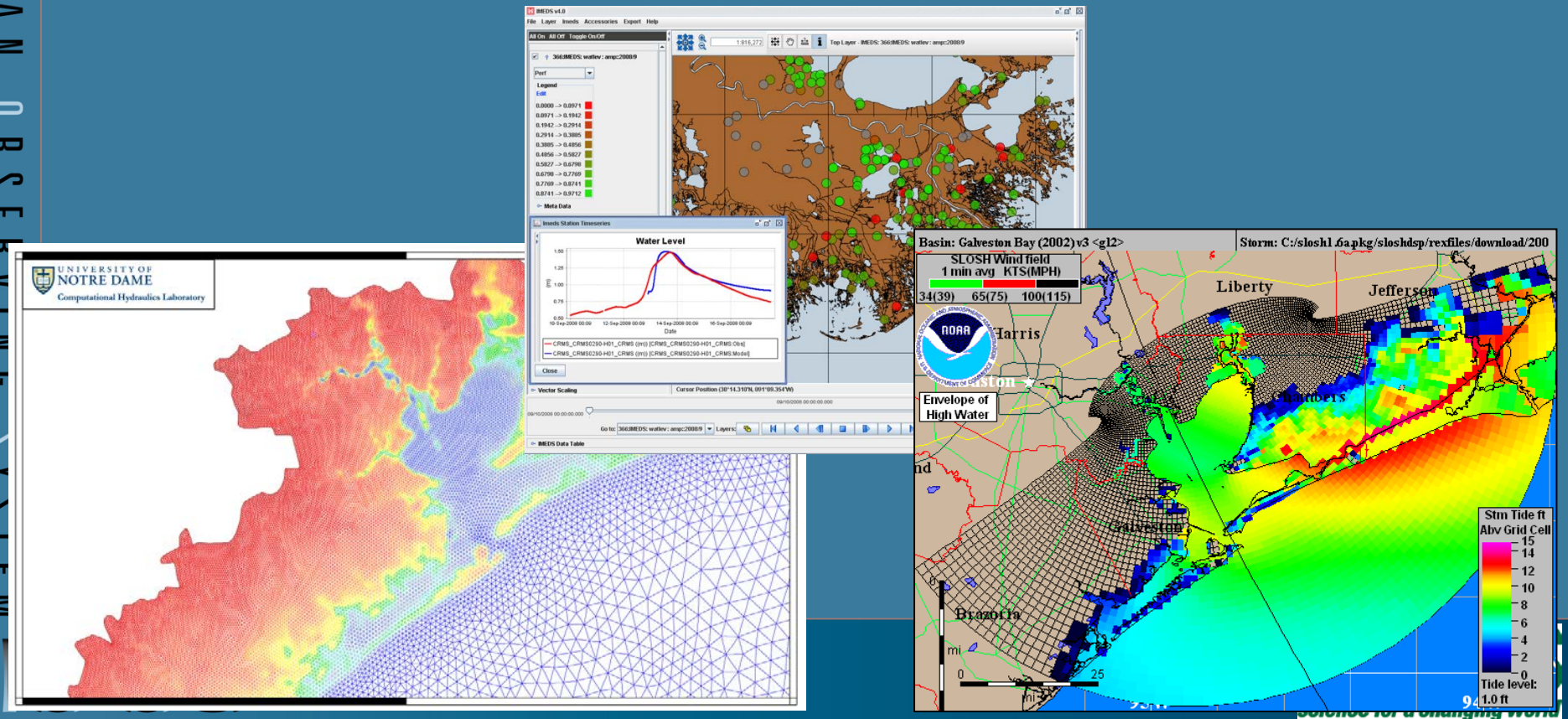
SECOORA PI Meeting, May 13, 2014



NetCDF Climate and Forecast (CF) Conventions provide a solution

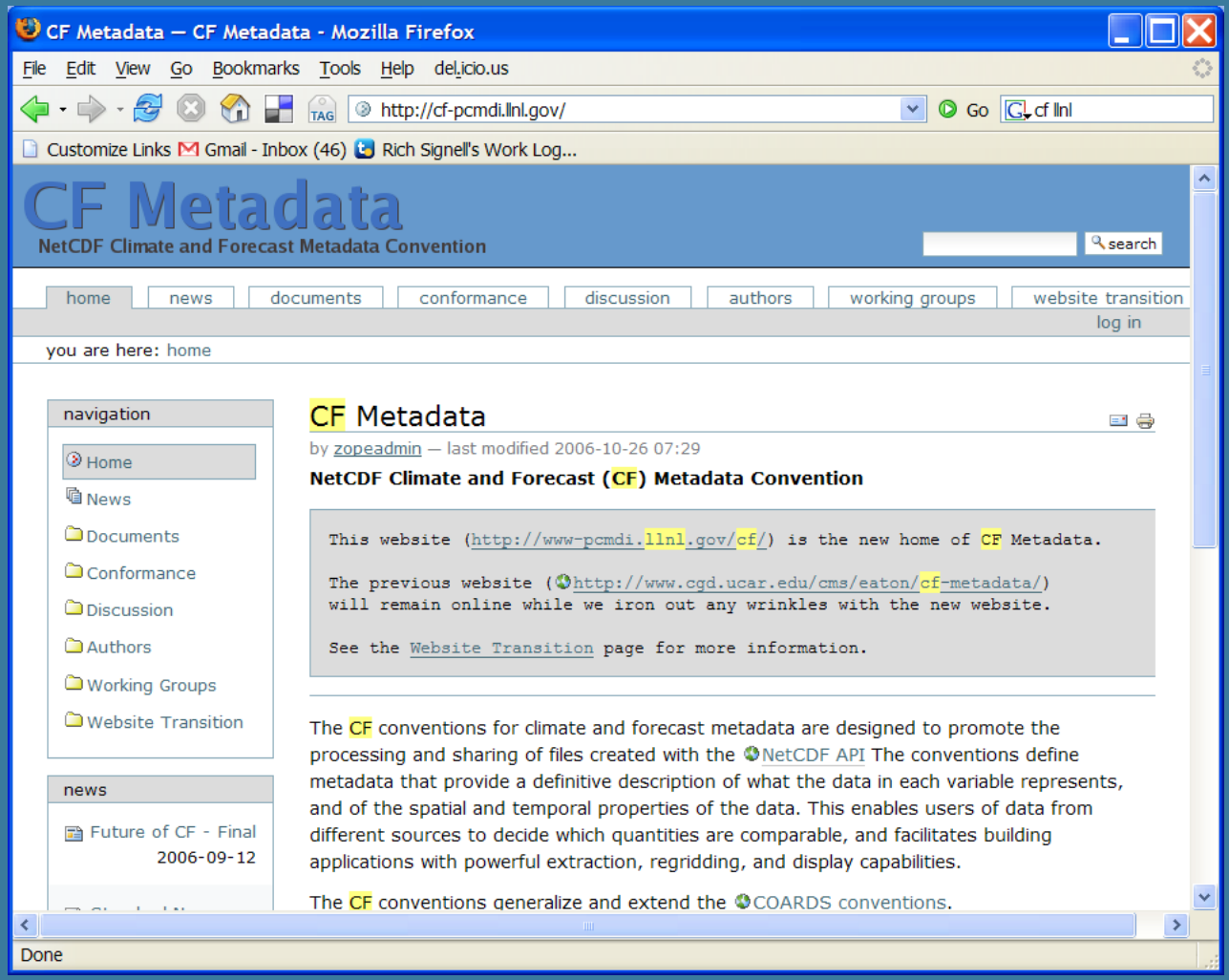
Groups using CF:

GO-ESSP: Global Organization for Earth System Science Portal

IOOS: Integrated Ocean Observing System

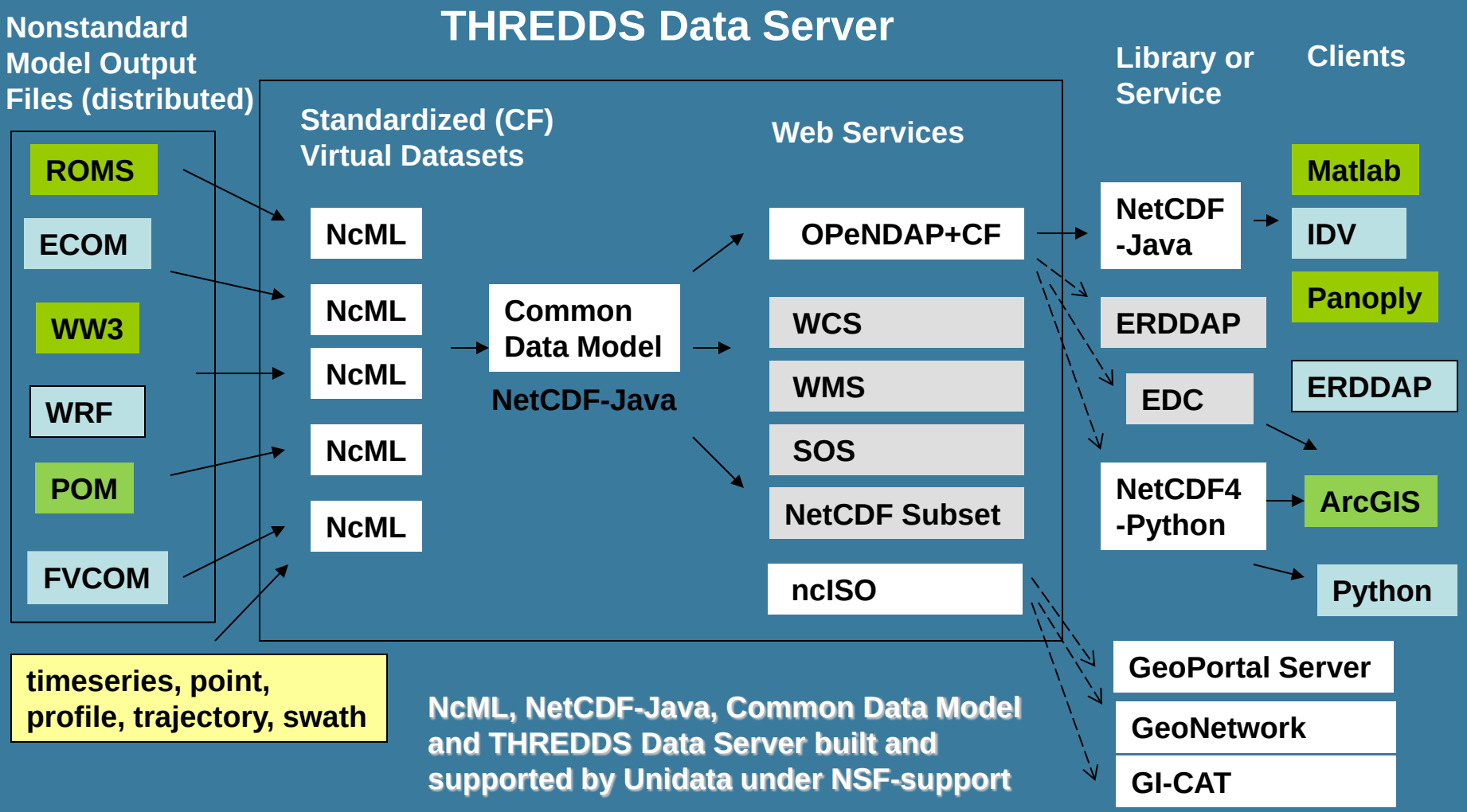
ESMF: Earth System Modeling Framework

OGC: Open Geospatial Consortium (GALEON: WCS profile)

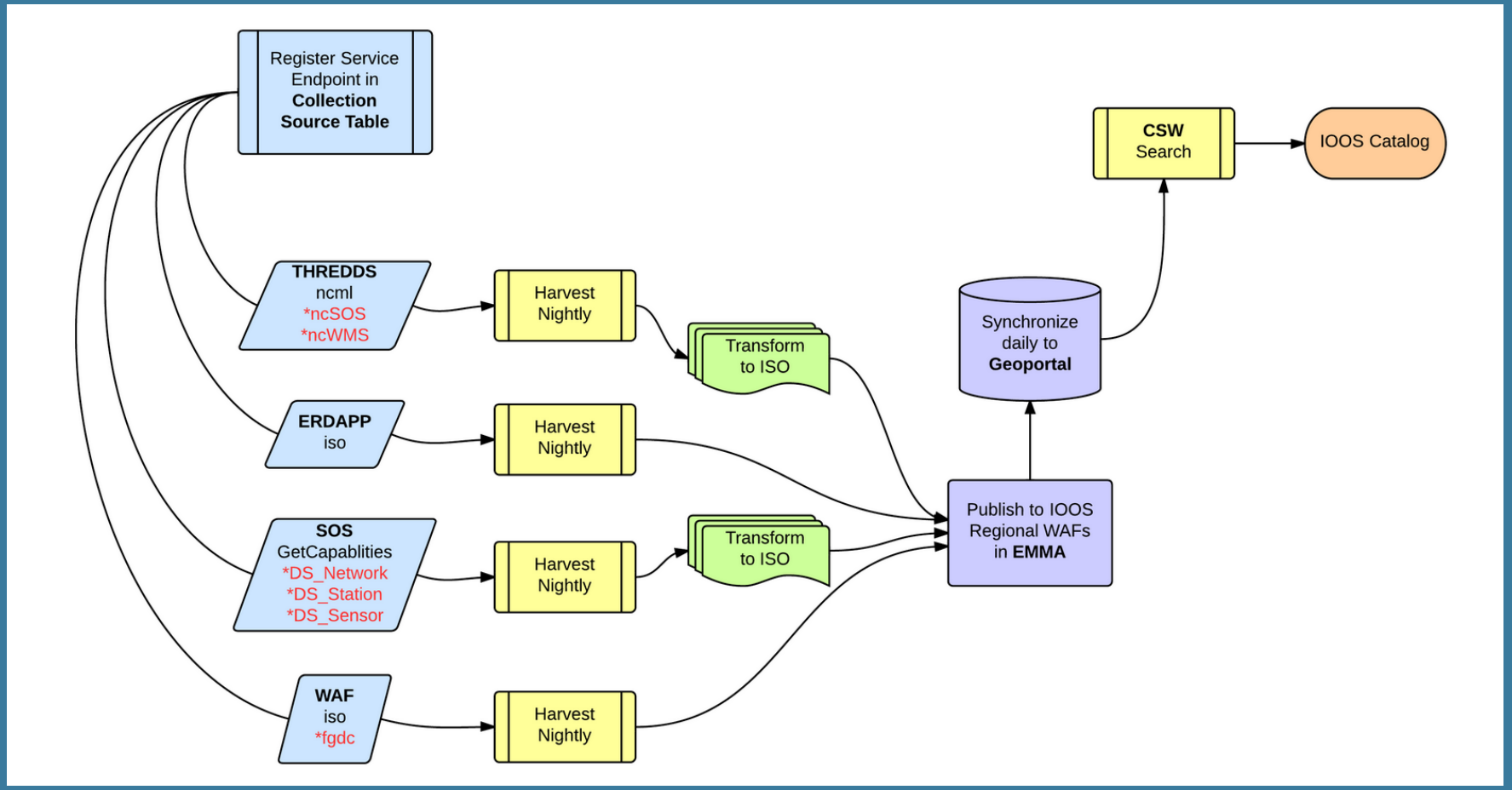


Also: github.com/ugrid-conventions

IOOS Model Data Interoperability Design



IOOS Catalog



test_cf_ugrid3.m

C:\cygwin\home\rsignell\distro\nctoolbox\demos\contrib\test_cf_ugrid3.m

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```
% TEST_CF_UGRID3
% Compare water levels from 3 different unstructured gri
% models that use UGRID conventions (http://bit.ly/cf_ug
% comparison with no model specific code
titl{1}='ADCIRC';
uris{1}='http://testbedapps.sura.org/thredds/dodsC/inund
vars{1}='zeta';
times{1}=[2008 9 13 06 0 0];

titl{2}='SELFE';
uris{2}='http://testbedapps.sura.org/thredds/dodsC/inund
vars{2}='elev';
times{2}=[2008 9 13 06 0 0];

titl{3}='FVCOM';
uris{3}='http://testbedapps.sura.org/thredds/dodsC/inund
vars{3}='zeta';
times{3}=[2008 9 13 06 0 0];
% bounding box for figures
ax=[-95.4519  -87.3856   28.0   31.0]
% color range for figures
cax=[0 5];

% There is nothing model specific in the loop below!
for i=1:length(uris)
  tic
  % Initialize dataset object
  nc=ncgeodataset(uris{i});
  %get geovariable object
  zvar=nc.geovariable(vars{i});
  % Find the coordinate variables
  lon=zvar.getlondata(:);
```

Figure 1

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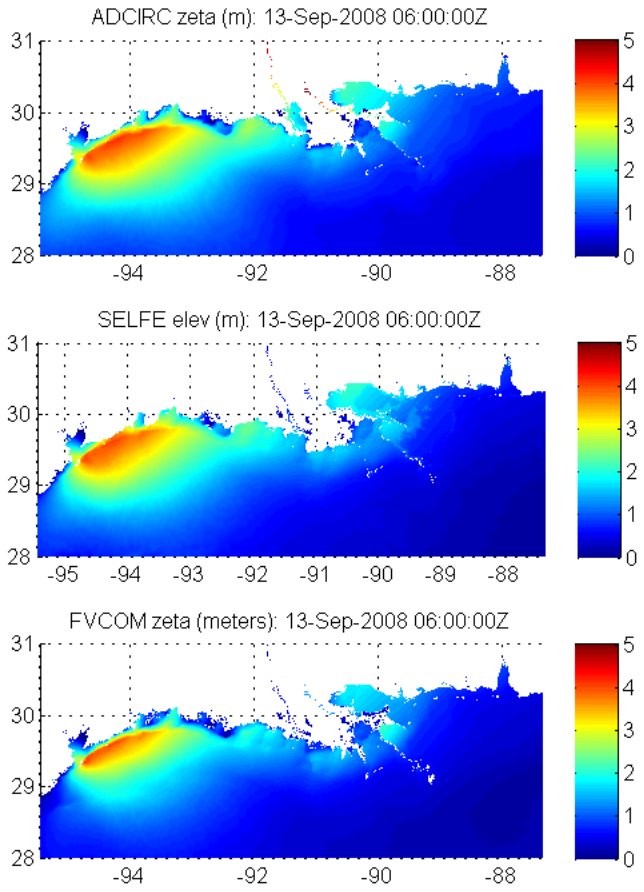
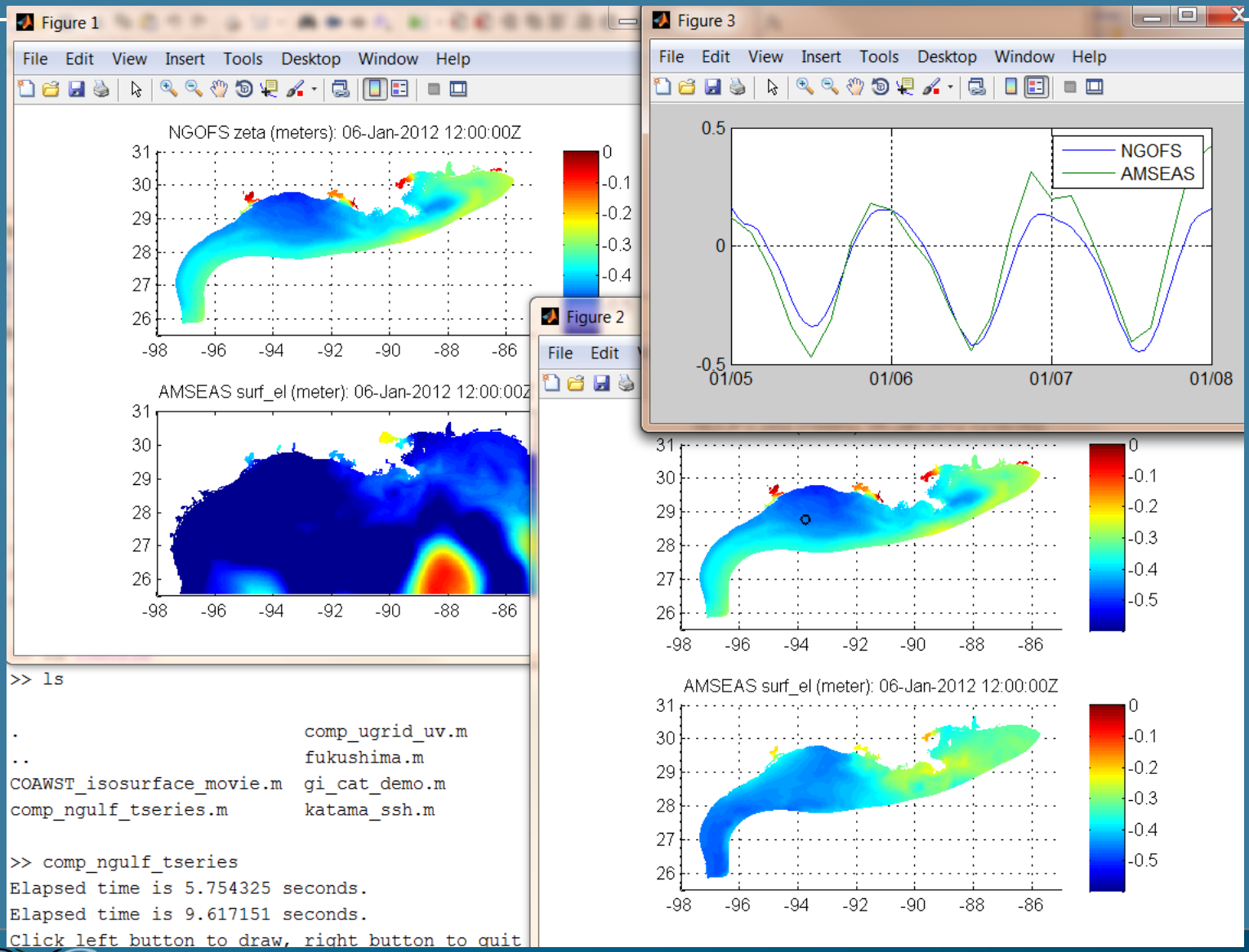
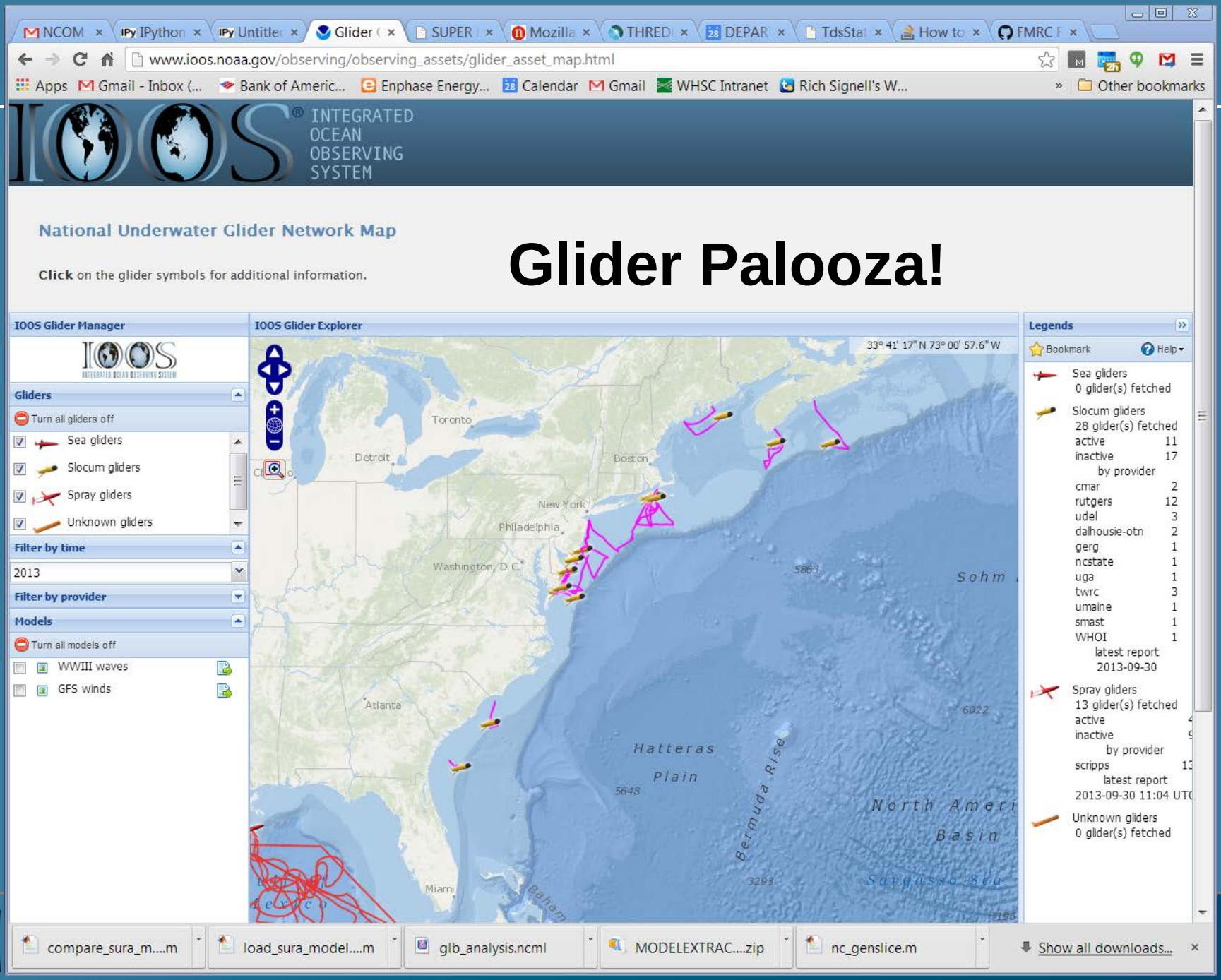
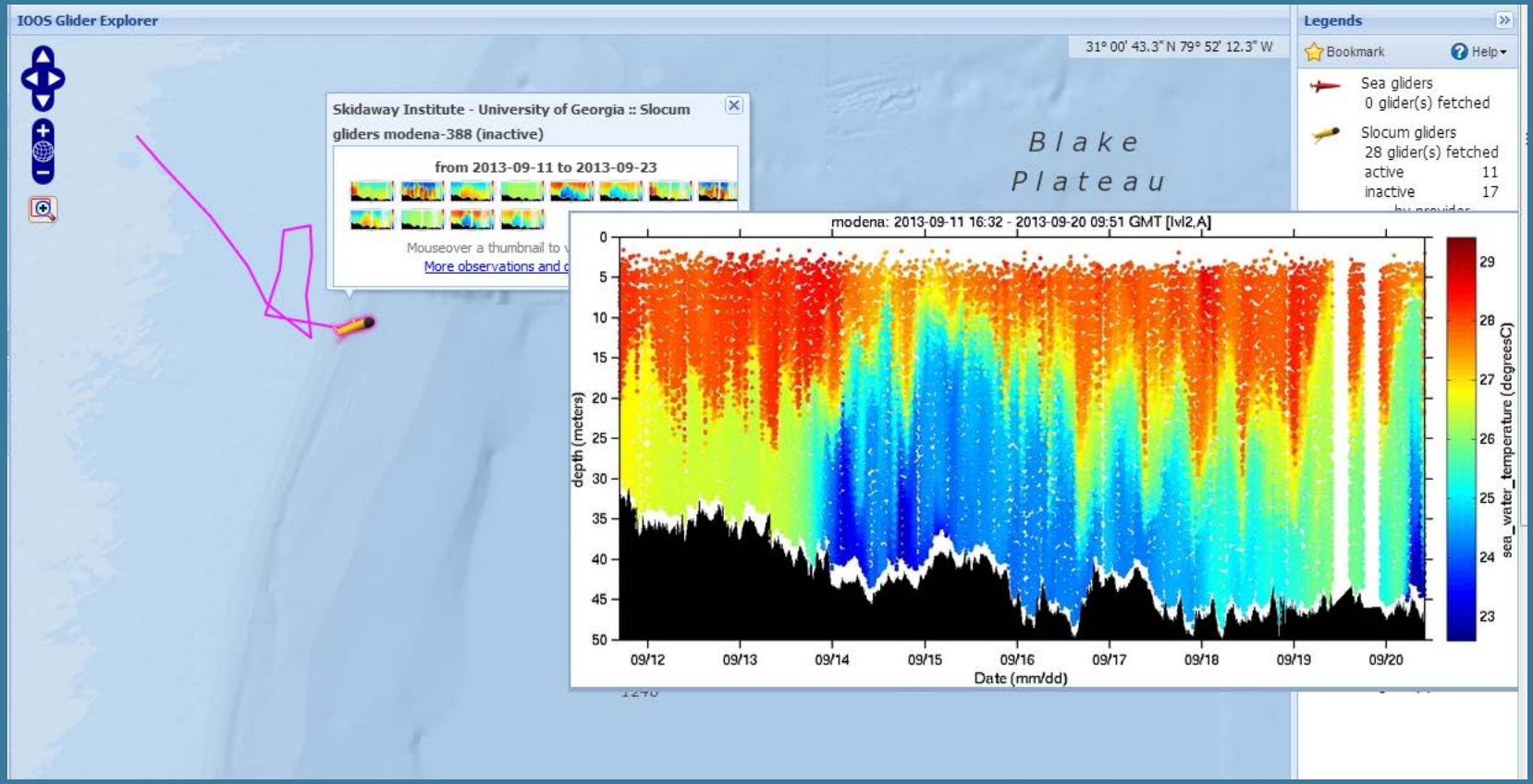


comp_ngulf_tseries.m

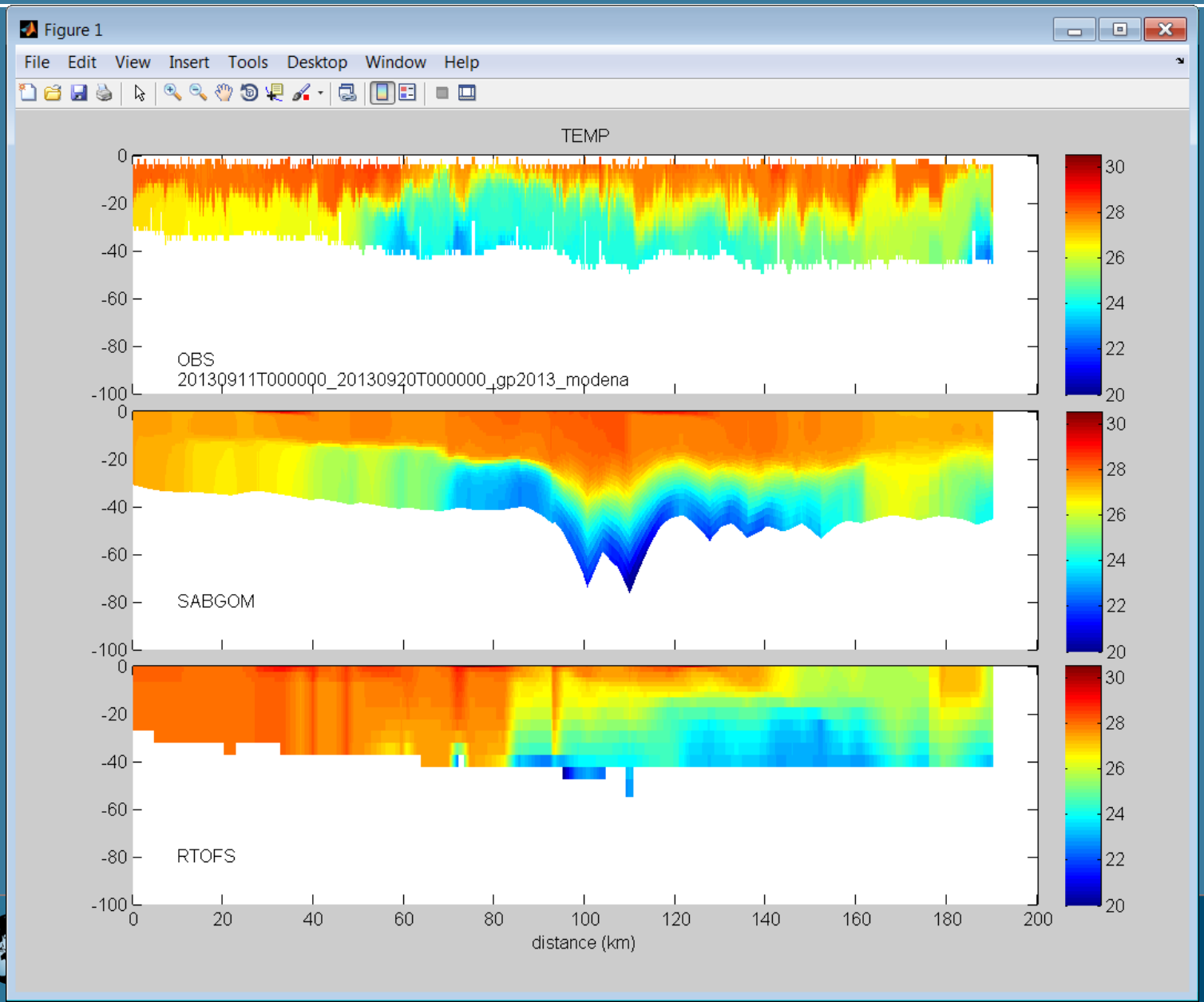



www.ioos.noaa.gov/observing/observing_assets/glider_asset_map.html
INTEGRATED OCEAN OBSERVING SYSTEM
National Underwater Glider Network Map
Click on the glider symbols for additional information.
Glider Palooza!
IOOS Glider Manager
Gliders
Turn all gliders off
Sea gliders
Slocum gliders
Spray gliders
Unknown gliders
Filter by time
2013
Filter by provider
Models
Turn all models off
WWIII waves
GFS winds
IOOS Glider Explorer
33° 41' 17" N 73° 00' 57.6" W
Toronto
Detroit
Boston
New York
Philadelphia
Washington, D.C.
Atlanta
Miami
Hatteras Plain
Bermuda Rise
Sohm
North Ameri
Basin
Sargasso Sea
Legends
Bookmark
Help
Sea gliders
0 glider(s) fetched
Slocum gliders
28 glider(s) fetched
active 11
inactive 17
by provider
cmar 2
rutgers 12
udel 3
dalhousie-otn 2
gerg 1
ncstate 1
uga 1
twrc 3
umaine 1
smast 1
WHOI 1
latest report
2013-09-30
Spray gliders
13 glider(s) fetched
scripps 13
latest report
2013-09-30 11:04 UTC
Unknown gliders
0 glider(s) fetched
compare_sura_m....m
load_sura_model....m
glb_analysis.ncml
MODELEXTRAC....zip
nc_genslice.m
Show all downloads...

Skidaway modena glider (Sep 11-23)



Skidaway “modena” glider: temperature



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An assessment of the skill of real-time models of Mid-Atlantic Bight continental shelf circulation

John L. Wilkin[1] and Elias J. Hunter[1]

Received 8 January 2013; revised 26 April 2013; accepted 29 April 2013.

[1] Prescribing open boundary conditions for regional coastal ocean models encounters the challenge of imposing information on sea level, velocity and tracers that characterize the unrepresented far field ocean. Deriving such information from a larger domain model without communicating information from the "nested" model back to the exterior model is "downscaling". We evaluate whether real-time models presently in operation for the Mid-Atlantic Bight (MAB) can deliver useful predictions of subtidal frequency currents and subsurface temperature and salinity for this downscaling purpose. The MAB is a broad continental shelf region where several models run in real time and there is a dense observational data set available for skill assessment. We examine seven real-time models that cover the MAB: three global models, and four regional models. A regional climatology is included as an eighth model. Skill metrics with respect to model bias, centered root mean

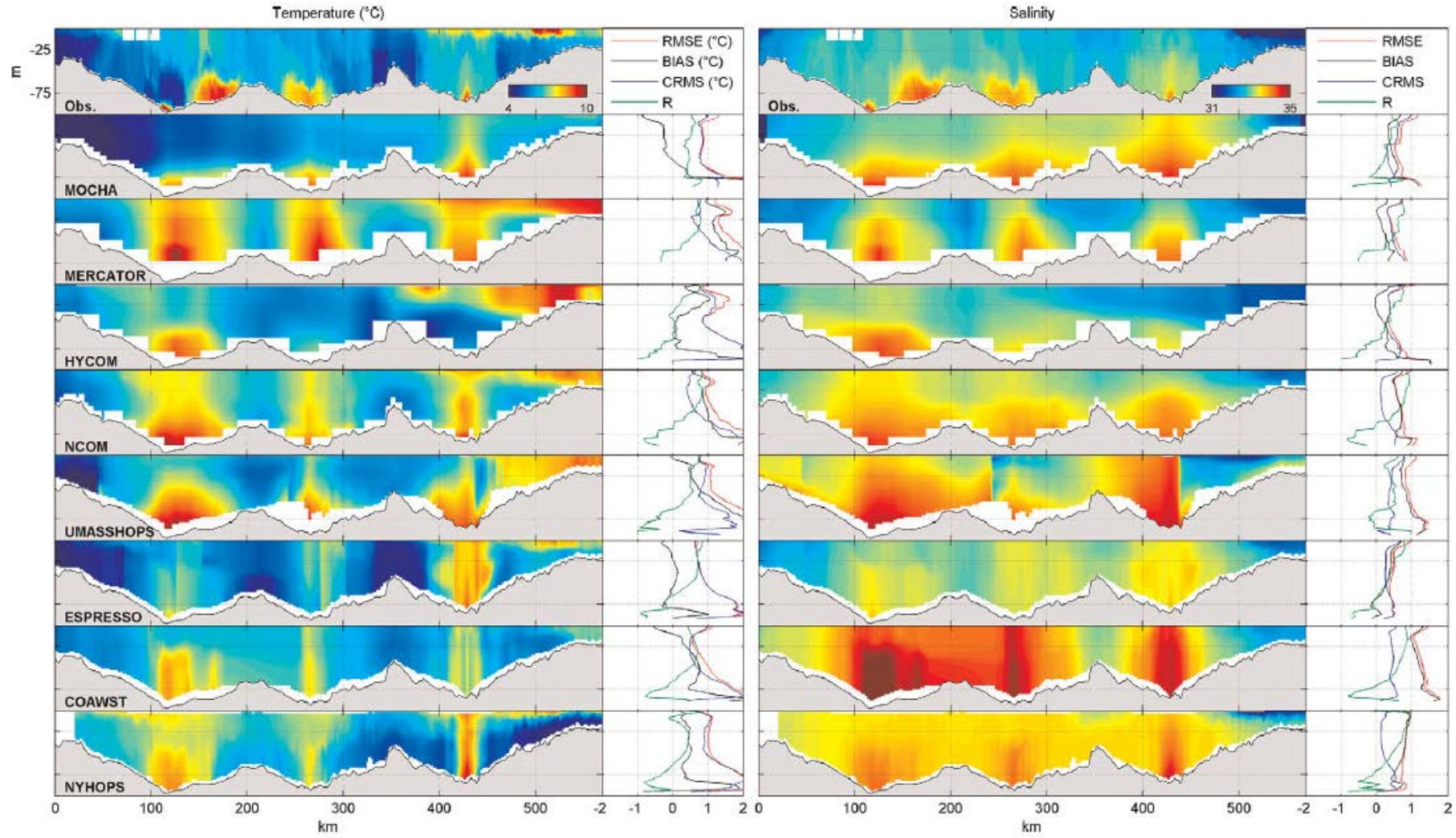
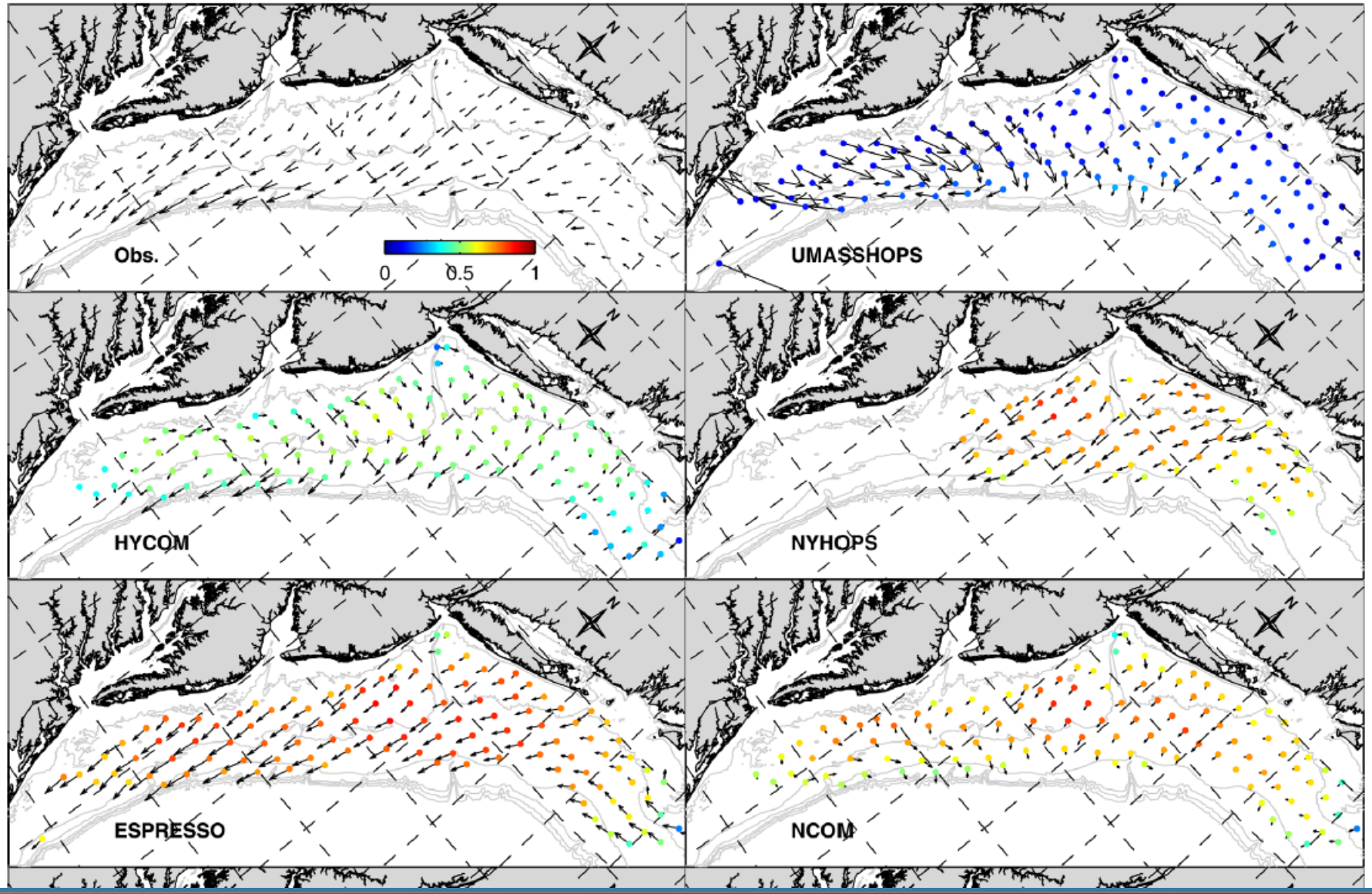


Figure 2. (left) Temperature and (right) salinity versus along-track distance and depth for the MAB AUGV deployment of 04/2010 (see Figure 1 for trajectory). Top row: reduced resolution observation set

WILKIN AND HUNTER: MID-ATLANTIC BIGHT MODELS SKILL ASSESSMENT



IP[y]: Notebook Iris test 2 Last saved: Mar 28 10:17 AM

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Code Cell Toolbar: None

In [12]:
```
# DAP URL: 30 year East Coast wave hindcast (Wave Watch 3 driven by CFSR Winds)
cubes = iris.load('http://geoport.whoi.edu/thredds/dodsC/fmrc/NCEP/ww3/cfsr/4m/best');
```

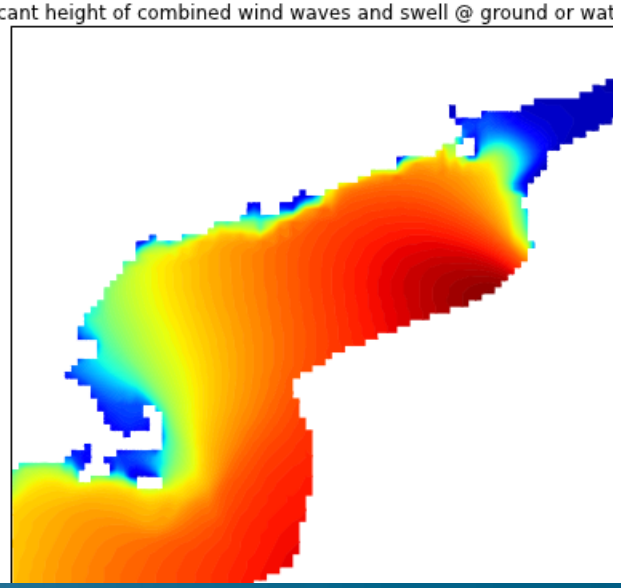
In [13]:
```
print cubes
```

```
0: Significant height of combined wind waves and swell @ Ground or water surface / m (time: 90584; latitude: 481; longitude: 586)
1: u-component of wind @ Ground or water surface / m/s (time: 90096; latitude: 481; longitude: 586)
2: v-component of wind @ Ground or water surface / m/s (time: 90096; latitude: 481; longitude: 586)
3: Primary wave direction (degree true) @ Ground or water surface / unknown (time: 90584; latitude: 481; longitude: 586)
4: Primary wave mean period @ Ground or water surface / s (time: 90584; latitude: 481; longitude: 586)
```

In [14]:
```
hsig=cubes[0]
```

In [15]:
```
slice=hsig.extract(iris.Constraint(time=tval(hsig,'1989-05-07 21:00'),
    longitude=lambda cell: -71.5 < cell < -65.0,
    latitude=lambda cell: 39.5 < cell < 46.0))
```

In [16]:
```
# make the plot
figure(figsize=(10,10))
qplt.contourf(slice,100);
```



scitools.org.uk/iris/

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Iris

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A Python library for Meteorology and Climatology

The Iris library implements a data model to create a data abstraction layer which isolates analysis and visualisation code from data format specifics. The data model we have chosen is the CF Data Model. The implementation of this model we have called an Iris Cube.

Iris currently supports read/write access to a range of data formats, including (CF-)netCDF, GRIB, and PP; fundamental data manipulation operations, such as arithmetic, interpolation, and statistics; and a range of integrated plotting options.

Iris is published under an LGPLv3 licence.

LGPL v3

IP[y]: Notebook IOOS_inundation2 Last Checkpoint: Apr 23 04:29 (autosaved) Logout

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IOOS System Test: Extreme Events Theme: Inundation

Compare modeled water levels with observations for a specified bounding box and time period using IOOS recommended service standards for catalog search (CSW) and data retrieval (OPeNDAP & SOS).

- Query CSW to find datasets that match criteria
- Extract OPeNDAP data endpoints from model datasets and SOS endpoints from observational datasets
- OPeNDAP model datasets will be granules
- SOS endpoints may be datasets (from ncSOS) or collections of datasets (from NDBC, CO-OPS SOS servers)
- Filter SOS services to obtain datasets
- Extract data from SOS datasets
- Extract data from model datasets at locations of observations
- Compare time series data on same vertical datum

Specify a time range and bounding box of interest:

In [2]:
```
# specific specific times (UTC) ...

# hurricane sandy
jd_start = dt.datetime(2012,10,26)
jd_stop = dt.datetime(2012,11,2)

# 2014 feb 10-15 storm
jd_start = dt.datetime(2014,2,10)
jd_stop = dt.datetime(2014,2,15)
```

IOOS

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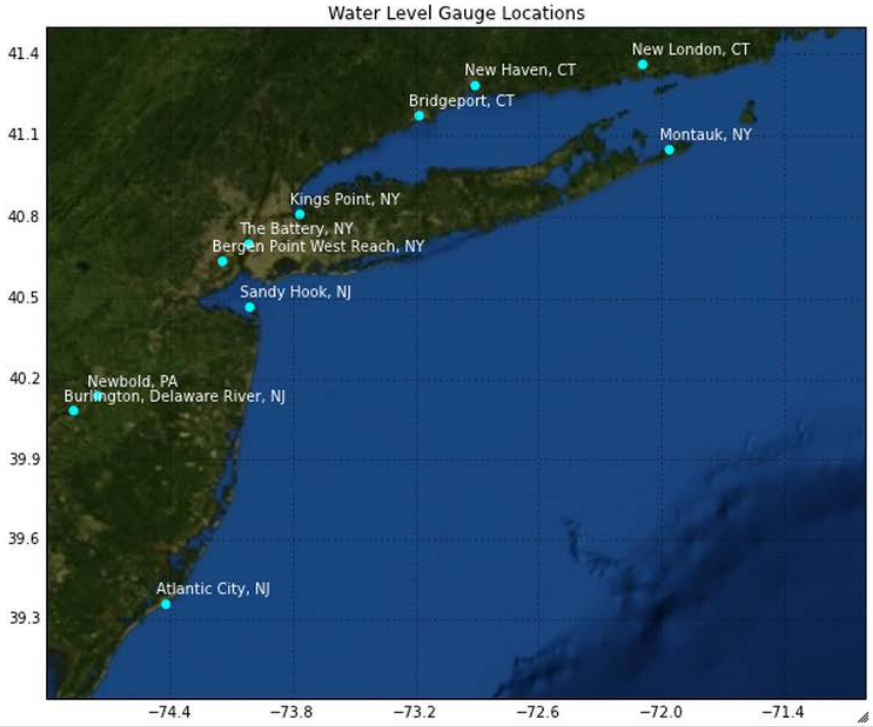
```
gl=ax.gridlines(draw_labels=True)
gl.xlabels_top = False
gl.ylabels_right = False
title('Water Level Gauge Locations');
```



Automated model comparison

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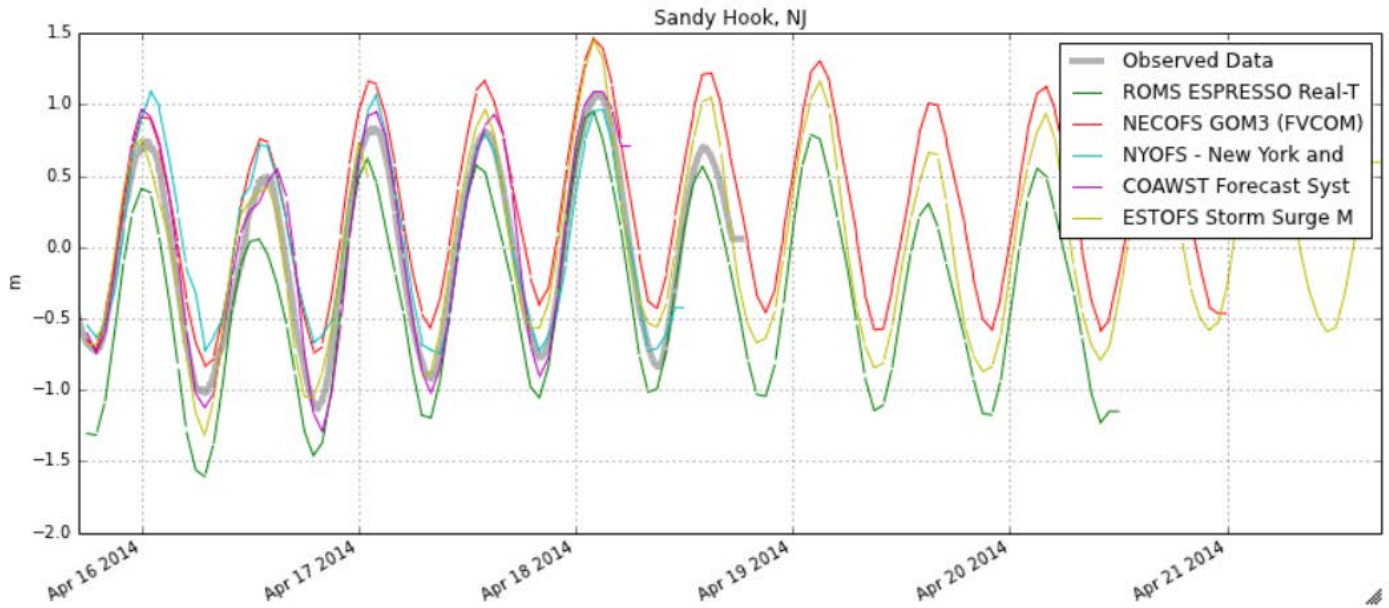
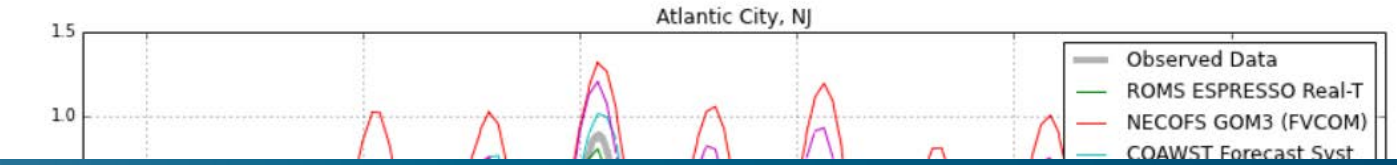
```
In [45]: for df in obs_df:
             df.plot(figsize=(14,6),title=df.name)
             ylabel('m')
```





Expected Outcomes

- Skill assessment products driven by free, transparent, reproducible IPython notebooks
- More standardized delivery of SECOORA observational and model data products
- Better understanding of appropriate use of modeling products
- Better models