2010-2015 ACCOMPLISHMENTS PART 2

SECOORA Regional Modeling Efforts

Image Credit: Pedro Matos-Llavona
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 (WRF)

Ocean Wave (SWAN)

Ocean Circulation (ROMS)

Marine Ecosystem

Model Validation

Ensemble

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

Coastal Circulation and Ecosystem Nowcast/Forecast System for the South Atlantic Bight and Gulf of Mexico

Variables: Temperature, Salinity, Current

Depth:
- On
- 5m
- 10m
- 15m
- 20m
- 30m
- 50m
- 100m
- 200m
- 300m
- 500m
- 1000m
- 2000m
- 3000m
- 5000m

Map data ©2014 Google, INE Terms of Use
Model validation

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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
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

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

CMAEPS model domains for SECOORA

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

Wind
Wave height
Water level
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
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.

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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
   - Rainfall
   - Currents
   - Salinity
   - Wave activity
   - Wind

2.) Model development
   - Database
   - Rain
   - Temp
   - Tide
   - Salinity
   - Wind
   - Wave activity
   - Operational model
   - Decision Rules
   - Regression model
   - Equation

3.) Model validation
   - GIS
   - ROC Curve
   - Selected sea data

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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, Mar 13, 2013 at 6:01 AM
Subject: [CEPC] Water Quality Prediction Results - 2013-05-13

Predictions for Date: 2013-05-13
Test Execution Date: 2013-05-13 05:01

--- Mail ---
Status: WAC-012
Overall Prediction: MEDIUM
Status: WAC-013
Overall Prediction: MEDIUM
Status: WAC-014
Overall Prediction: MEDIUM
Status: WAC-015
Overall Prediction: MEDIUM
Status: WAC-016
Overall Prediction: MEDIUM

Data used for station tests:
SUNZ Safety[SI]b: 32.240000
HCO3: 68.692000 Water Level[ml]: 0.797454
Inc爱吃: 0.861980
NMLR Daily Summary Past 16hrs: 3.230007
LWMTF [T]: 0.144000
RMDR Daily Summary Past 48hrs: 2.713777

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

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<td>0.95</td>
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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 stakeholders to develop value added products