A Coupled Ocean Circulation, Wave, Atmosphere and Marine Ecosystem Prediction System for the Northwest Atlantic Coastal Ocean

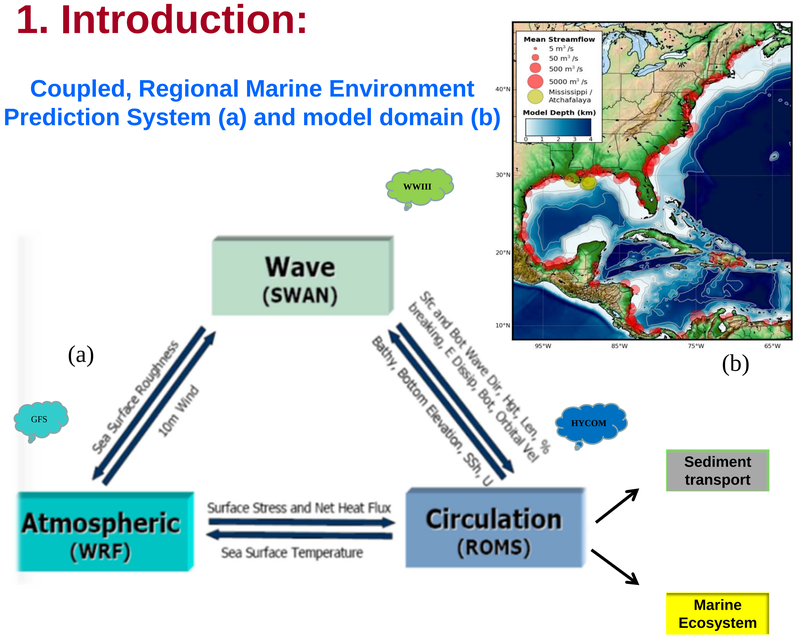
Ruoying He*, Joseph Zambon, Zhigang Yao, Austin Todd

North Carolina State University (*Email: rhe@ncsu.edu)

Abstract: A 3-dimensional marine environmental prediction system has been constructed and is running quasi-operationally for the Northwest Atlantic Coastal Ocean. This fully coupled modeling accounts for the interactions among Ocean, Atmosphere, Wave, Sediment Transport and the low-trophic marine ecosystem. It is driven by realistic meteorological boundary forcing, tides, river, and deep-ocean boundary conditions provided by data assimilative global models. Model output from this prediction system, including marine weather, ocean wave, ocean circulation and marine ecosystem variable are generated daily and available for public access. The construction of this prediction system, functionalities, and case studies on air-sea interactions during major storms and regional biophysical connectivity are provided.

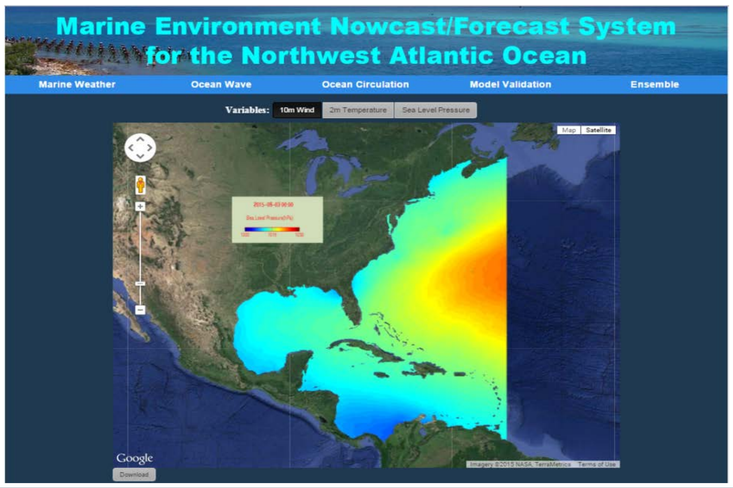
1. Introduction:

Coupled, Regional Marine Environment Prediction System (a) and model domain (b)

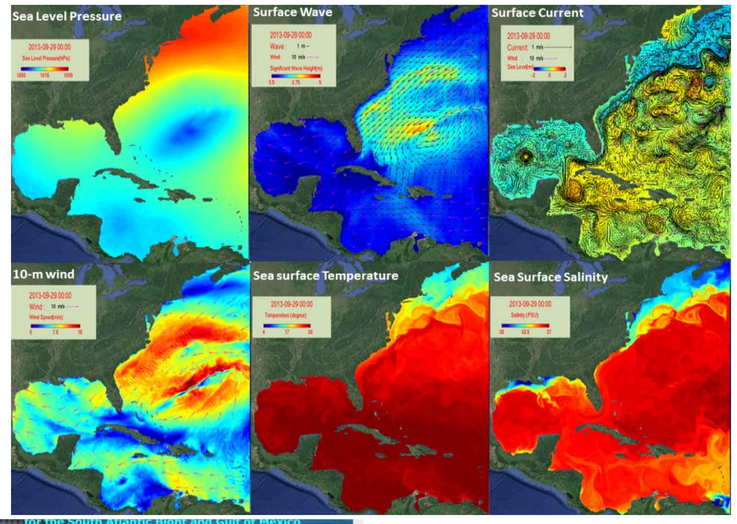


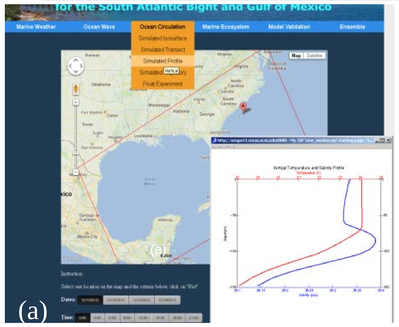
2. System Product

Website: http://omgsrv1.meas.ncsu.edu:8080/ocean-circulation2



Daily concurrent ocean , atmosphere and wave predictions



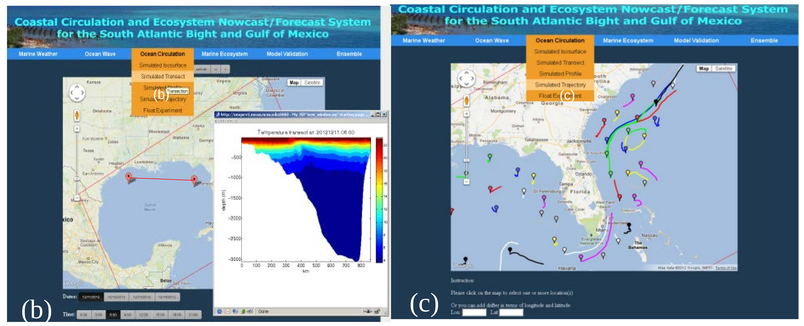


Online user-defined functionalities

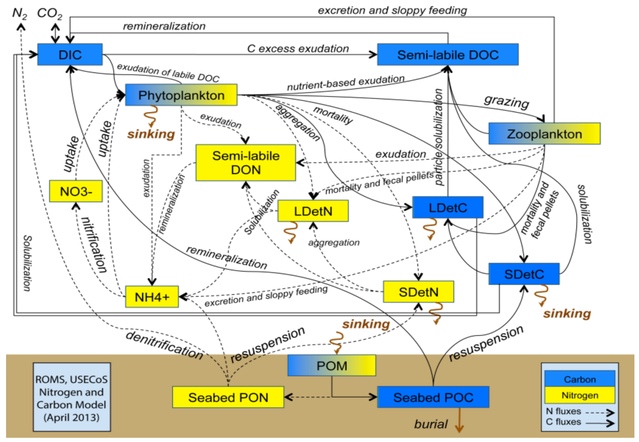
a) Virtual mooring profile

b) Virtual transect

c) 84-hour virtual drifter trajectory

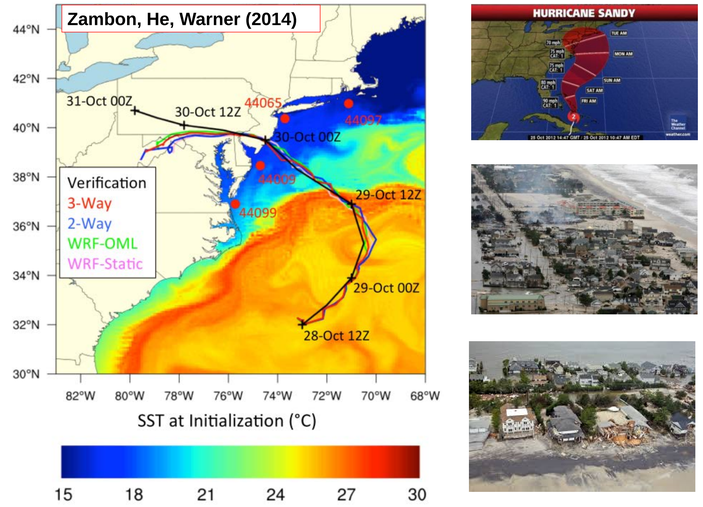


The system is also coupled with a primary production marine ecosystem model that embeds nitrogen and carbon cycling

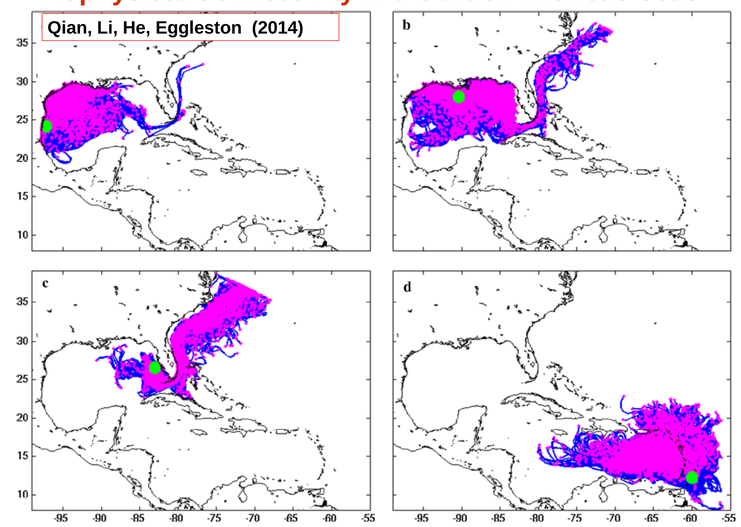


3. Scientific Applications (Examples)

- **Air-sea interaction during Hurricane Sandy**



- **Biophysical Connectivity in the Intra-Americas Seas**



4. Related Publications

Xue, Z., J. Zambon, Z. Yao, Y. Liu, and **R. He** (2015) An integrated ocean circulation, wave, atmosphere, and marine ecosystem prediction system for the South Atlantic Bight and Gulf of Mexico, *Journal of Operational Oceanography*, doi:10.1080/1755876X.2015.1014667.

Qian, H., Y. Li, R. He, and D. B. Eggleston (2014) Connectivity in the Intra-American Seas and implications for potential larval transport,*Coral Reefs*, doi:10.1007/s00338-014-1244-0.

Zambon, J. B., R. He, and J. C. Warner (2014) Investigation of Hurricane Ivan using the Coupled Ocean-Atmosphere-Wave-Sediment Transport (COAWST) Model, *Ocean Dynamics*, 64(11), pp. 1535-1554, doi:10.1007/s10236-014-0777-7.

Nelson, J., R. He, J. C. Warner, and J. Bane. (2014) Air-sea interactions during strong winter extratropical storms, *Ocean Dynamics*, doi:10.1007/s10236-014-0745-2.

Zambon, J. B., R. He, and J. C. Warner (2014) Tropical to extratropical: Marine environmental changes associated with Superstorm Sandy prior to its landfall, *Geophysical Research Letters,* doi:10.1002/ 2014GL061357

Xue, Z., R. He, K. Fennel, W. J. Cai, S. Lohrenz, and C. Hopkinson (2013), Modeling ocean circulation and biogeochemical variability in the Gulf of Mexico, *Biogeosciences*, 10, 7219-7234, doi: 10.5194/bg-10-7219-2013.

Nelson, J. and R. He, (2012), Effect of the Gulf Stream on winter extratropical cyclone outbreaks, *Atmosphere Research Letters*, doi: 10.1002/asl.400.