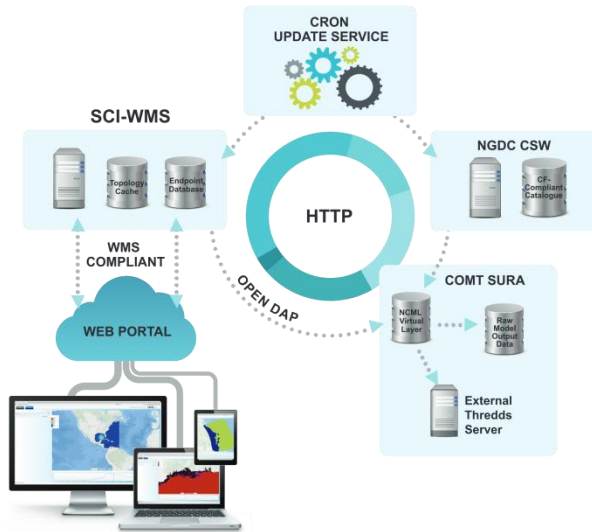


COMT CI: Y3 in Review & Goals for Y4
Kelly Knee & Brian McKenna
RPS ASA



COMT Cyber-Infrastructure


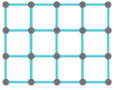




Motivation

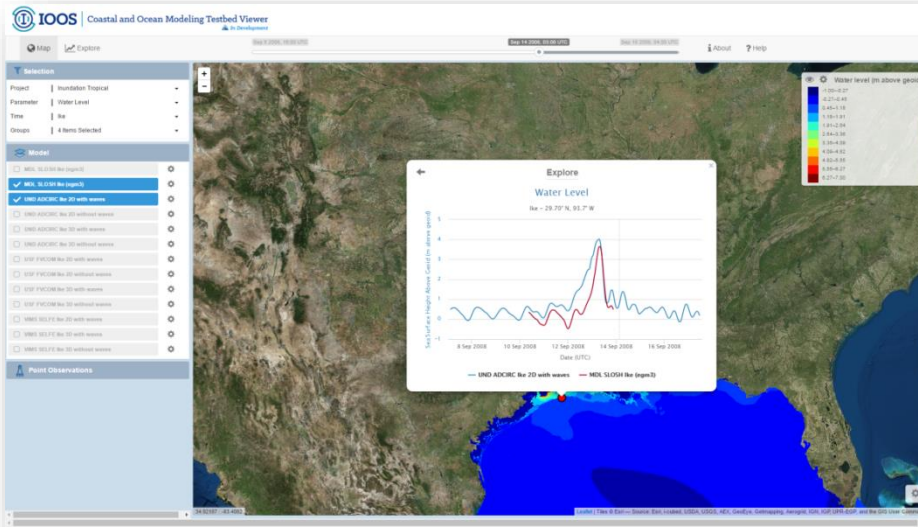
- facilitate **collaboration** across various institutions and models
- enable **exploration**, presentation and archive of research results
- provide **community** access and tools to the COMT research

Implementation/Tools

- modelers upload data via FTP to central server
- CI works with modelers to make all data CF-compliant
- direct data access available via TDS (OPeNDAP and HTTP)
- visualization via Python based SCI-WMS for graphic display of data
 - handles structured, staggered and unstructured GRIDS
- user interface enables exploration of catalog and graphics for all projects

	TOPOLOGY	OPEN DAP ENDPOINT
C-GRID		HTTP://...
		HTTP://...
	⋮	⋮
U-GRID		HTTP://...
		HTTP://...

Presentation/User Interface



Services

sci-wms (1.6.0-dev) a Python WMS service for geospatial gridded data

[datasets](#) [defaults](#) [documentation](#) [demo \(Leaflet WMS client\)](#) [login](#)

Description	Preview	Info	Actions
cb_hypoxia.CHEROMS_1term...	n/a	GetCapabilities Data (DAP) Updated: 1 week, 1 day ago Keep up to date: <input checked="" type="checkbox"/>	Update
cb_hypoxia.CHEROMS_1termDO	n/a	GetCapabilities Data (DAP) Updated: 1 week, 1 day ago Keep up to date: <input checked="" type="checkbox"/>	Update
uww_integration.exp16	n/a	GetCapabilities Data (DAP) Updated: 1 week, 1 day ago	Update

Data Access (eg. OPeNDAP)

Tested on Netscape 4.01 and Internet Explorer 5.00

OPeNDAP

Action: [GetASCI](#) [GetBinary](#) [ShowHelp](#)

Data URL: http://comt.sura.org/thredds/dodsC/coord2/pr_

Global Attributes:

```

FillValue: -99999.0
model: ADCIRC
version: 51.28
grid_type: Triangular
description: PRV1 TIDAL

```

Variables:

- time:** Array of 64 bit Reals [time = 0.47][node = 0.2733257]


```

time: [ ] node: [ ]
long_name: model time
standard_name: time
units: seconds since 1988-09-28 00:00
base_date: 1988-09-28 00:00:00 UTC

```
- X:** Array of 64 bit Reals [node = 0.2733257]


```

node: [ ]
long_name: longitude
standard_name: longitude
units: degrees_east
positive: east

```
- Y:** Array of 64 bit Reals [node = 0.2733257]


```

node: [ ]
long_name: latitude
standard_name: latitude
units: degrees_north
positive: north

```
- element:** Array of 32 bit Integers [node = 0.2733257]


```

node: [ ]
long_name: element
cf_role: face_node_connectivity
start_index: 1
units: nondimensional

```
- adcirc_mesh:** Array of 32 bit Integers [node = 0.2733257]


```

mesh: [ ]
long_name: mesh_topology
cf_role: mesh_topology
topology_dimension: 2
node_coordinates: x y
face_node_connectivity: element

```
- net:** 32 bit Integer [node = 0.2733257]


```

net: [ ]
long_name: total number of elevation
units: nondimensional

```
- zeta:** Array of 64 bit Reals [time = 0.47][node = 0.2733257]


```

time: [ ] node: [ ]
long_name: water surface elevation above geoid
standard_name: sea_surface_height_above_geoid
coordinates: time y x
location: node
mesh: adcirc_mesh

```
- U-vel:** Array of 64 bit Reals [time = 0.47][node = 0.2733257]


```

time: [ ] node: [ ]
long_name: water column vertically averaged east/west velocity
standard_name: eastward_water_velocity
positive: east
units: m s-2
FillValue: -99999.0

```
- V-vel:** Array of 64 bit Reals [time = 0.47][node = 0.2733257]


```

time: [ ] node: [ ]
long_name: water column vertically averaged north/south velocity
standard_name: northward_water_velocity
positive: north
units: m s-2

```
- pressure:** Array of 64 bit Reals [time = 0.47][node = 0.2733257]


```

time: [ ] node: [ ]
long_name: air pressure at sea level
standard_name: air_pressure_at_sea_level
units: meters of water
FillValue: -99999.0
coordinates: time y x

```
- windx:** Array of 64 bit Reals [time = 0.47][node = 0.2733257]


```

time: [ ] node: [ ]
long_name: e/w wind velocity
standard_name: eastward_wind
positive: east
units: m s-2
FillValue: -99999.0

```
- windy:** Array of 64 bit Reals [time = 0.47][node = 0.2733257]


```

time: [ ] node: [ ]
long_name: n/s wind velocity
standard_name: northward_wind
positive: north
units: m s-2
FillValue: -99999.0

```
- swan_HS:** Array of 64 bit Reals [time = 0.47][node = 0.2733257]

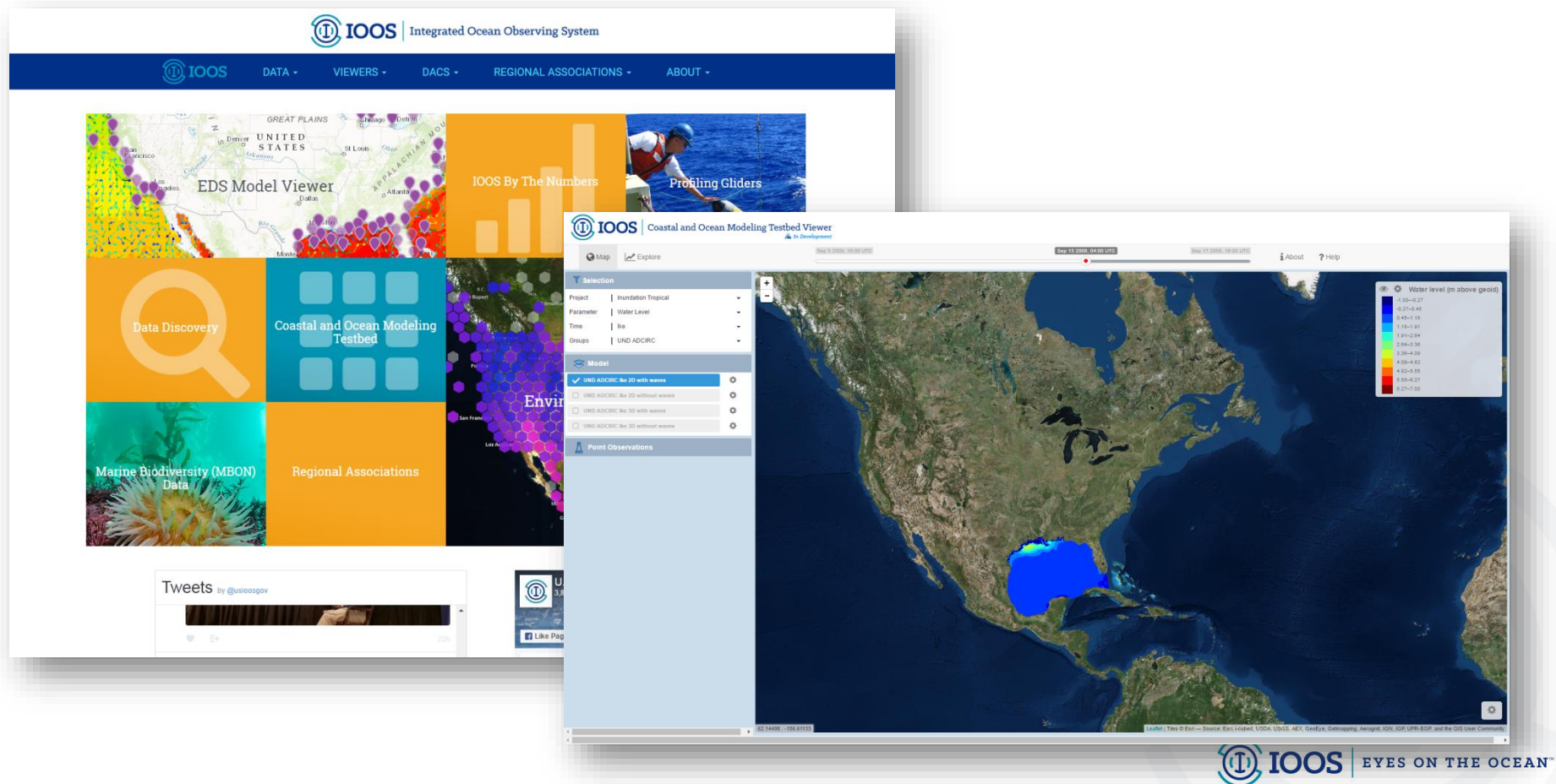

```

time: [ ] node: [ ]
long_name: significant wave height
standard_name: sea_surface_wave_significant_height
units: m
FillValue: -99999.0
coordinates: time y x

```

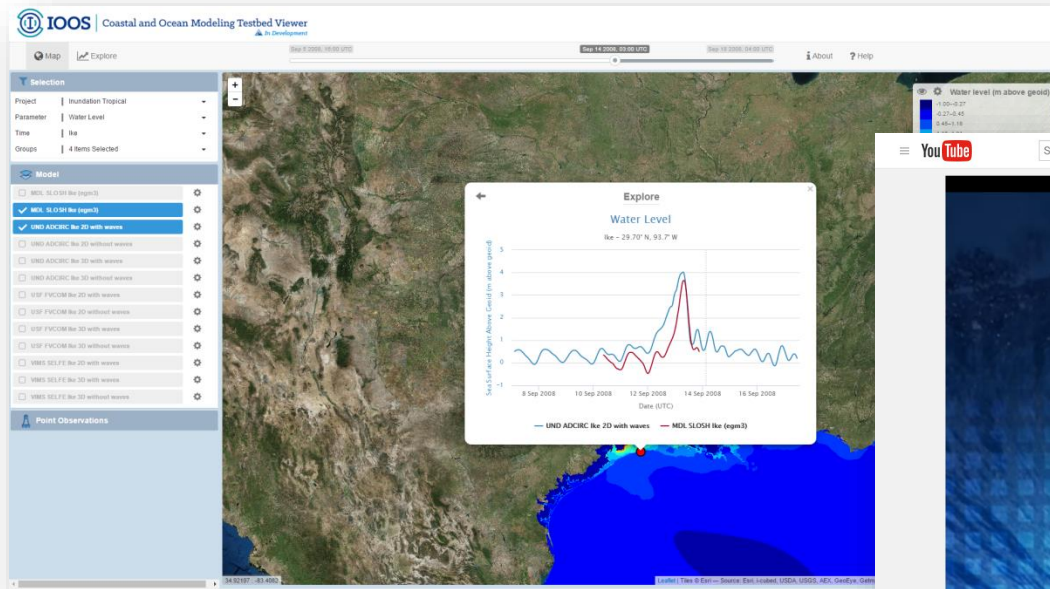
Year 3 In Review

- Deployment of comt.ioos.us
- Addition of <http://comt.sura.org/thredds> to RPA ASA's operational service monitoring system
- Model Viewer Improvements



Year 3 In Review

- Coordination with modeling teams & participation on team calls
- Demos and [tutorials](#)
- **Development of Data Upload Tool**
- Review of draft Data Management Plan



Year 3 In Review: CB Hypoxia

Challenge: Downloadable Publication Archives

- Create unique and stable (and now branded!) TDS catalog location for archiving publication model runs & related observations
 - http://comt.sura.org/thredds/catalog/comt_2_full/cb_hypoxia/2004-2005/catalog.html
 - http://thredds.comt.ioos.us/thredds/projects/cb_hypoxia/papers/irbyetal2016.html



IOOS

Integrated Ocean Observing System

THREDDS Catalog http://thredds.comt.ioos.us/thredds/projects/cb_hypoxia/papers/irbyetal2016.html

Dataset	Size	Last Modified
Irby et al. 2016		--
VIMS ChesROMS 1-term DO surfsat/		--
NOAA CSDL CROFS2 (ROMS) development Synoptic Hindcast/		--
UMCES ROMS RCA/		--

COMT TDS at RPS ASA see [Info](#)
THREDDS Data Server [Version 4.6.6 - 2016-06-13T15:13:41-0600] [Documentation](#)



IOOS | EYES ON THE OCEAN™

Year 3 In Review: CB Hypoxia

- Added new model runs
 - ChesROMS
 - CBOFS
 - ROMS_RCA
- Organized model runs by project period
 - 2004-2005
 - 1984-2013
 - 2014-2015
- Re-organization of Model Viewer filters to allow multiple time periods per project
- Enabled water temperature variable in the model viewer
- Integrated the Chesapeake Bay Program observation data with the TDS catalog and Model Viewer
- Added CBIBS buoy data to the Model Viewer

Year 3 In Review: CB Hypoxia

Outstanding Requests:

- Process observation data
- Enable model-observation comparisons
- Enable inter-comparison of models with sigma coordinates at various depths
- Add additional biogeochemical variables (chlorophyll and nitrate)
- Integration of 'Station' data from simulations
- Allow Model Viewer to generate longer (2-yr) time-series
- Calculation of hypoxic volume

Year 3 In Review: GoM Hypoxia

Challenge: Calculation of bottom boundary layer

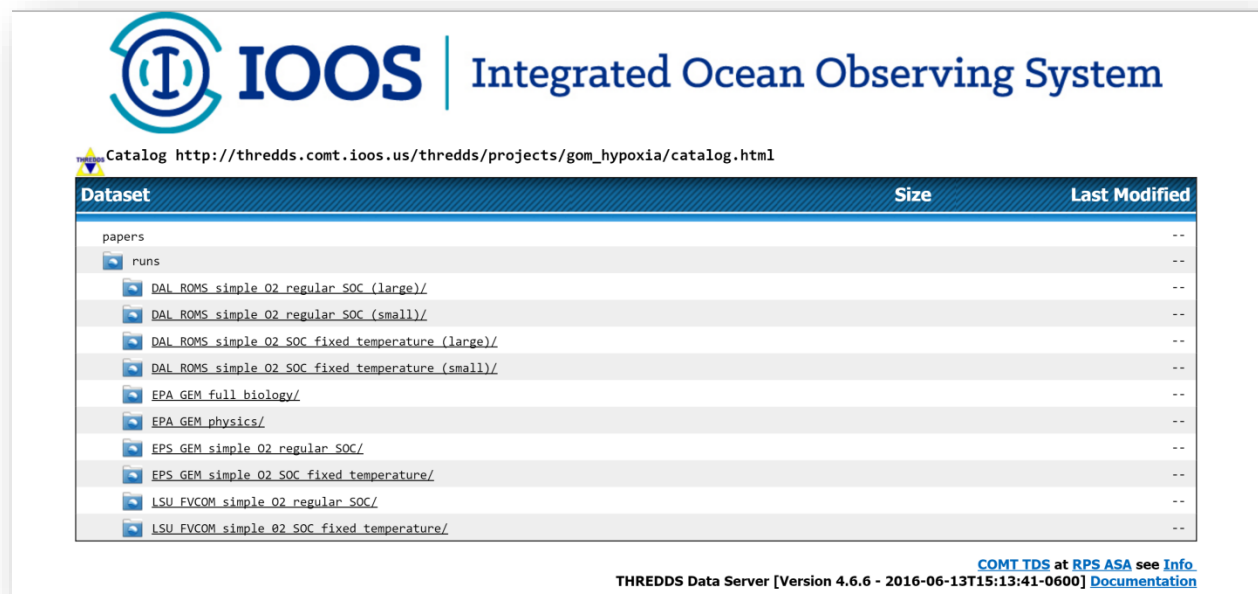
- Boundary layer thickness, as compared to NGOFS, is a key diagnostic for inclusion of new models.
- Review existing Matlab code for boundary layer calculation provided by modeling team
- Convert to Python and performed test integration with data ingest process as a post-processing step

Potential Next Steps

- Testing!
- Add boundary layer thickness as 2D variable to model output files;
 - Requires discussion of CF convention for new variable
- Determine best practices for visualization, color scheme, etc
- Comparison with NGOFS

Year 3 In Review: GoM Hypoxia

- Defined the model data expectations for Y3 and Y4 for all three models (ROMS, GEM, FVCOM)
 - Y3: (1) simple oxygen model and (2) the diagnostic run
 - Y4: full biogeochemical model results
- Created a [stable TDS catalog link](#) for use in publications
- Continued coordination with FVCOM group to work through topology and time variable issues
- Added first round of simple O2 models to the TDS catalog



The screenshot displays the IOOS Integrated Ocean Observing System (IOOS) web interface. At the top, the IOOS logo is followed by the text "Integrated Ocean Observing System". Below this, a URL bar shows the catalog link: http://thredds.comt.ioos.us/thredds/projects/gom_hypoxia/catalog.html. The main content area features a table with three columns: "Dataset", "Size", and "Last Modified". The table lists various datasets, including "papers", "runs", and several model runs for ROMS, GEM, and FVCOM. The "Last Modified" column shows "--" for all entries. At the bottom right, there is a link to "COMT TDS at RPS ASA see Info Documentation". The footer of the page reads "THREDDS Data Server [Version 4.6.6 - 2016-06-13T15:13:41-0600] Documentation".

Dataset	Size	Last Modified
papers		--
runs		--
DAL ROMS simple O2 regular SOC (large)/		--
DAL ROMS simple O2 regular SOC (small)/		--
DAL ROMS simple O2 SOC fixed temperature (large)/		--
DAL ROMS simple O2 SOC fixed temperature (small)/		--
EPA GEM full biology/		--
EPA GEM physics/		--
EPS GEM simple O2 regular SOC/		--
EPS GEM simple O2 SOC fixed temperature/		--
LSU FVCOM simple O2 regular SOC/		--
LSU FVCOM simple O2 SOC fixed temperature/		--

Year 3 In Review: GoM Hypoxia

Outstanding Requests:

- Process observation data
- Enable model-observation comparisons
- Add full biogeochemical model output
- Add bottom boundary layer thickness to UI
 - Perform a simple difference calculation between NGOFS and the testbed runs

Year 3 In Review: USWC Integration

Challenge: Integration of real-time simulations

- Primarily leveraging remotely served ongoing forecast products
- A single case study dataset has been added to the COMT TDS catalog: full aggregation available at http://comt.sura.org/thredds/dodsC/comt2/usw_integration/Exp16/roms.xml.html

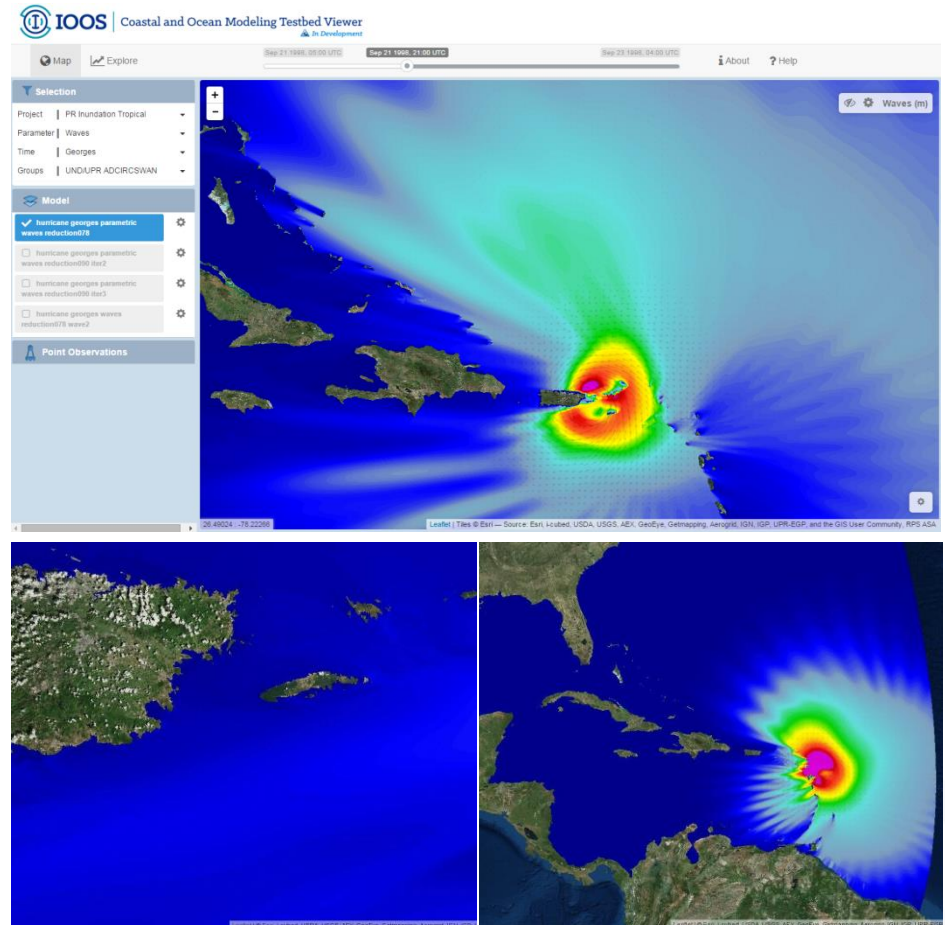
Outstanding Requests:

- Add time-series of public buoys to compare with model
- Mechanism for analyzing past month of model performance

Year 3 In Review: PR Inundation

Challenge: Many, massive, model runs

- Pushing boundaries of fast & efficient integration of new model runs
- Datasets with millions of nodes too slow to draw in Model Viewer
- Leveraged a python-based tile cache for key model results



Year 3 In Review: PR Inundation

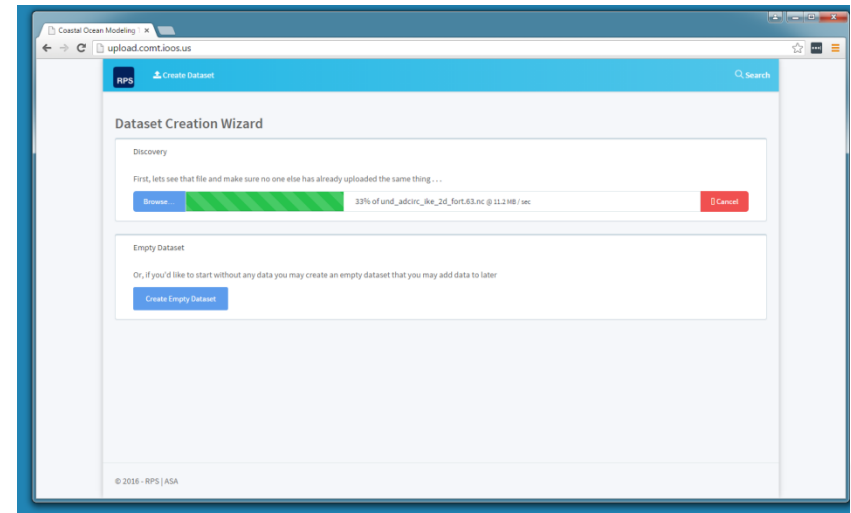
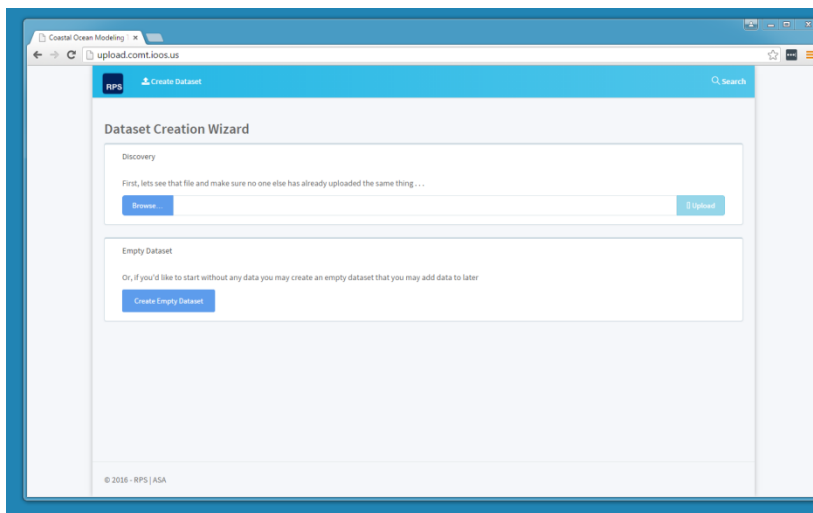
- Addition of Georges, Irene, and Sandy ADCIRC runs to the TDS Catalog
- Addition of Georges observation data to the TDS catalog
- Support of NOAA Testbed Conference abstract and presentation
- Continued coordination with PR team to work through SLOSH basin issues

Outstanding Requests:

- Integration of observation data
- Enable model-observation comparisons
- Continued coordination with NHC on SLOSH integration
- Difference calculation

Data Upload Tool

Upload View/Creation Wizard allows local files to be uploaded
(checks file hash before upload to see if this file has been processed)



Data Upload Tool

Once uploaded, metadata is used to fill in initial dataset profile
(standards such as ACDD and CF are initial targets)

The screenshot shows a web browser window with the URL `upload.comt.ioos.us/nc-inspector/98hfeDBZNfkTeBjMb`. The page is titled "Coastal Ocean Modeling" and features a "Create Dataset" button. The form is divided into several sections:

- Title:** `Ike 2D`
- Discovery - ACDD:** This section contains fields for ID, Naming Authority, Conventions, Description, Institution, and Keywords. The ID, Naming Authority, Conventions, and Keywords fields are marked as "Empty". The Description field contains the text "Tropics_SURF_Ike_Tides_Winds132 CHARACTER ALPHANUMERIC RUN DESCRIPTION". The Institution field contains "University of Notre Dame".
- CF:** This section contains a table with columns for File Variable Name, Long Name, Standard Name, Units, and Location. The table has one row with the following values: File Variable Name: `zeta`, Long Name: `water surface elevation above geoid`, Standard Name: `sea_surface_height_above_geoid`, Units: `metric`, and Location: `node`.
- NcML:** This section contains a dropdown menu for Dimension Variables, which is currently set to `time`.

Data Upload Tool

Additional conventions/standards such as UGRID are presented

The screenshot shows a web browser window titled "Coastal Ocean Modeling" with the URL "upload.comt.ioos.us/nc-inspector/98hfeDBZNfkTeBjMb". The interface displays a table of variables and their units, followed by sections for "NcML" and "UGRID" conventions.

Variable	Description	Value	Unit	Category
ibtype	type of normal flow (discharge) boundary	Empty	nondimensional	
ibtypee	elevation boundary type	Empty	nondimensional	
nbdv	node numbers on each elevation specified boundary segment	Empty	nondimensional	
nbdv	node numbers on normal flow boundary segment	Empty	nondimensional	
neta	total number of elevation specified boundary nodes	Empty	nondimensional	
nvdl	number of nodes in each elevation specified boundary segment	Empty	nondimensional	
nvel	total number of normal flow specified boundary nodes including both the front and back nodes on internal barrier boundaries	Empty	nondimensional	
nvell	number of nodes in each normal flow specified boundary segment	Empty	nondimensional	
x	longitude	longitude	degrees_east	
y	latitude	latitude	degrees_north	
zeta	water surface elevation above geoid	sea surface height above geoid	metric	node

NcML

Dimension Variables:

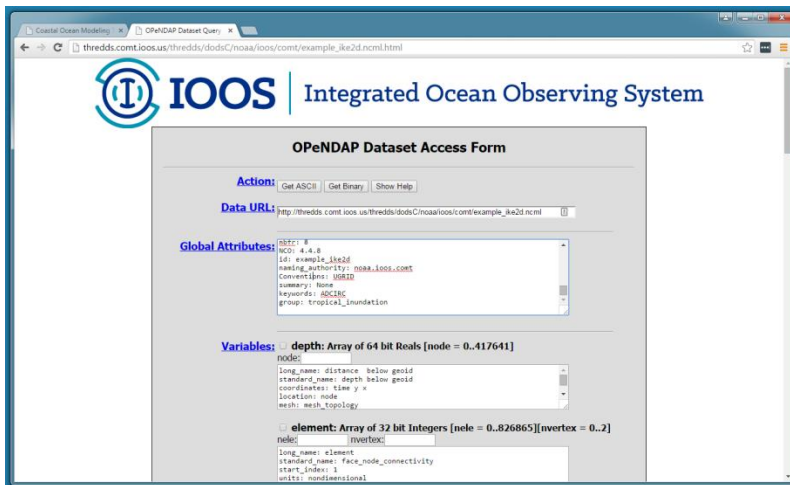
UGRID

Node Coordinates:

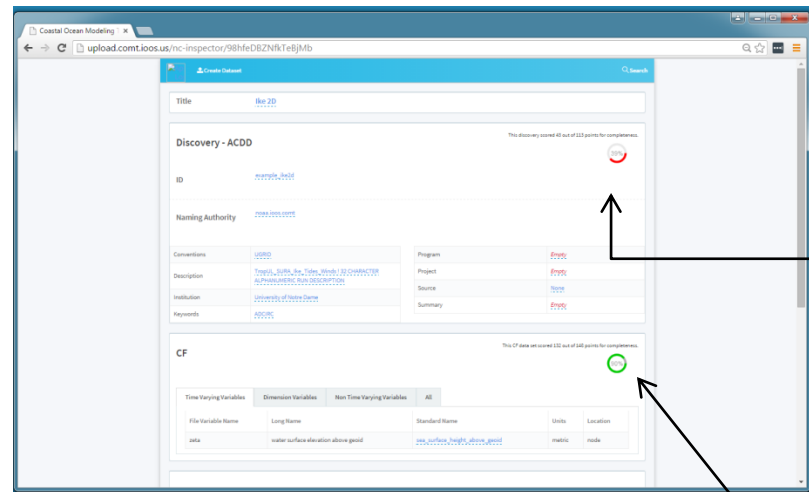
Face Node Connectivity:

Data Upload Tool

When required metadata is provided (e.g., *id* and *naming_authority*)
OPeNDAP endpoint is dynamically created using provided metadata
and IOOS compliance checker is run using DAP



The screenshot shows the IOOS OPeNDAP Dataset Access Form. It includes fields for Action (Get ASCII, Get Binary, Show Help), Data URL, Global Attributes (a text area with metadata like NCID, ID, naming_authority, etc.), and Variables (a list of variables like depth, element, etc.).

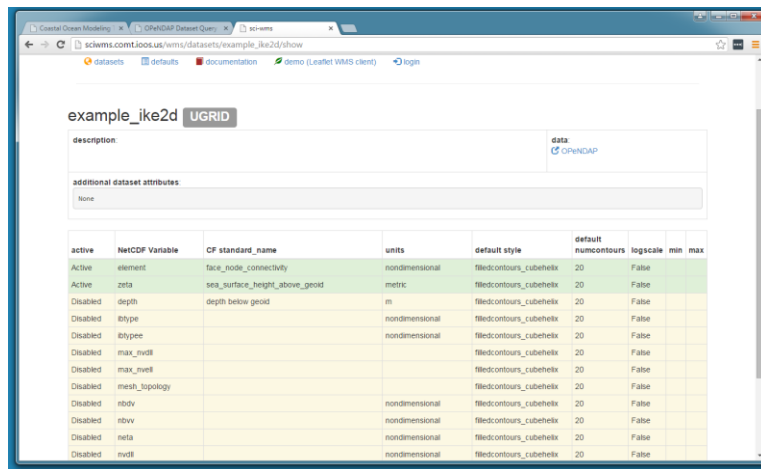


The screenshot shows the upload.com interface for creating a dataset. It includes fields for Title, ID, Naming Authority, Conventions, Description, Institution, Keywords, Program, Project, Source, and Summary. Below these fields, there are two sections: CF (Compliance Framework) and CF (Compliance Framework). The CF section shows a table of variables and their compliance scores. A red arrow points to a red circle indicating a failed compliance check, and a green arrow points to a green circle indicating a passed compliance check.

compliance
checker
scores

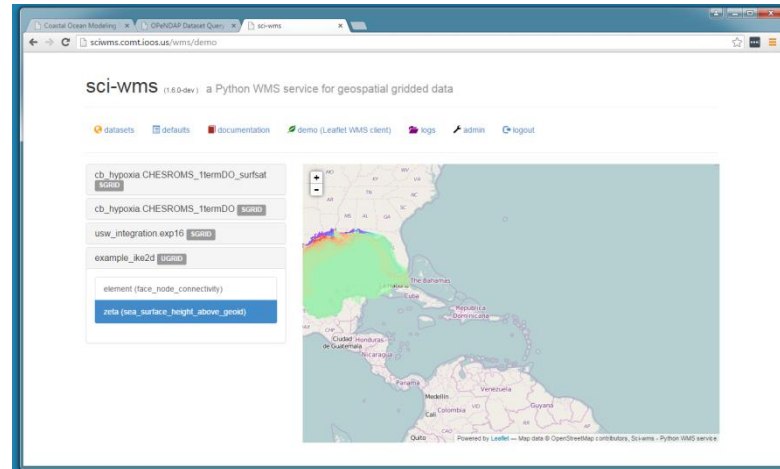
Data Upload Tool

If sufficient metadata is provided (eg. CF + UGRID)
a **sci-wms** dataset is created automatically allowing
visual access to the data via WMS

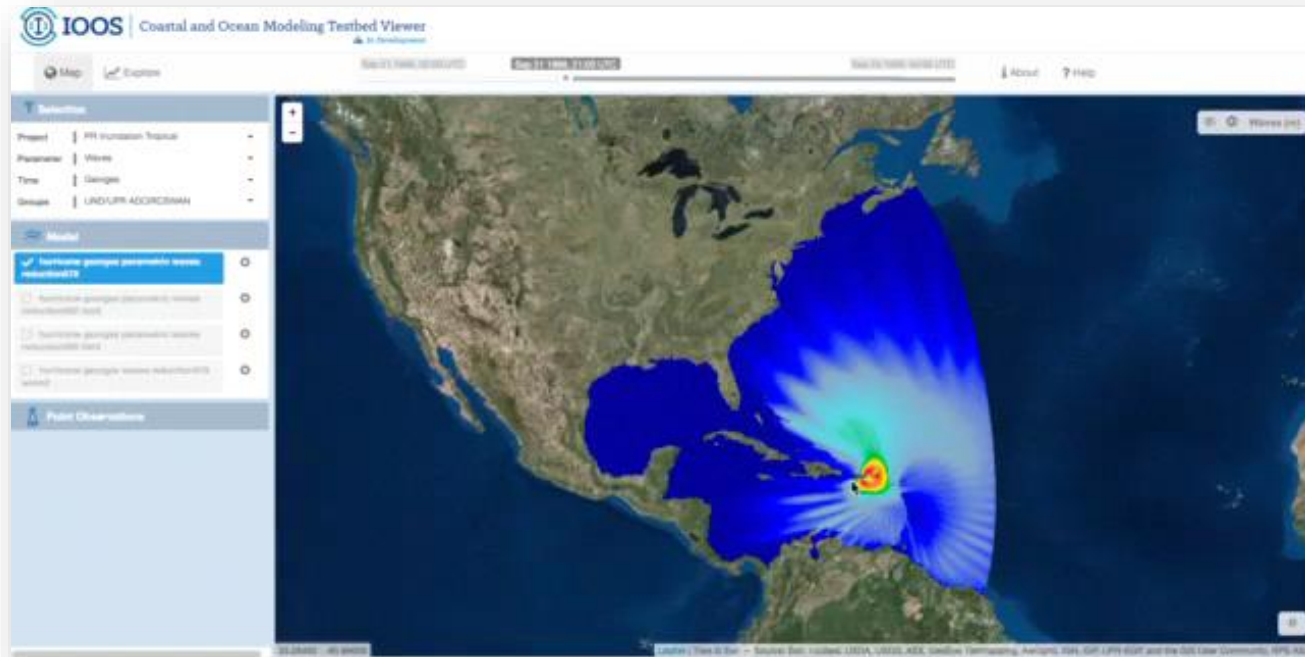


The screenshot shows the 'example_ike2d' dataset page in the sci-wms interface. It includes a description field, a 'data' dropdown set to 'CF + UGRID', and a table of NetCDF variables.

active	NetCDF Variable	CF standard_name	units	default style	default numcontours	logscale	min	max
Active	element	face_node_connectivity	nondimensional	filled:contours_cubehelix	20	False		
Active	zeta	sea_surface_height_above_geoid	metric	filled:contours_cubehelix	20	False		
Disabled	depth	depth below geoid	m	filled:contours_cubehelix	20	False		
Disabled	htype		nondimensional	filled:contours_cubehelix	20	False		
Disabled	hypee		nondimensional	filled:contours_cubehelix	20	False		
Disabled	max_rvdt			filled:contours_cubehelix	20	False		
Disabled	max_rvdt			filled:contours_cubehelix	20	False		
Disabled	mesh_topology			filled:contours_cubehelix	20	False		
Disabled	nbv		nondimensional	filled:contours_cubehelix	20	False		
Disabled	nbv		nondimensional	filled:contours_cubehelix	20	False		
Disabled	net		nondimensional	filled:contours_cubehelix	20	False		
Disabled	rvdt		nondimensional	filled:contours_cubehelix	20	False		

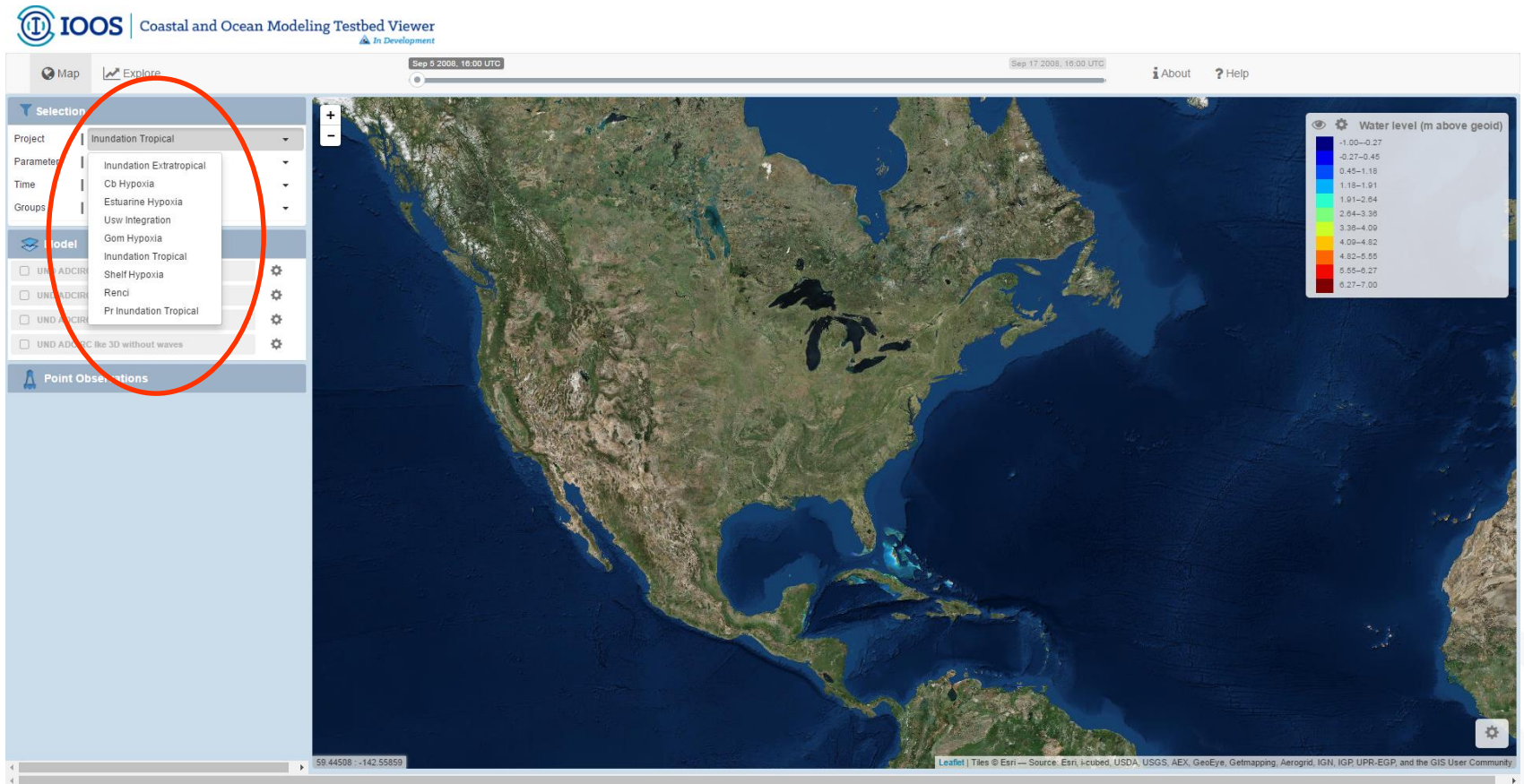


Model Viewer

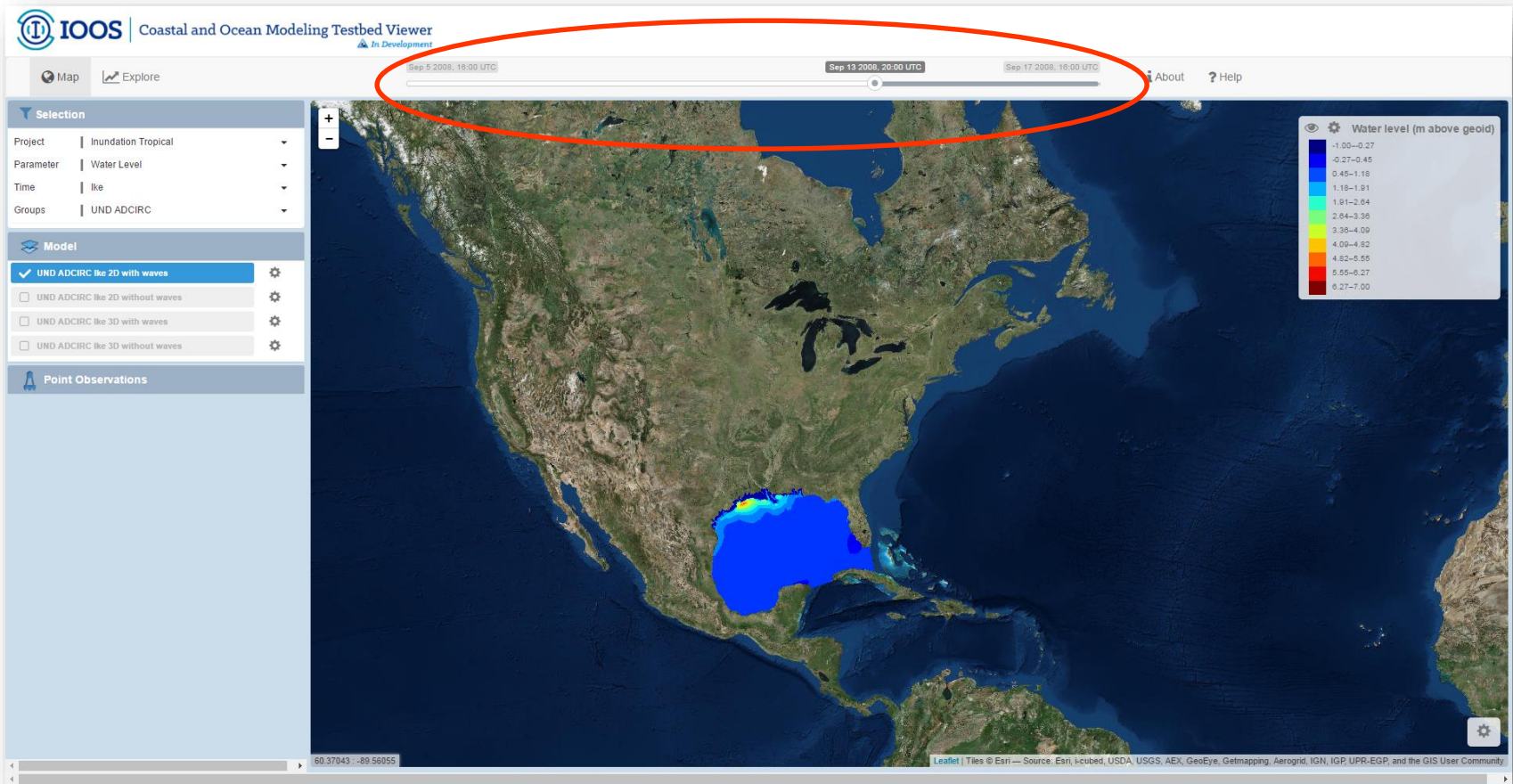


- Web-based map view enabled rapid exploration of model output from large scale to local
- Inter-comparison of models regardless of grid or domain
- Time-series comparison across models available for any point within domain via OGC WMS GetFeatureInfo requests

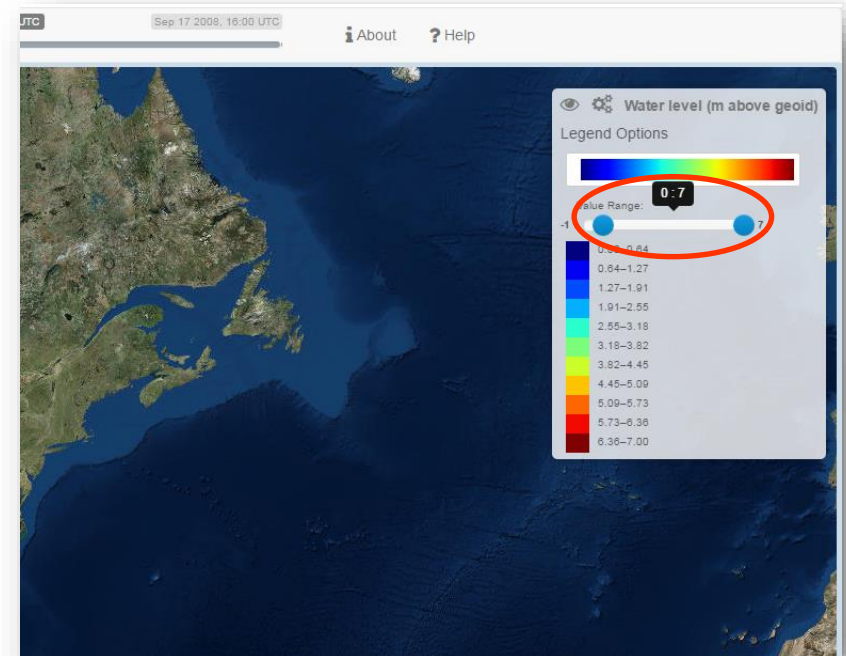
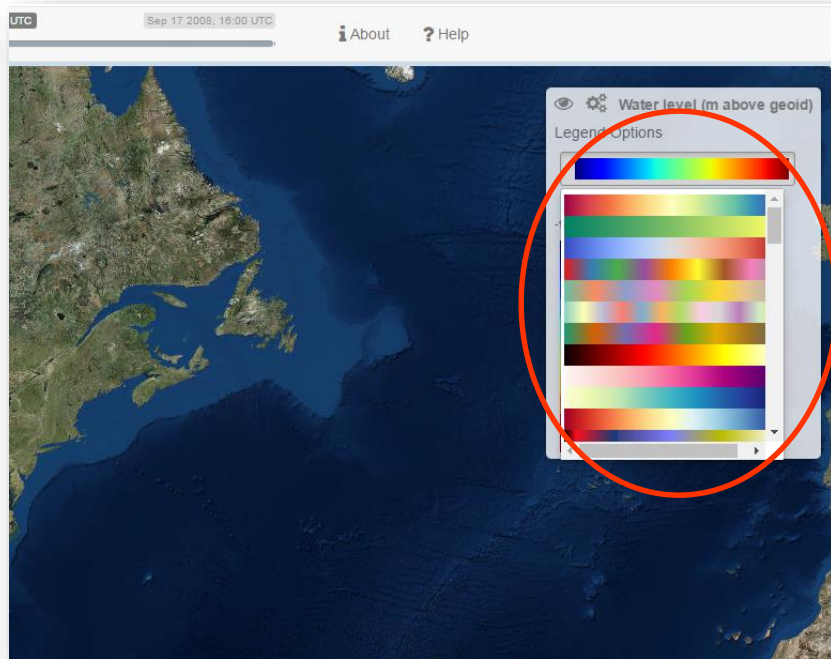
Model Viewer



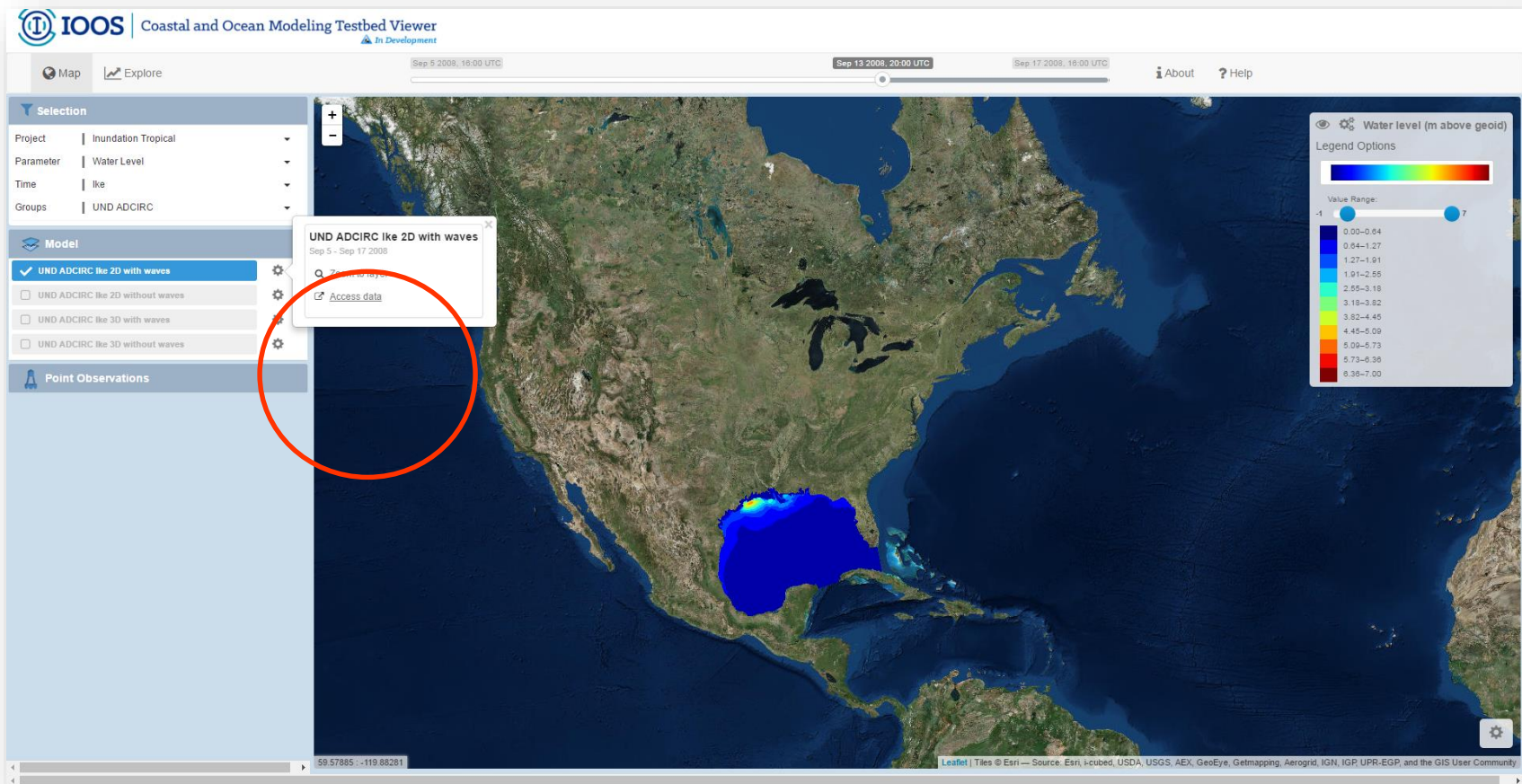
Model Viewer



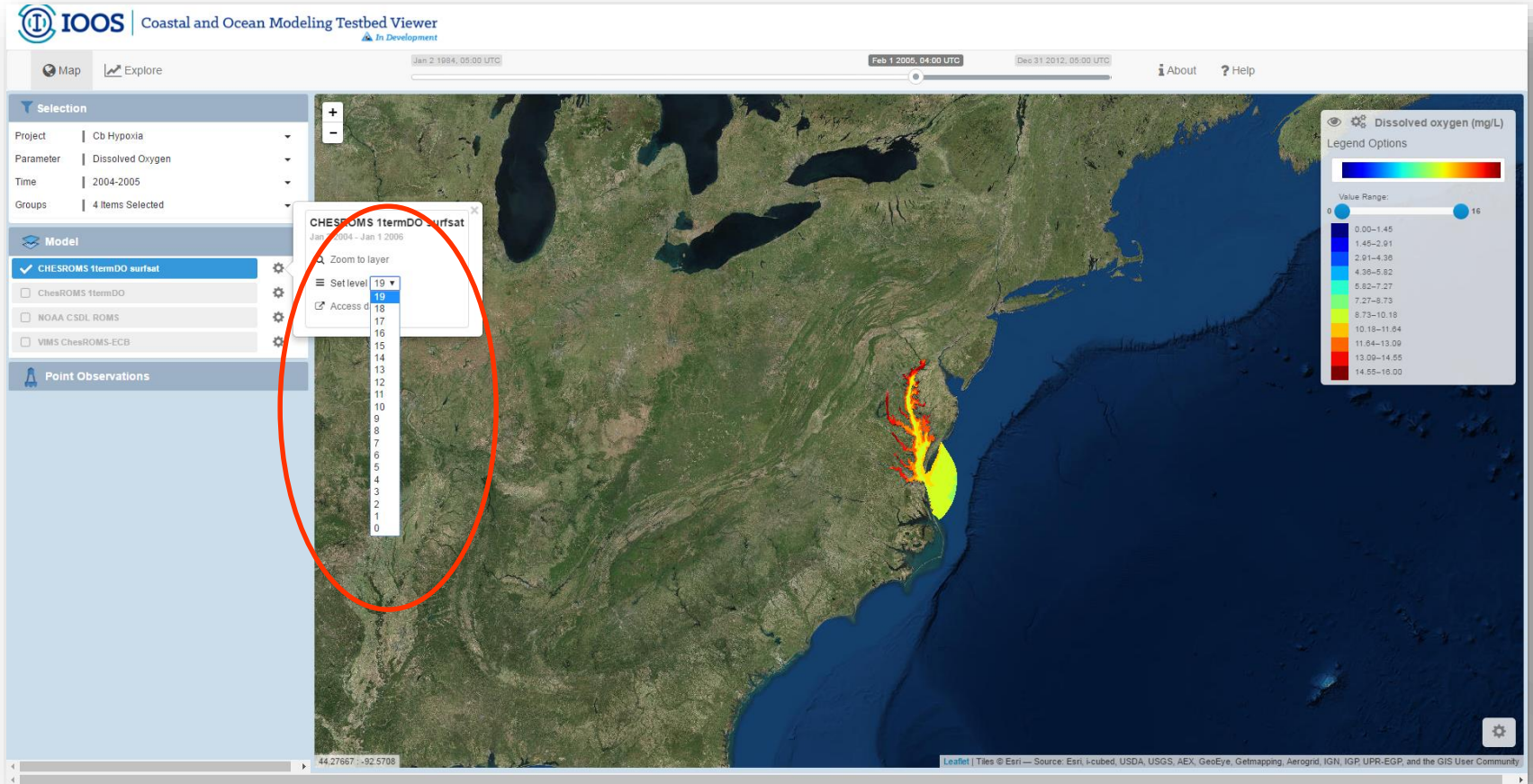
Model Viewer



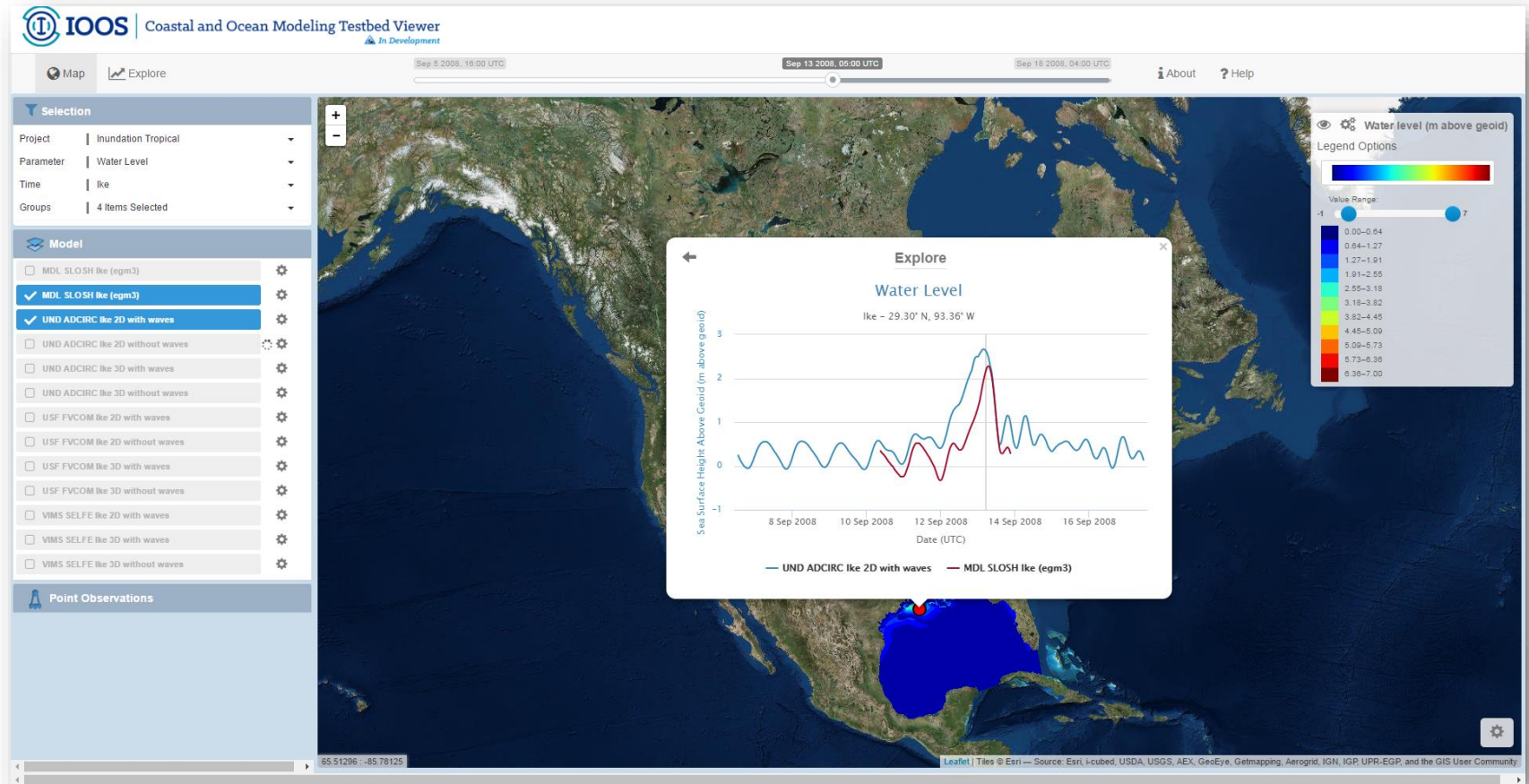
Model Viewer



Model Viewer



Model Viewer



Model Viewer Updates

Simplified Project Filters & Addition of Search

The screenshot shows the Model Viewer interface with a timeline from 09/01 to 09/29. The 'Slider Range' is set to 09/01/2008 - 10/01/2008, and the 'Map Time' is 09/12/2008 20:00 -04:00. The 'Data Layers' tab is active, and the search bar contains 'Inundation Tropical'. A dropdown menu is open, showing the following options:

- Inundation Tropical: IKE
- CB hypoxia: 1984-2013
- CB hypoxia: 2014-2015
- CB hypoxia: 2004-2005
- USWC Integration
- GOM Hypoxia: 2004-2007
- PR Inundation Tropical: SANDY
- PR Inundation Tropical: IRENE
- PR Inundation Tropical: GEORGES

The left sidebar contains the following sections:

- Observations**
 - ☒ CO-OPS Stations
- Water Level**
 - ☐ ADCIRC 2D no waves
 - ☐ ADCIRC 2D waves
 - ☐ ADCIRC 3D no waves
 - ☐ ADCIRC 3D waves
 - ☐ FVCOM 2D no waves
 - ☐ FVCOM 2D waves
 - ☐ FVCOM 3D no waves
 - ☐ SLOSH (UND) eql3
 - ☐ SLOSH (UND) eqm3
- Wave Height**
 - ☐ ADCIRC 2D waves
 - ☐ ADCIRC 3D waves
 - ☐ SWAN no surge

The screenshot shows the Model Viewer interface with a timeline from Jan '04 to Jul '05. The 'Slider Range' is set to 01/01/2004 - 01/01/2006, and the 'Map Time' is 06/05/2005 20:00 -04:00. The 'Data Layers' tab is active, and the search bar contains 'CB hypoxia: 2004-'. A dropdown menu is open, showing the following options:

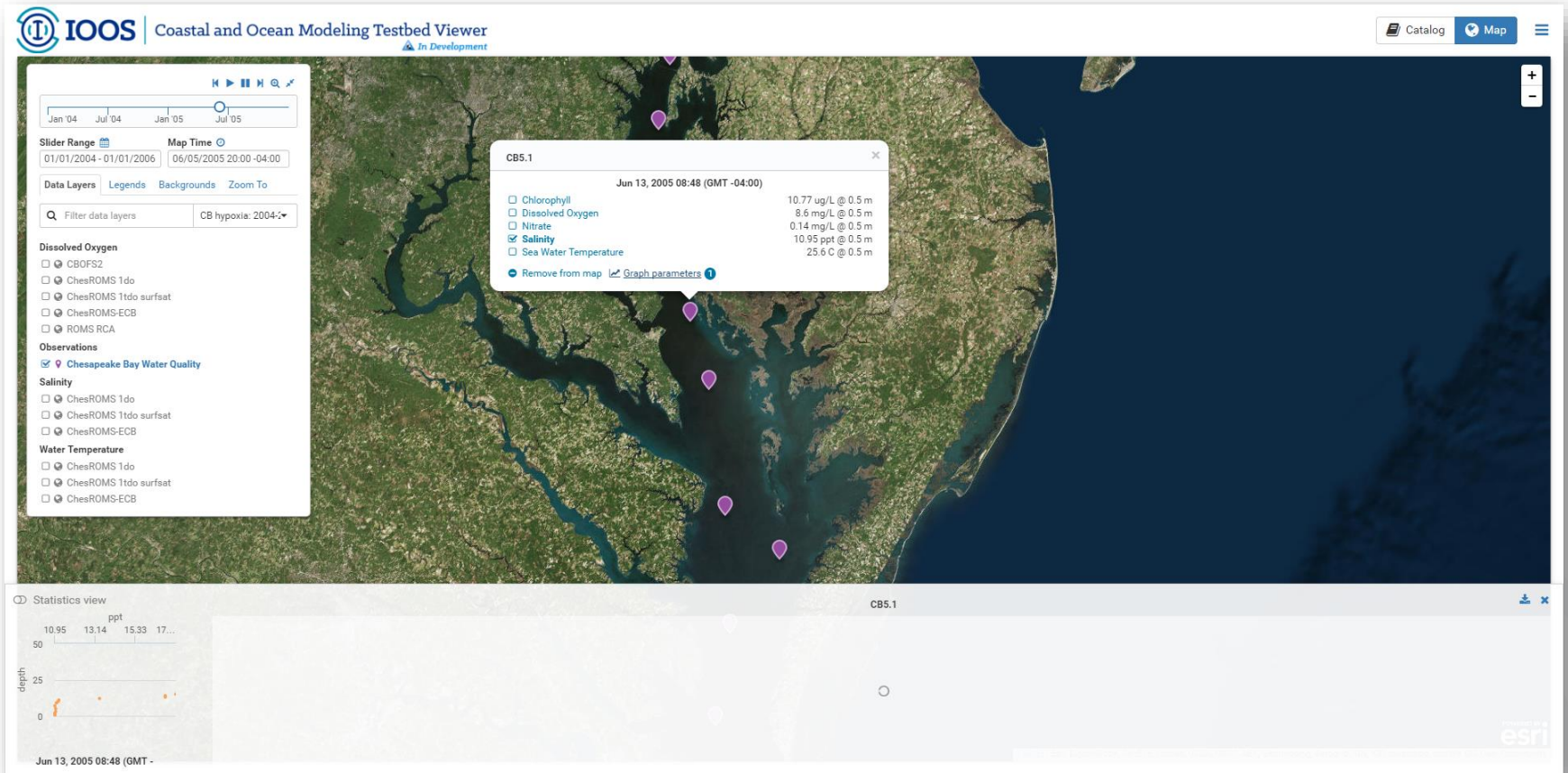
- Inundation Tropical: IKE
- CB hypoxia: 1984-2013
- CB hypoxia: 2014-2015
- CB hypoxia: 2004-2005
- USWC Integration
- GOM Hypoxia: 2004-2007
- PR Inundation Tropical: SANDY
- PR Inundation Tropical: IRENE
- PR Inundation Tropical: GEORGES

The left sidebar contains the following sections:

- Dissolved Oxygen**
 - ☐ CBOFS2
 - ☐ ChesROMS 1do
 - ☐ ChesROMS 1tdo surfsat
 - ☐ ChesROMS-ECB
 - ☐ ROMS RCA
- Observations**
 - ☒ Chesapeake Bay Water Quality
- Salinity**
 - ☐ ChesROMS 1do
 - ☐ ChesROMS 1tdo surfsat
 - ☐ ChesROMS-ECB
- Water Temperature**
 - ☐ ChesROMS 1do
 - ☐ ChesROMS 1tdo surfsat
 - ☐ ChesROMS-ECB

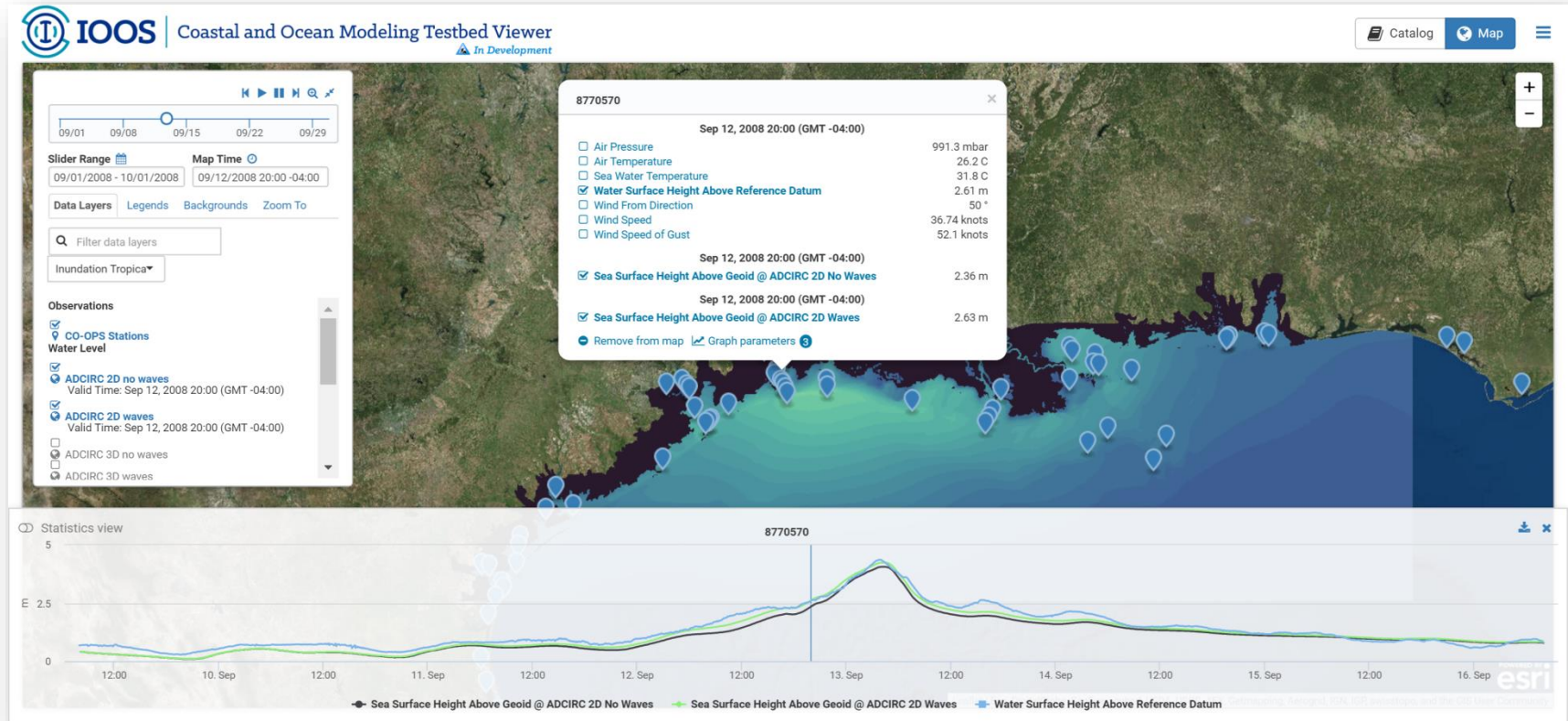
Model Viewer Updates

Addition of Observations





Model Viewer Updates




Addition of Observations



Model Viewer Updates

Web-based Catalog


 **IOOS** | Coastal and Ocean Modeling Testbed Viewer
 In Development

 Catalog  Map 


Showing 1 to 10 of 25 entries

Category


All
Observations
Dissolved Oxygen
Salinity
Water Temperature
Water Level
Wave Height
Water Level
Other



ADCIRC 2D no waves [Find on map](#)
title:ADCIRC 2D no waves
institution:UND
Conventions:UGRID
group:pr_inundation
model:ADCIRC
uuid:5a549f38-282f-44f7-bca5-81b8bd2cad47



ADCIRC parametric wave reduction 078 wave2
title:ADCIRC parametric wave reduction 078 wave2
institution:UND
Conventions:UGRID
group:pr_inundation
model:ADCIRC
uuid:7712b49a-f48d-41e3-aba3-15b5213144c8



ADCIRC parametric wave reduction 078 wave2

Y4 Draft Workplan

Landing Page/Catalog

- Intuitive & self-explanatory
- Discoverability & accessibility



Y4 Draft Workplan

sciWMS Enhancements

- Improved color schemes/scales

Modeling Team Support

- Identify key datasets for Y4
- Launch data upload tool and provide training
- Hands on facilitation of data ingest
- Maintenance and oversight of TDS catalog
- Finalize data management plan
- Approach/Tools for deriving new parameters (e.g. BBL, Hypoxic Volume, Difference)

Model Viewer

- Continued integration of observation data
- Enhanced data comparison tools
- Animations
- Landing page/catalog view
- Balance between sciWMS & tile services
- Additional 3D visualization tools

Y4 Draft Workplan

Data Comparison Tool



Slider Range

Map Time

08/18/2016 - 08/25/2016

08/18/2016 00:00 -04:00

Data Layers Legends Backgrounds


Parameter

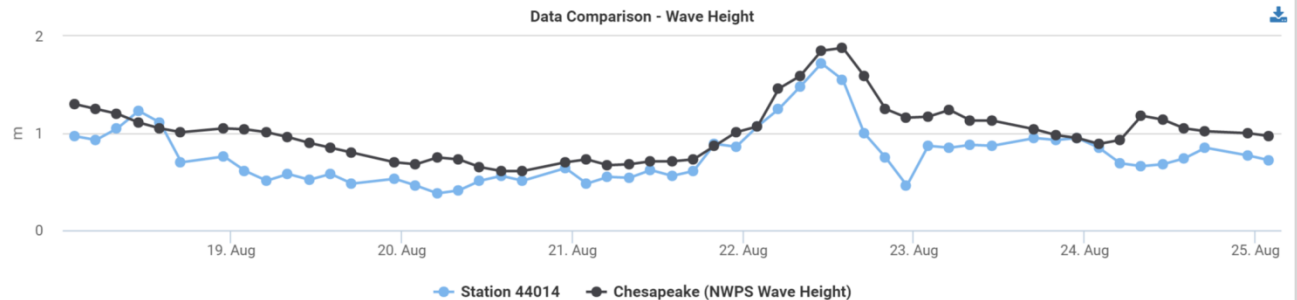
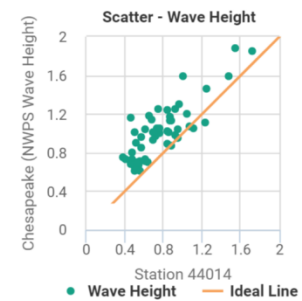
Wave Height

Station/Model

Station 44014

Chesapeake (NWPS Wave Height)

Error Statistics Table	
Bias (m)	0.231
Num Points	52
R2	0.689
RMS (m)	0.286
Scatter Index	0.218



Questions

***Enables decision making
Fosters Advances in Science and Technology***

<https://ioos.noaa.gov>

 <https://www.facebook.com/usioosgov>

 @usioosgov

