Image Credit: Pedro Matos-Llavona

2010-2015 ACCOMPLISHMENTS PART 2

SECOORA Regional Modeling Efforts

SECOORA
Southeast Coastal Ocean Observing Regional Association

IOOS
INTEGRATED OCEAN OBSERVING SYSTEM

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SECOORA Modeling Efforts

Lead PIs and teams:

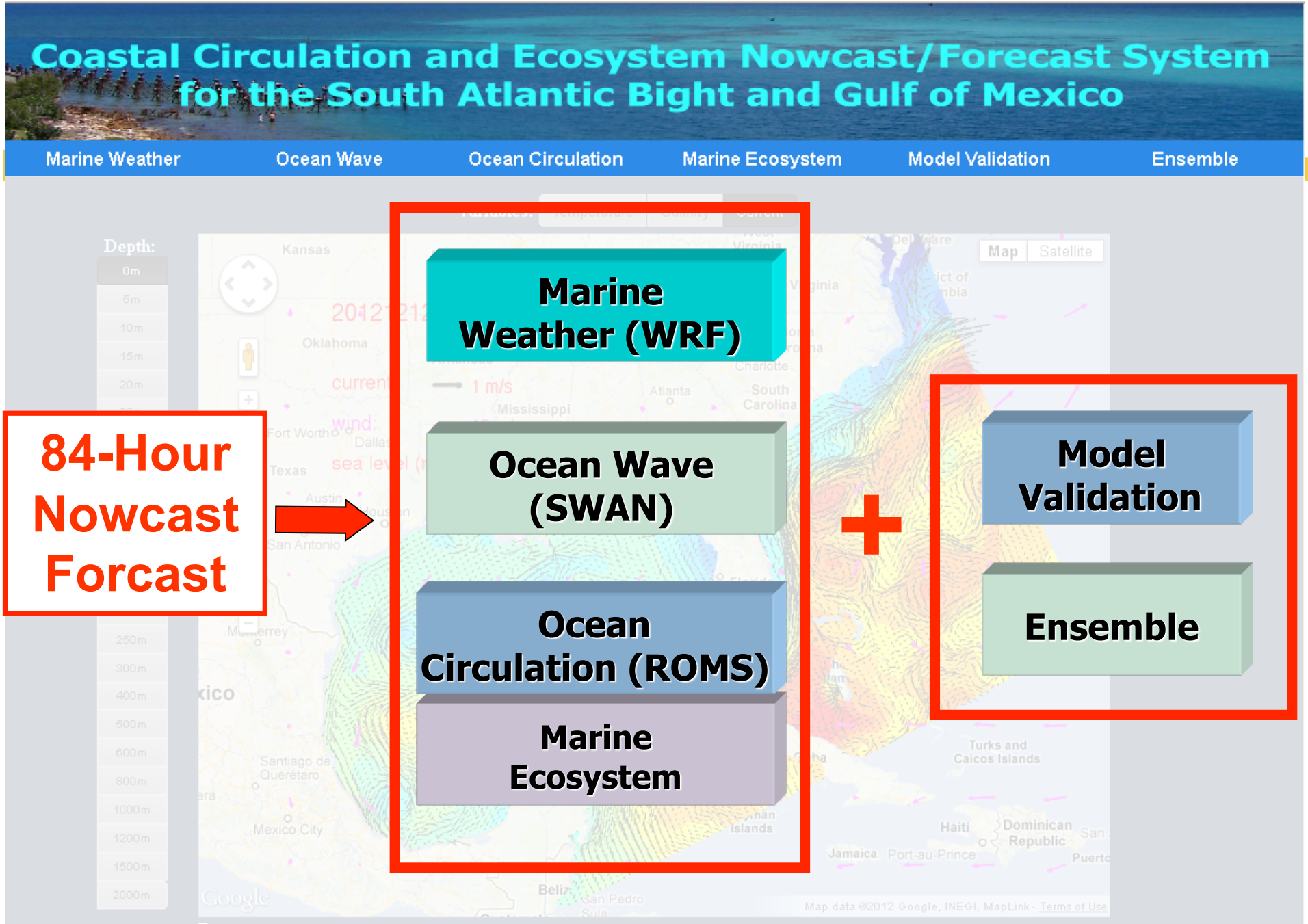
- Ruoying He (NCSU) - Regional Circulation Modeling
- Peter Sheng (UF) and Lian Xie (NCSU) - Storm surge Modeling
- Mitch Roffer (Roffs Inc.) - Fisheries Habitat Modeling
- Dwayne Porter (USC) - Beach Water Quality Modeling
- Filipe Fernandes - Model Skill Assessment

1. Regional ocean circulation modeling

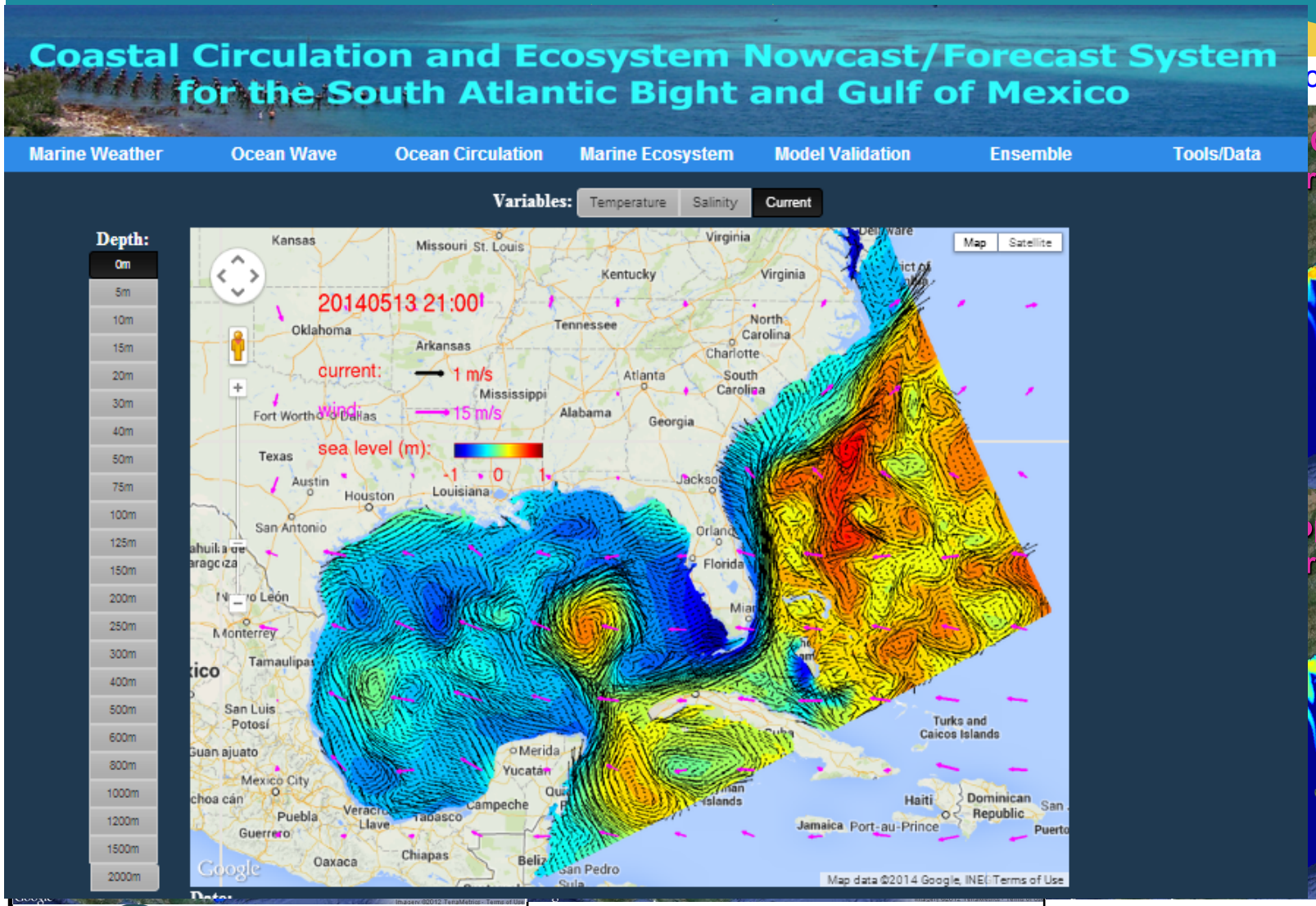
Ruoying He (NCSU)

Goals:

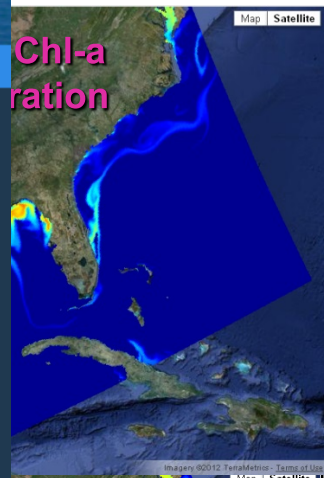
- To predict regional ocean state variables (sea level, currents, salinity, temperature, etc.)
- To Fill temporal and spatial gaps in observations
- To support all four of the SECOORA regional themes
  - Coastal hazard responses (e.g., oil spill, HAB, storms)
  - Safe and efficient marine operations
  - Water quality and marine resource management
  - Climate change (e.g., OA)


Coastal Circulation and Ecosystem Nowcast/Forecast System for the South Atlantic Bight and Gulf of Mexico
Marine Weather
Ocean Wave
Ocean Circulation
Marine Ecosystem
Model Validation
Ensemble
84-Hour Nowcast Forcast
Marine Weather (WRF)
Ocean Wave (SWAN)
Ocean Circulation (ROMS)
Marine Ecosystem
+
Model Validation
Ensemble

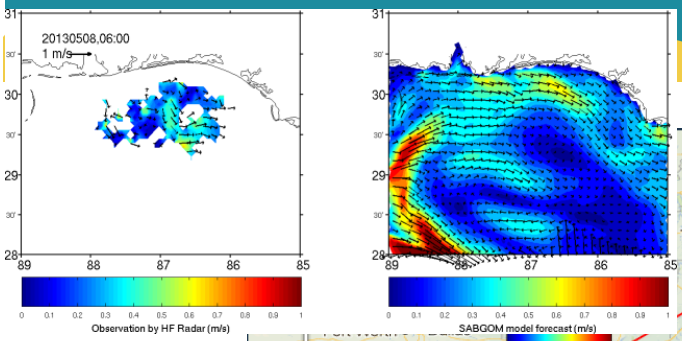
Daily Nowcast and Forecast of Marine Environmental Condition
http://omgsrv1.meas.ncsu.edu:8080/ocean-circulation/s

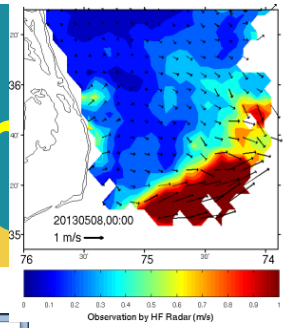


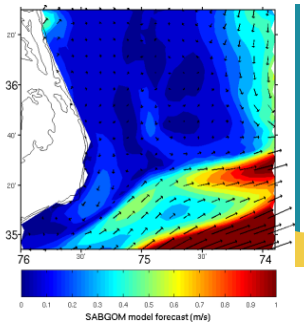
cosystem

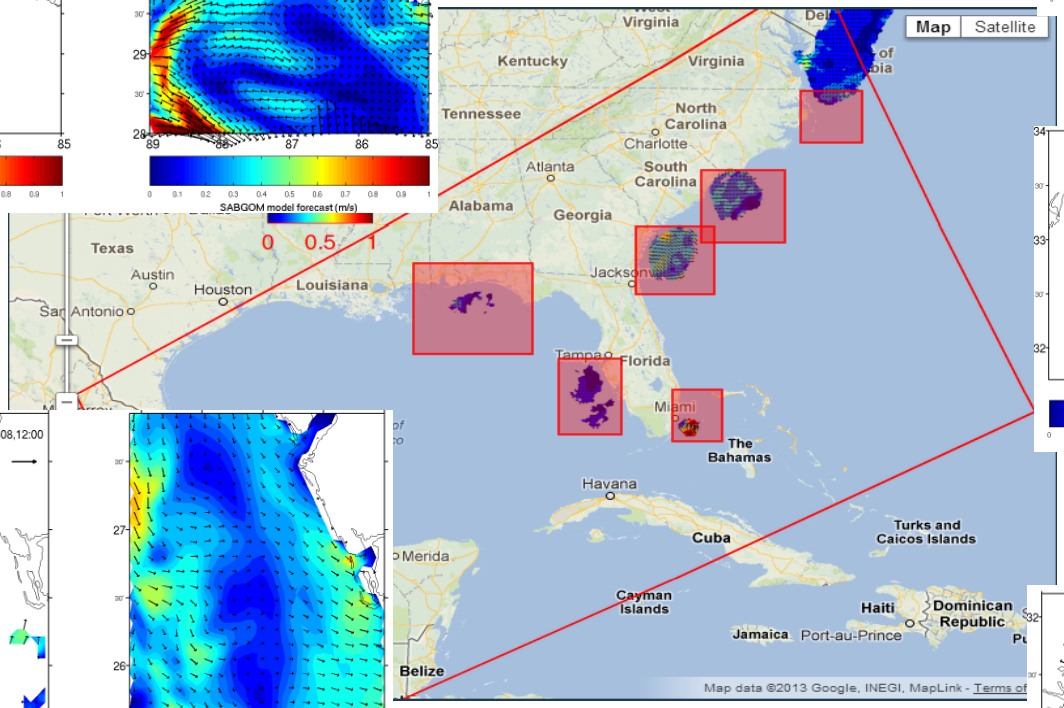


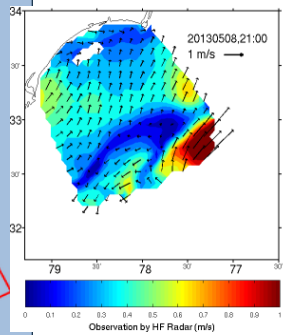
Model validation

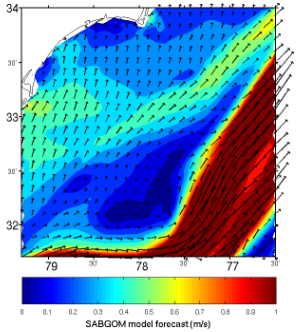


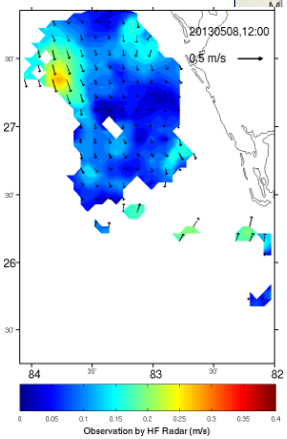


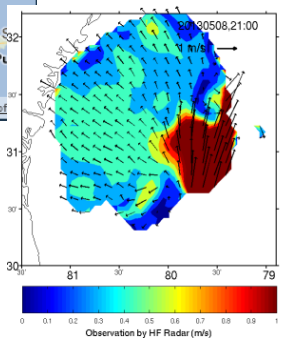


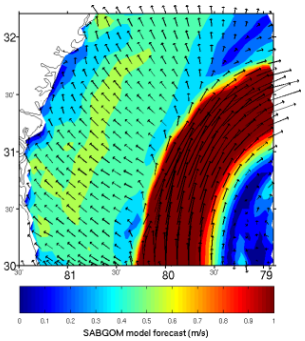


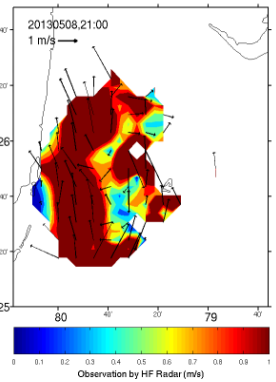


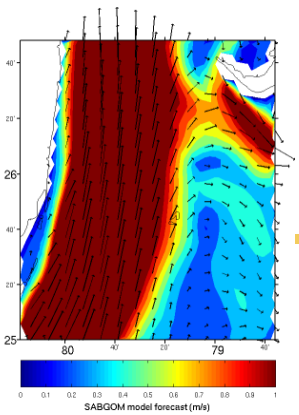












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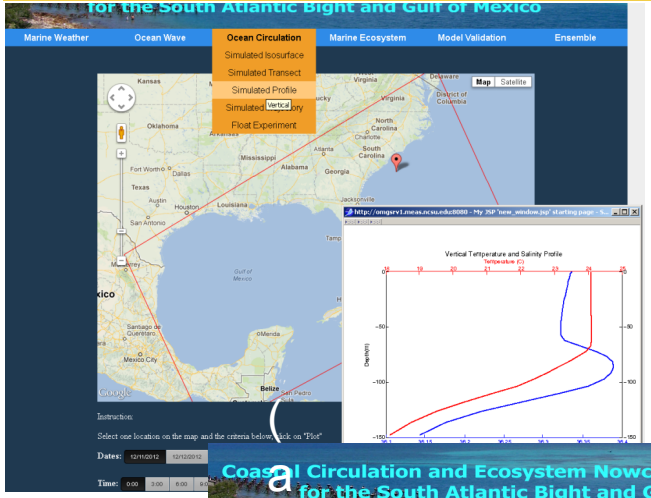
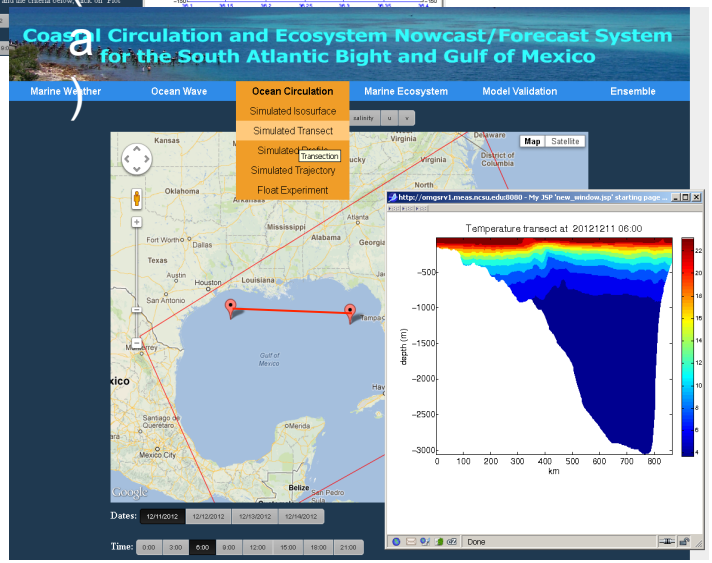
SABGOM nowcast/forecast System



a)



Online user-defined functions

a) virtual mooring profile (T/S/V)

b) virtual transect (T/S/V)

c) 84-hour virtual drifter trajectory

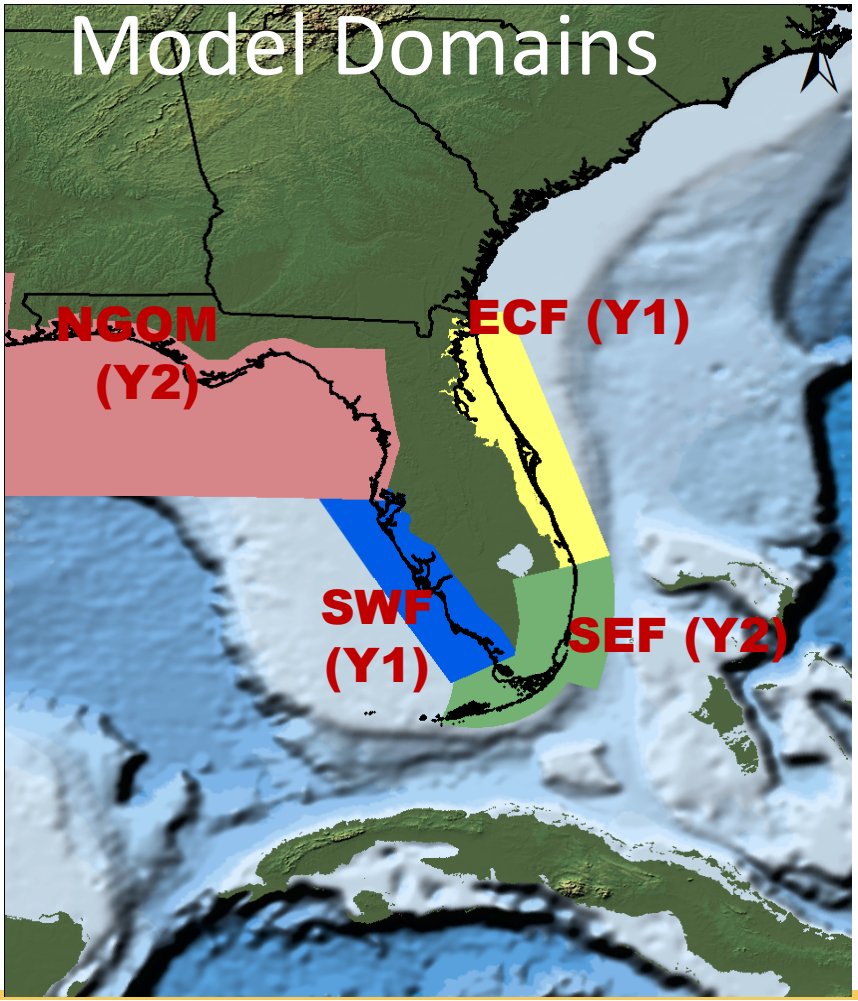
2. Real-time Forecasting with Advanced Coastal Modeling System

Peter Sheng (UF)

Goals:

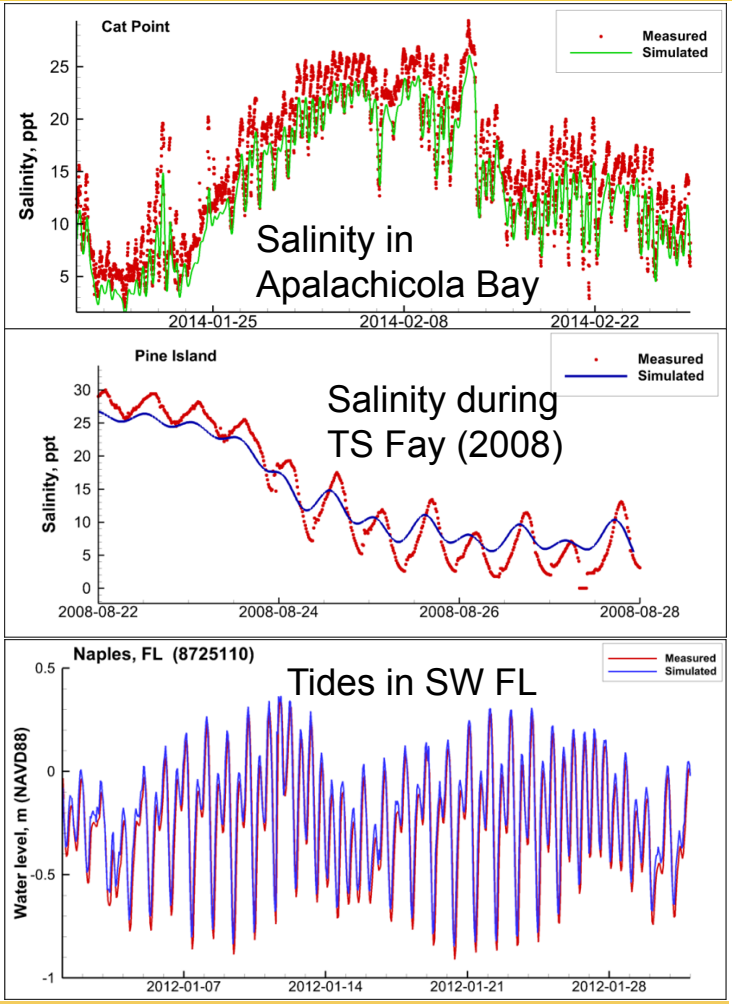
- To implement a high resolution, 24/7, computationally efficient inundation and storm surge forecasting system for the Florida coastal waters, comprising of four domains

- To assist decision making regarding regional surge/ inundation scenarios under time constraints



Real-time Forecasting with ACMS
Peter Sheng (UF)

- **Stakeholders / User engagement**
  - St. Johns River Water Management
  - GTM National Estuarine Research Reserve
  - NASA Kennedy Space Center
  - National Weather Service – JAX
  - NE Florida Regional Planning Council
  - U.S. Army Corps of Engineers JAX
  - U.S. Navy
  - Florida Dept. of Transportation
  - Water Resources Management
  - Emergency Management
  - Emergency Evacuation
  - Storm Surge Forecasting
  - Navigation and Security
  - Dredging Industry
  - Numerous Florida Counties



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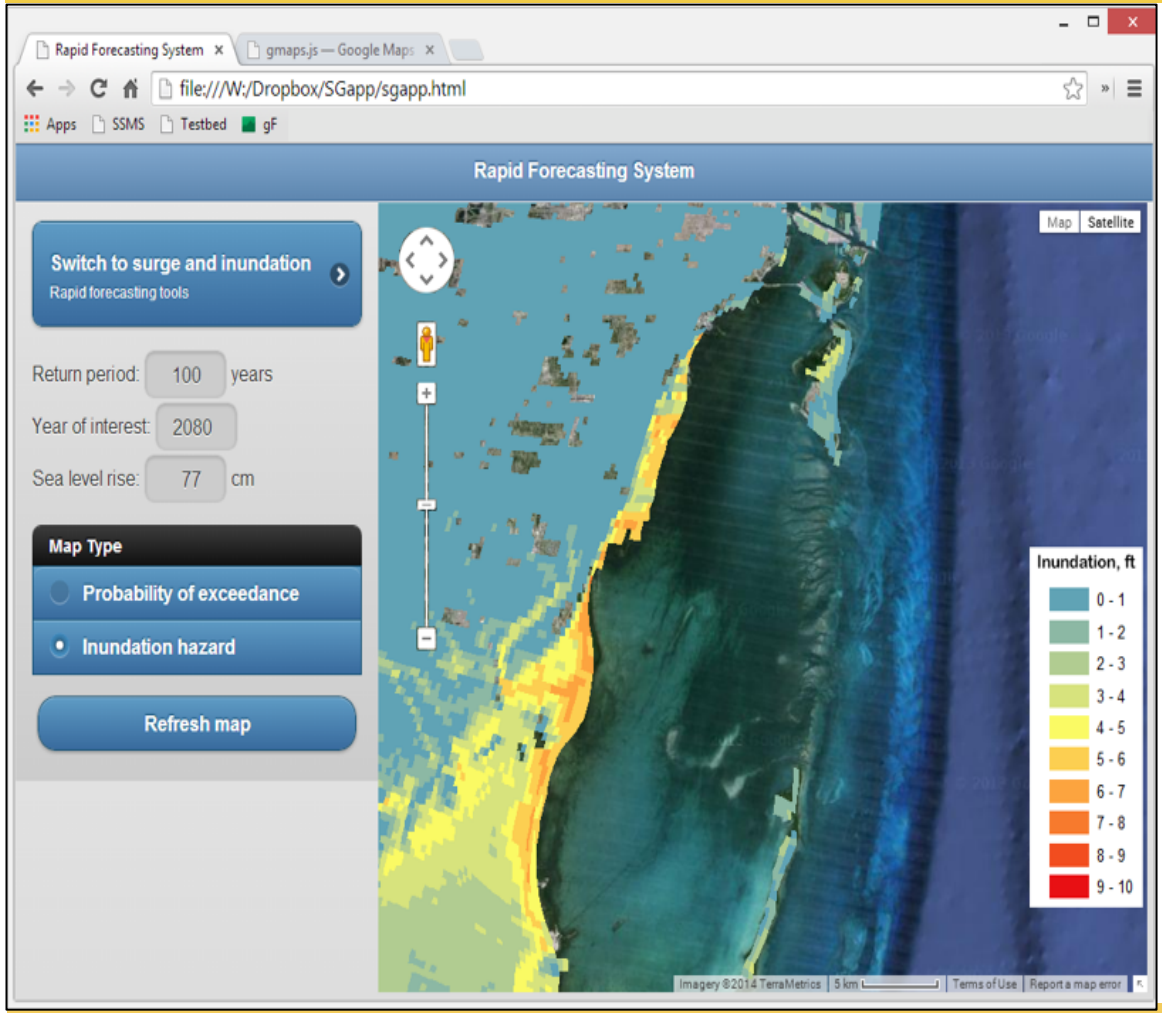
Rapid Forecasting System (RFS)

Peter Sheng (UF)

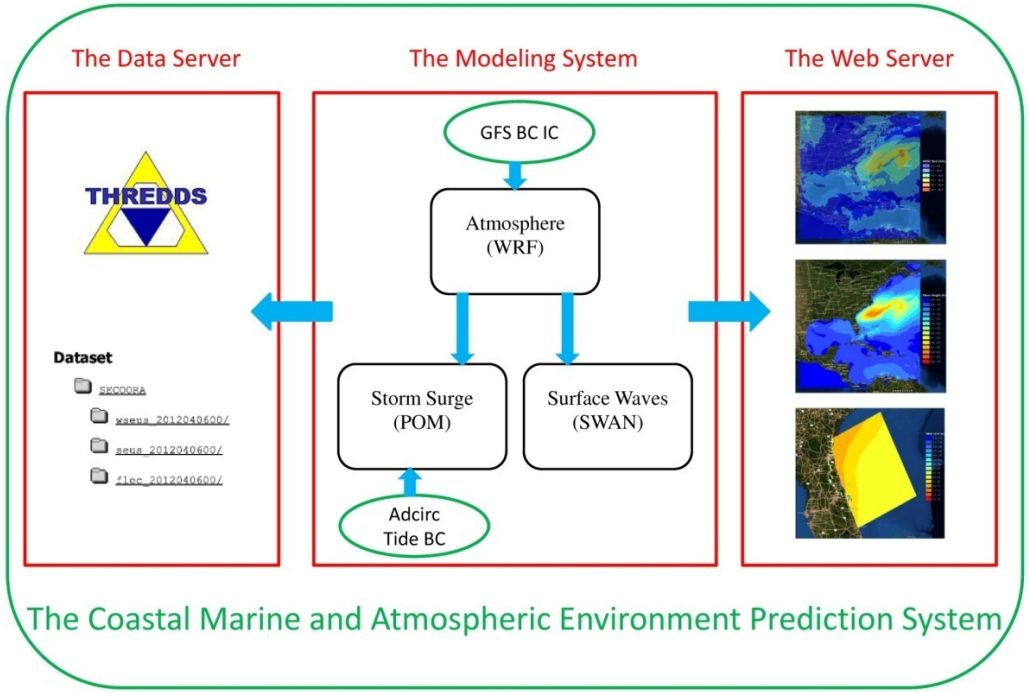


Rapid Forecasting System (RFS) for Southeast Florida:

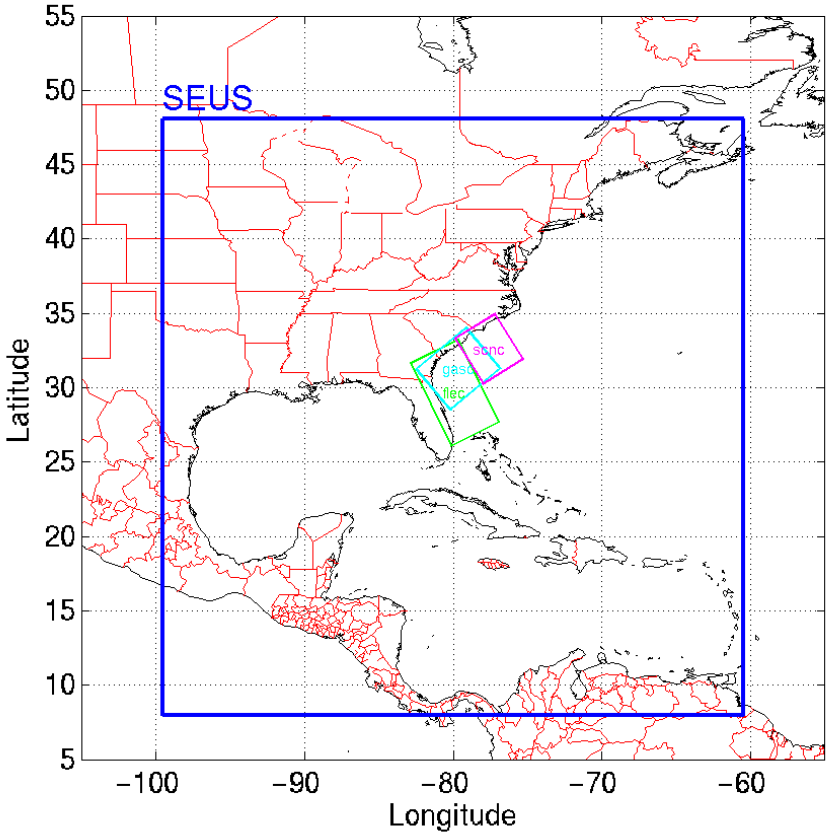
- Efficient forecast method applies a multidimensional interpolation technique to generate the surge responses for storms based on their landfall characteristics
- A Prototype tool being developed for Southeast Florida region that includes forecasting and planning features for both current and future climates

Coastal Marine and Atmospheric Environment Prediction

Lian Xie (NCSU)



Schematic of CMAEPS for SECOORA



CMAEPS model domains for SECOORA

http://cfdl.meas.ncsu/SECOORA/index.html

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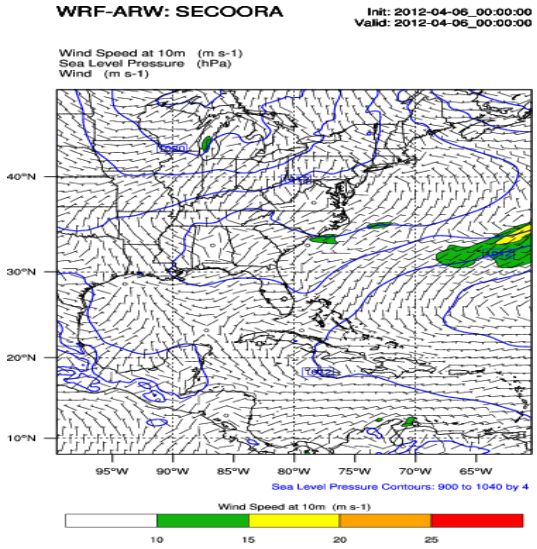
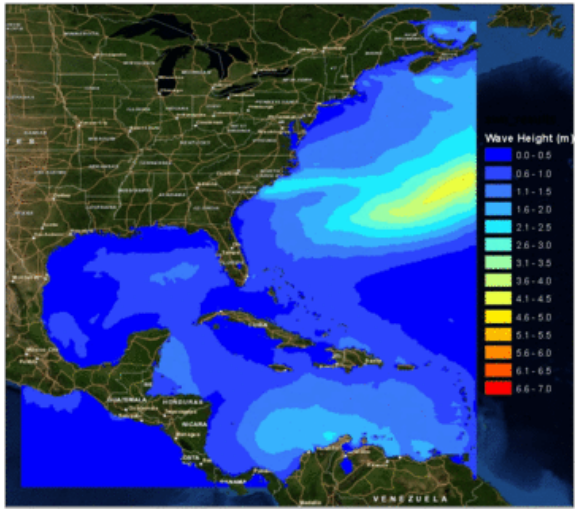
Example forecasts of CMAEPS on April 6, 2012
The passage of a cold front

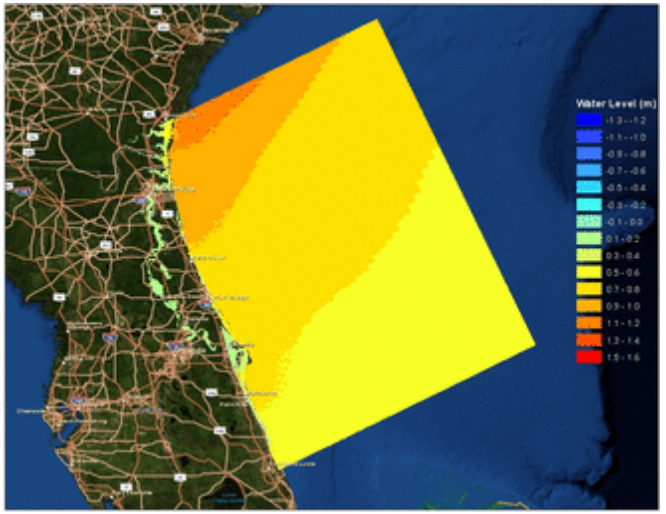
Wind

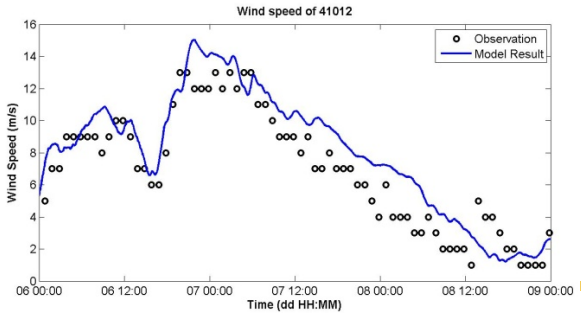


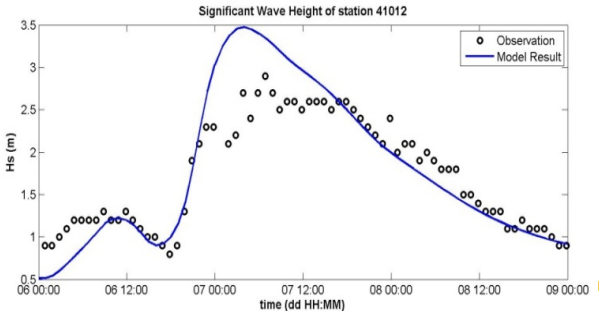
Wave height

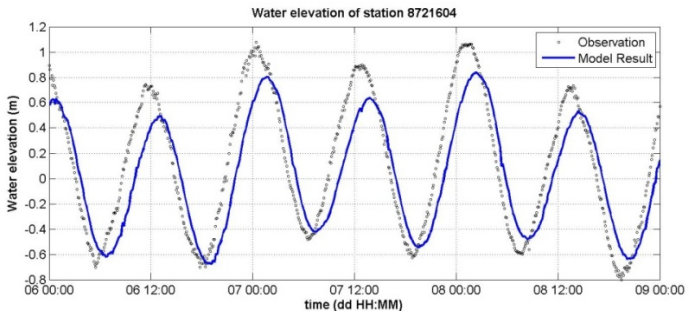


Water level









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3. Habitat Modeling and satellite data to support fisheries management

Developing Data Products Derived From Satellite And *In Situ* Observations For Fisheries Stock Assessment

- PI: Mitchell A. Roffer, Roffer's Ocean Fishing Forecasting Service, Inc. (ROFFS™) West Melbourne, FL
- Co-I: Barbara Muhling, University of Miami Cooperative Institute for Marine and Atmospheric Studies (CIMAS), Miami, FL
- Co-I: Roger Pugliese, South Atlantic Fishery Management Council (SAFMC), Charleston, SC
- Other I: Marcel Reichert, Tracey Smart, Joseph Ballenger, Marine Resources Monitoring, Assessment and Prediction, South Carolina Department of Natural Resources (SCDNR-MARMAP), Charleston, SC

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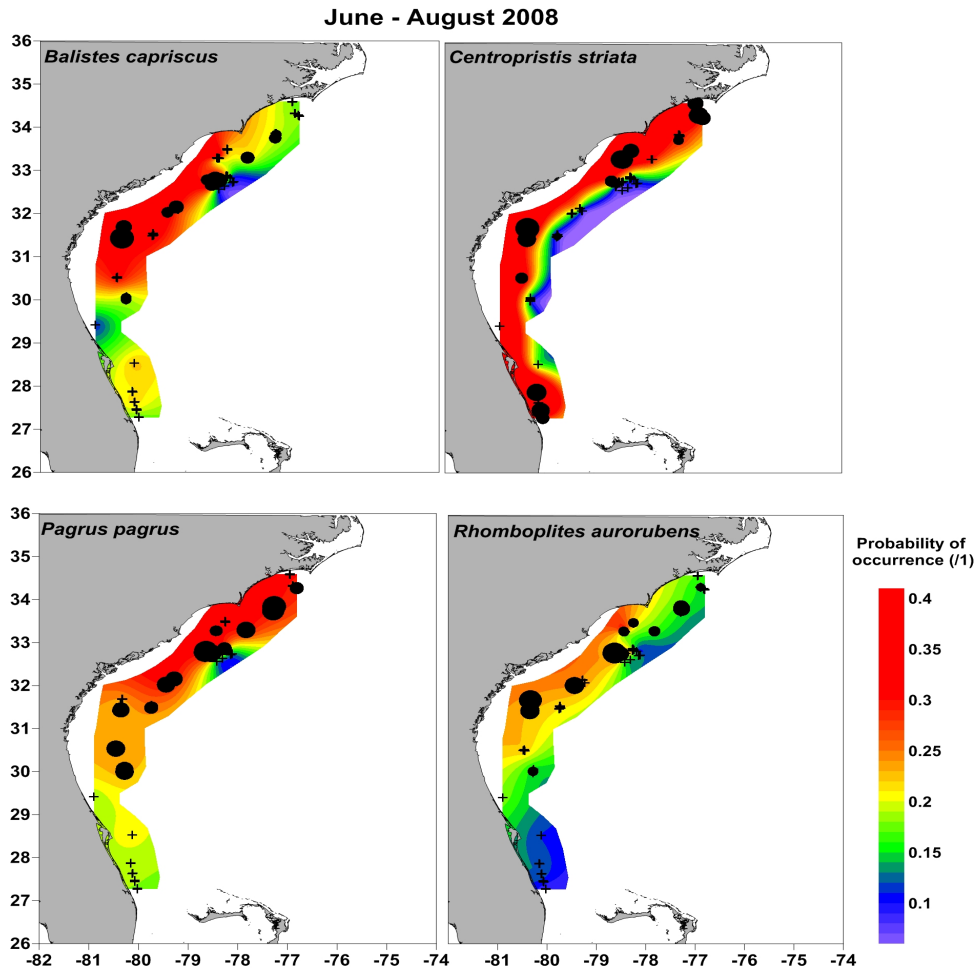
3. Habitat Modeling and satellite data to support fisheries management

Goal: Develop better fisheries management tools (models, stock assessment analyses) for managers and policy makers that incorporate real-time oceanographic observations.

Addresses: SECOORA theme area of "Ecosystem, Living Marine Resources and Water Quality"

Results: will 1) allow resource managers to derive more reliable estimate of the abundance and projections of fish stocks; 2) improve ecosystem based fishery management strategies for use across the SECOORA region.

3. Habitat Modeling and satellite data to support fisheries management

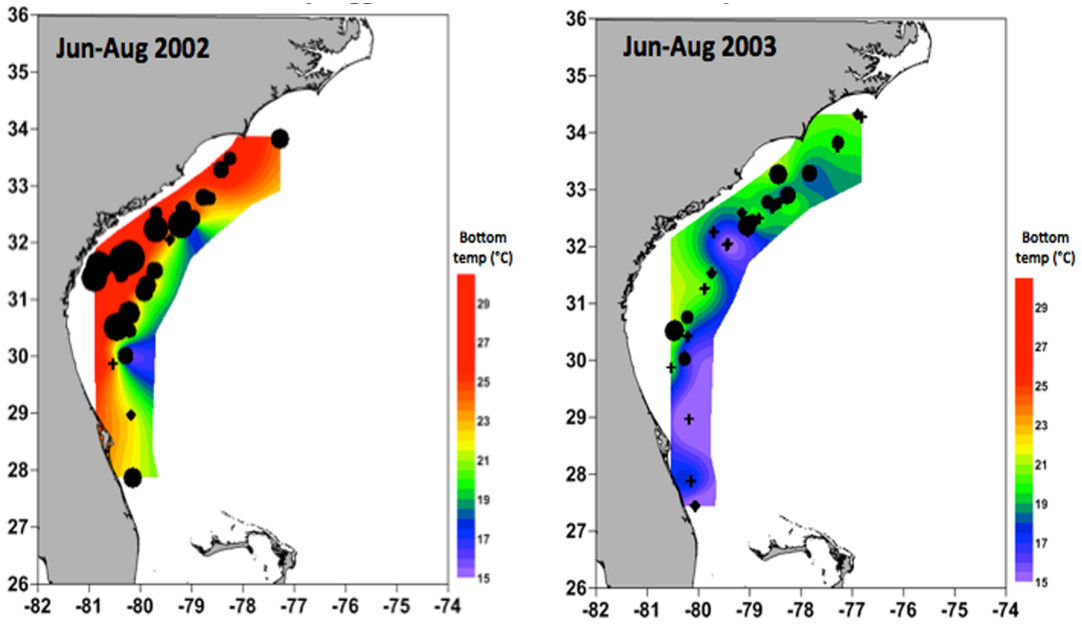


Results of the habitat modeling for the four species for the period June to August 2008.

Warmer colors represent higher probabilities of occurrence of species

The predictive models showed positive catches :
1) occur in shallower water, and,
2) are influenced by longitude and latitude, with higher catches at more north-eastern locations.

3. Habitat Modeling and satellite data to support fisheries management



Upwelling of cold water onto the continental shelf affects availability of fish catch, and potentially the derived stock indices.

Conclusion:

The occurrences of four target species were influenced by several interacting environmental and geographic variables

"Habitat covariate" is included and analyzed in the southeast Data Assessment and Review (SEDAR) plan

4. Beach Water Quality Modeling Activities

Dwayne Porter (USC), et al.

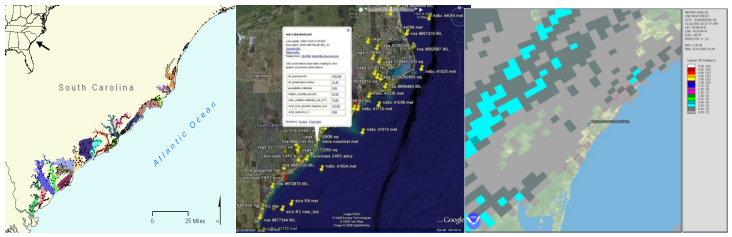
Issue: Exposure to beach swimming waters with elevated bacterial levels is a public health concern and one of economic vitality.

Goal: Working with stakeholders, develop and implement scientifically-justified, decision-support tools for accurate and defensible preemptive advisory issuance decisions.

Process:

1.) Data integration and fusion

Field programs *Obs. systems* *RS / models*

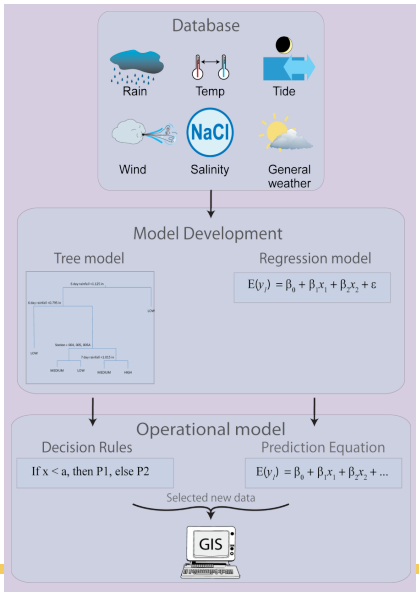


- *Bacteria density*
- *Salinity*
- *Air/water temp*
- *Tide*
- *Weather*
- *Counts*

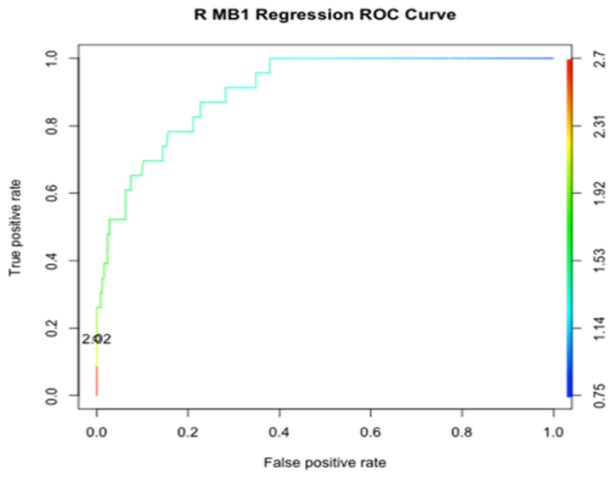
- *Salinity*
- *Air/water temp*
- *Rainfall*
- *Currents*
- *Wave activity*
- *Wind*

- *Rainfall*
- *Currents*
- *Salinity*
- *Wind*

2.) Model development



3.) Model validation



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4. Beach Water Quality Modeling Activities

Dwayne Porter (USC), et al.

Process (continued):

4.) Operational decision-support tools

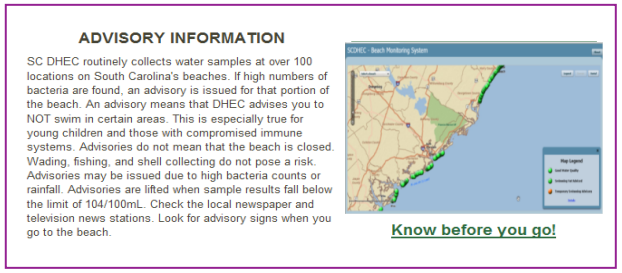
--------- Forwarded message ---------
Date: Wed, May 13, 2015 at 6:01 AM
Subject: [DHEC] Water Quality Prediction Results - 2015-05-13

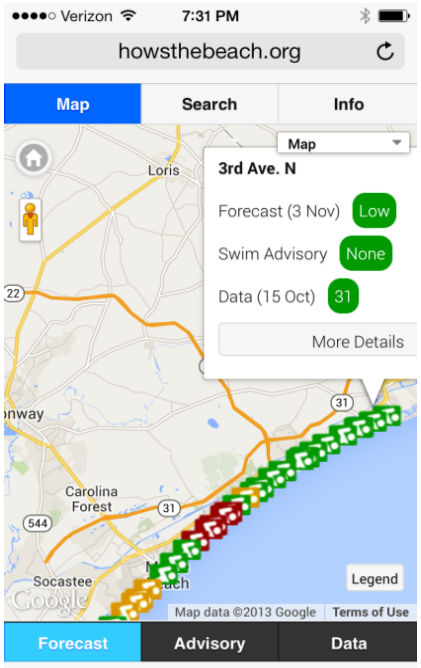
Predictions for Date: 2015-05-13
Test Execution Date: 2015-05-13 06:01

-------MB1--------

Station: WAC-012
Overall Prediction: MEDIUM
Station: WAC-013
Overall Prediction: MEDIUM
Station: WAC-014
Overall Prediction: MEDIUM
Station: WAC-015
Overall Prediction: MEDIUM
Station: WAC-015A
Overall Prediction: HIGH
Station: WAC-016
Overall Prediction: MEDIUM

Data used for station tests:
SUN2 Salinity(PSU): 32.240000
NOS 8661070 Water Level(m): 0.797404
Intercept: -0.661880
Radar Rain Summary Past 144hrs: 3.235007
Lowest Tide(Ft): 0.144000
Radar Rain Summary Past 48hrs: 2.712377





End result is a decision-support tool available at your fingertips for public health, economic and personal decision making.

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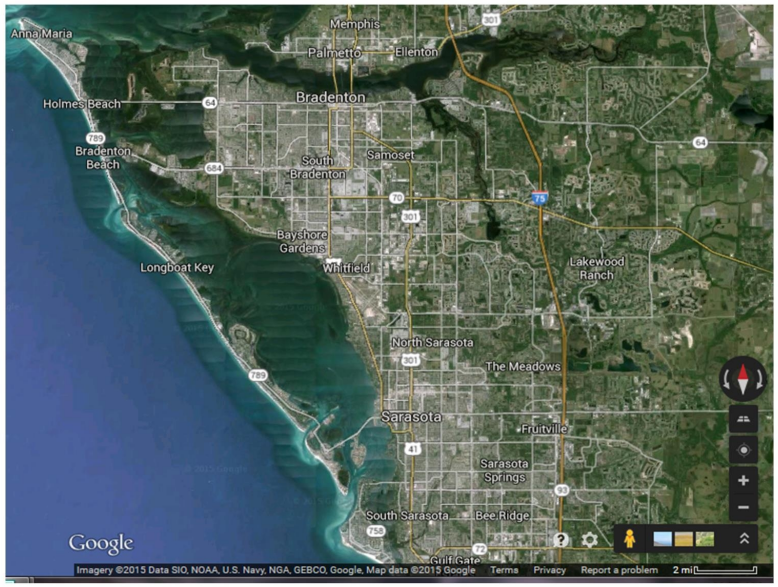
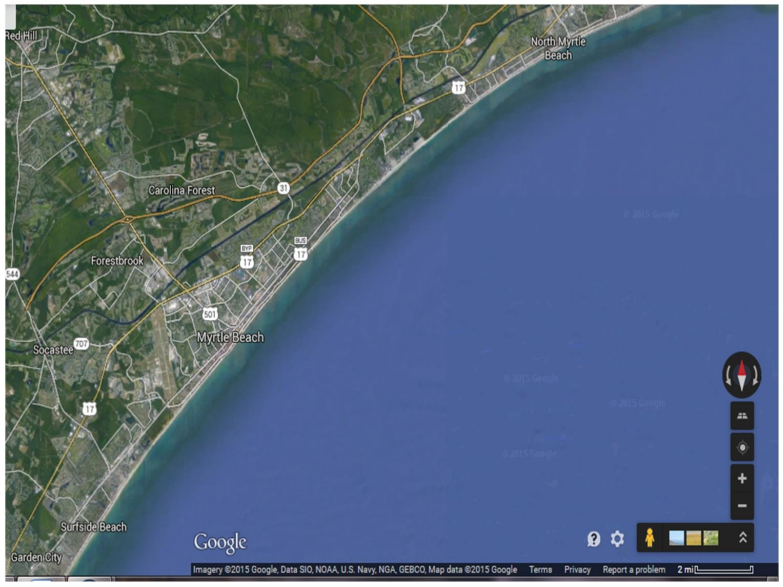
4. Beach Water Quality Modeling Activities

Dwayne Porter (USC), et al.

Who is doing it: A growing partnership of stakeholders including beach managers, tourism interests, public health officials and the general public.



Sarasota region of FL



Long Bay region of SC

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5. Model Skill assessment
Filipe Fernandes

Goals:

- develop a quick/easy and automated model-observation online comparison tool
- help visualize various SECOORA modeling results and compare them with observations from SECOORA/NODC/NDBC
- Identify issues in observations and models

5. Model Skill assessment

Filipe Fernandes

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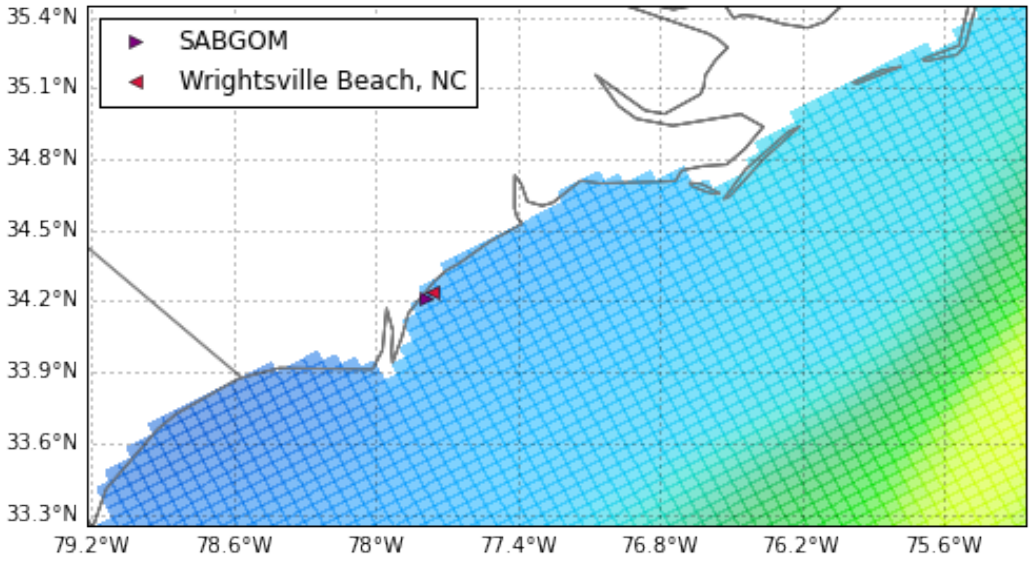
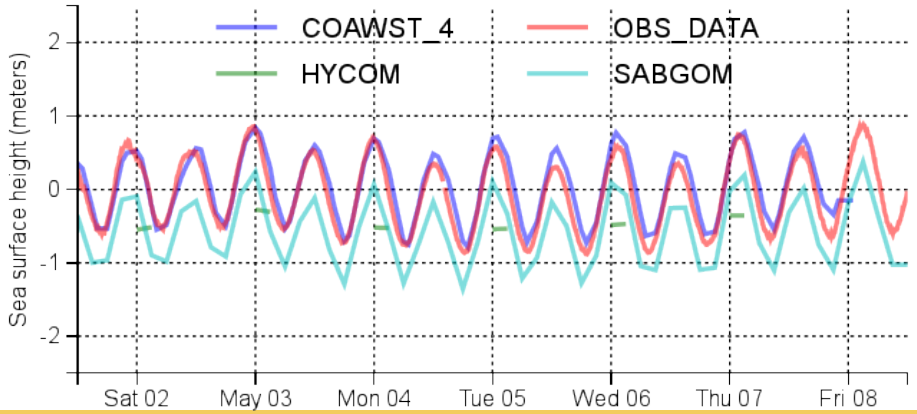
5. Model Skill assessment
Filipe Fernandes



- Find model-observation with 4 km radius
- Interpolate to 30 min time-series
- Compare the model elevation to NAVD88 datum (Bias)
- Calculate Pearson correlation (Skill)
- Reject when there is not enough data to compare (HYCOM time resolution is too low)

	COAWST4	HYCOM	SABGOM
Bias	0.09	-0.39	-0.51
Skill	0.95	NA	0.98



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Summary

What do we have now?

SECOORA modeling projects are advancing IOOS goals and helping stakeholders

- ocean state variables
- storm surge and inundation
- fish stock assessment
- beach water quality

What and where are the needs?

- Couplings of physics, biology, and geochemistry (fishery, water quality, OA)
- Linking observations with models (via data assimilations) in real-time
- More engagement with stake holders to develop value added products