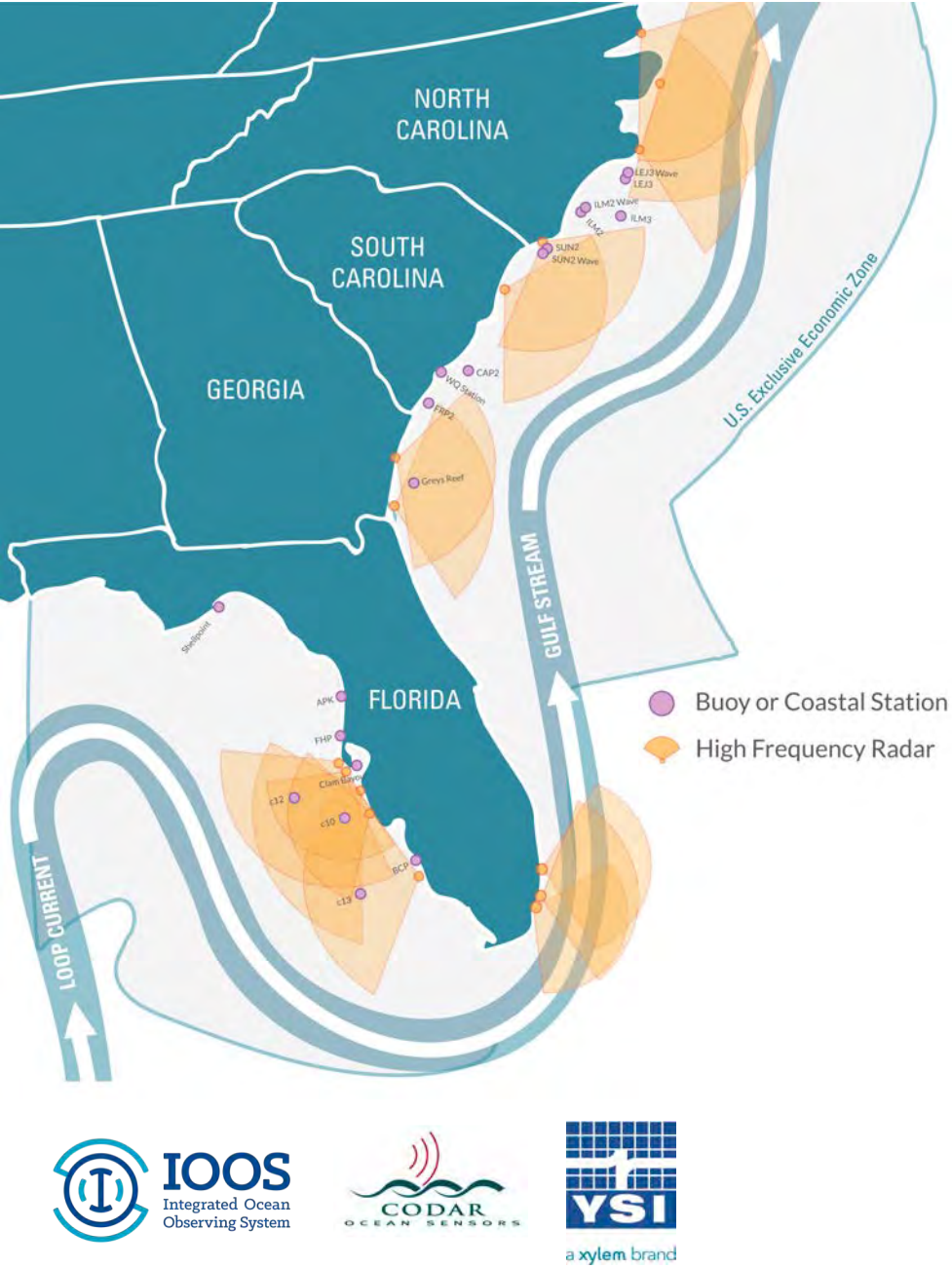


SECOORA
Southeast Coastal Ocean Observing Regional Association

A Coupled Marine Environmental Assessment and Prediction System for the Southeastern U.S. Coastal Ocean in Support of Effective Marine Ecosystem-Based Management, Efficient Marine Operations, and Resilient Coastal Communities

Ruoying He

Ocean Observating and Modeling Group (OOMG)

North Carolina State University

IOOS Integrated Ocean Observing System

CODAR OCEAN SENSORS

YSI a xylem brand

Objective and Approach

Objective

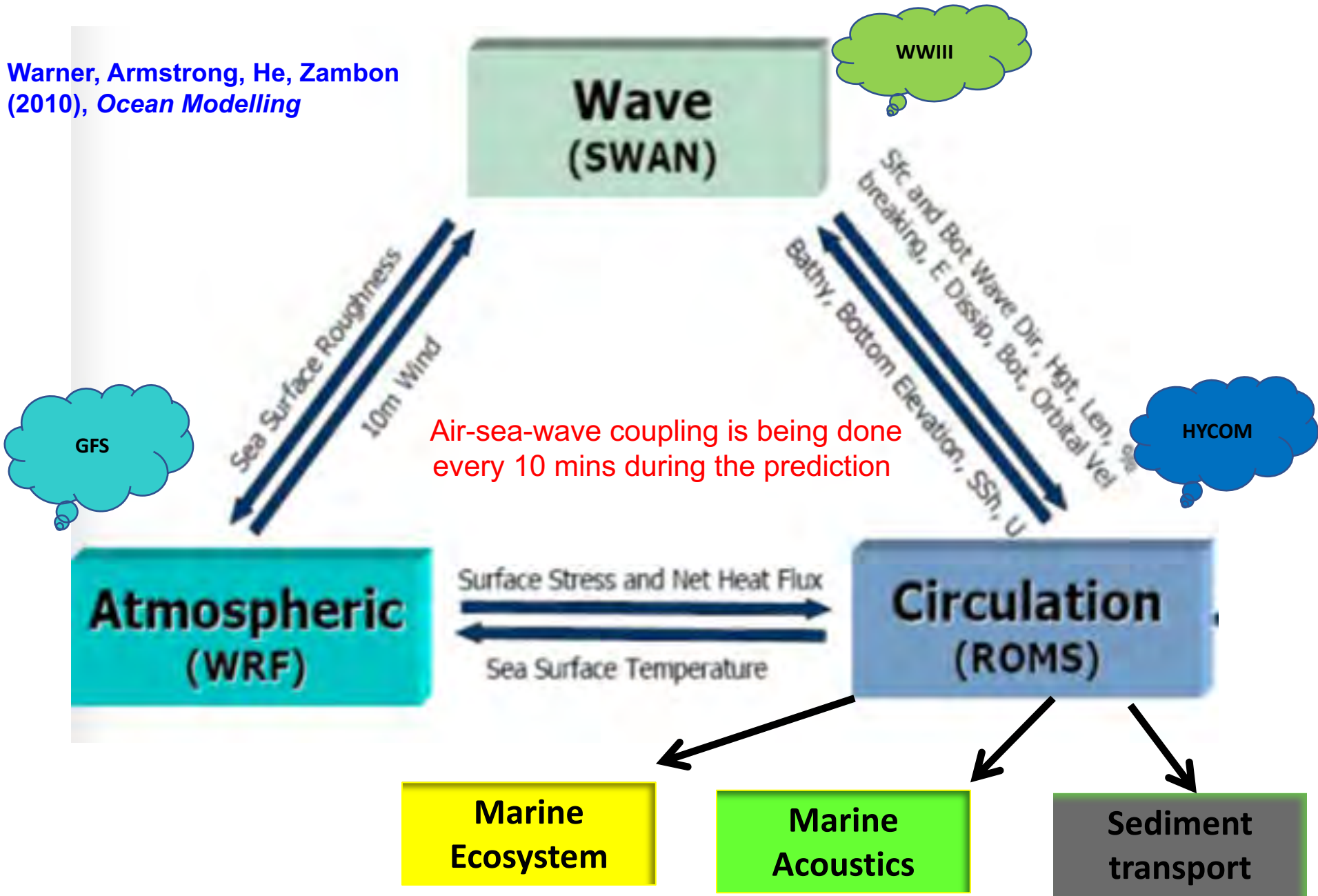
- Developing an advanced regional marine environment assessment and prediction capability
- Contributing to the effort of building a regional ocean observatory
- Providing marine environment hindcast, nowcast, forecast to support research and operations in climate change, coastal hazards, safe and efficient marine operations, water quality and living marine resource management

Approach

- Implement, operate, and refine a fully coupled ocean-atmosphere-wave-marine ecosystem prediction modeling system
- Operate the system to predict coastal ocean conditions over the entire SECOORA footprint with a high degree of scientific accuracy, and update and transmit such information to stakeholders in a timely fashion.
- inform and update the system continuously through data assimilation.

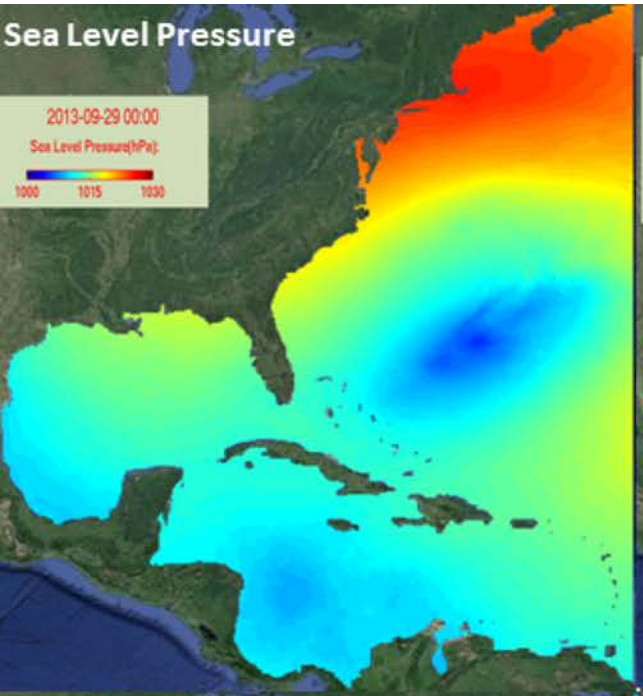
Fully Coupled Marine Environment Modeling System

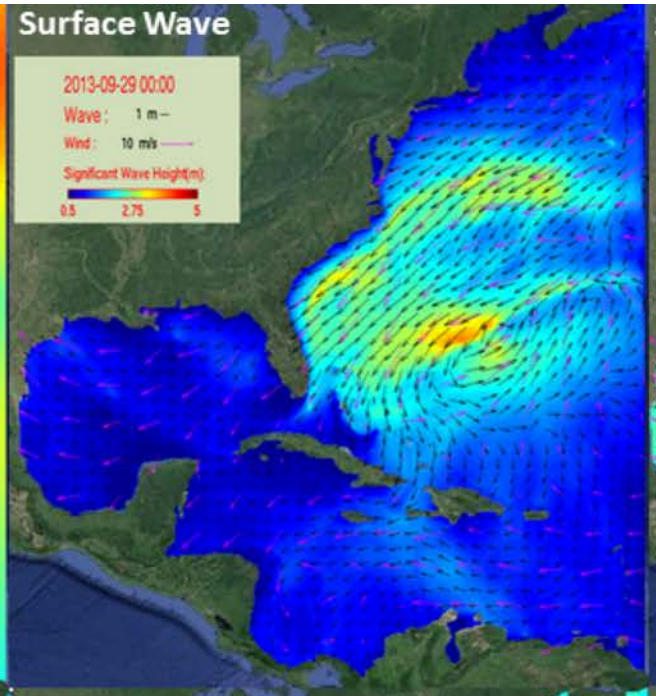
Warner, Armstrong, He, Zambon (2010), *Ocean Modelling*

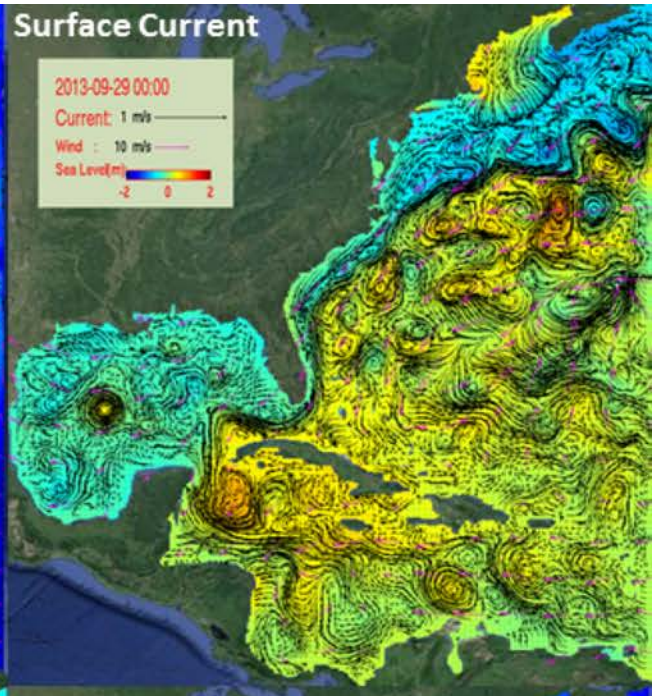


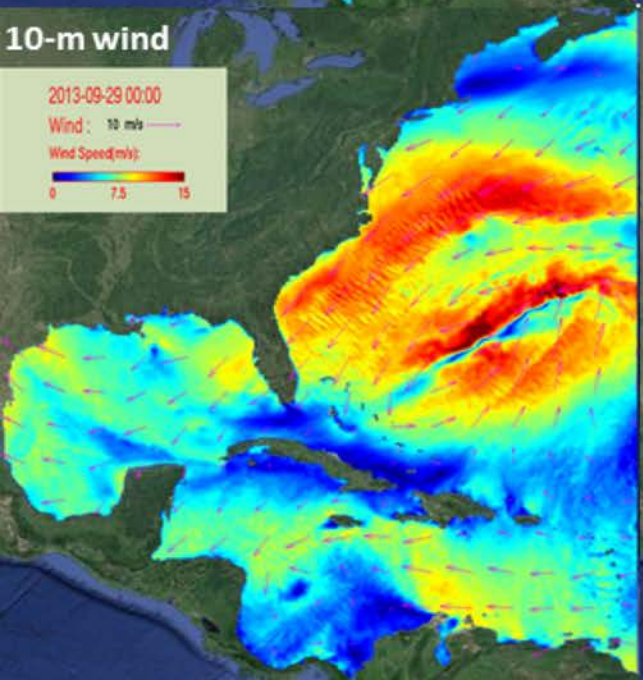
NC STATE UNIVERSITY

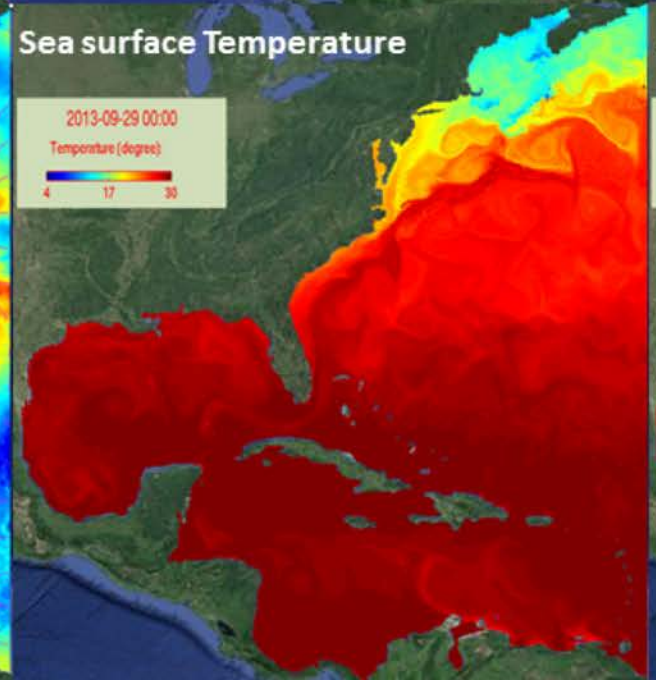
Coupled NW Atlantic Prediction System: http://go.ncsu.edu/CNAPS

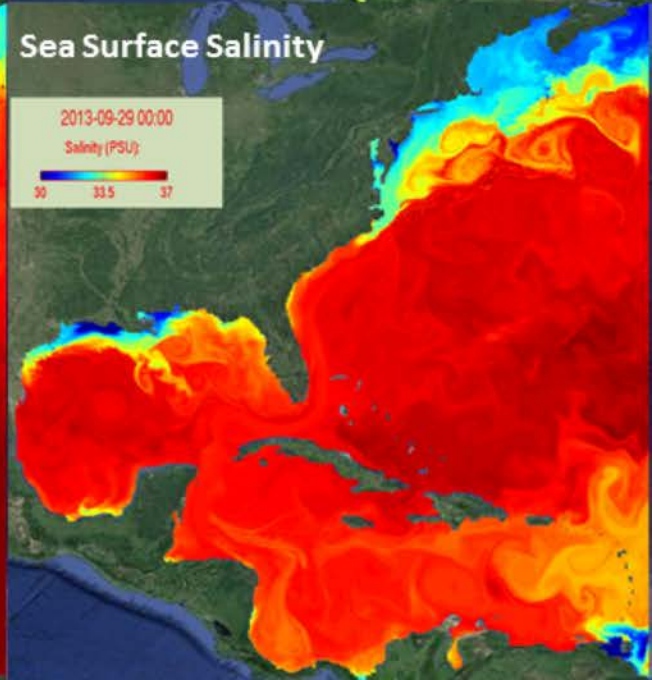




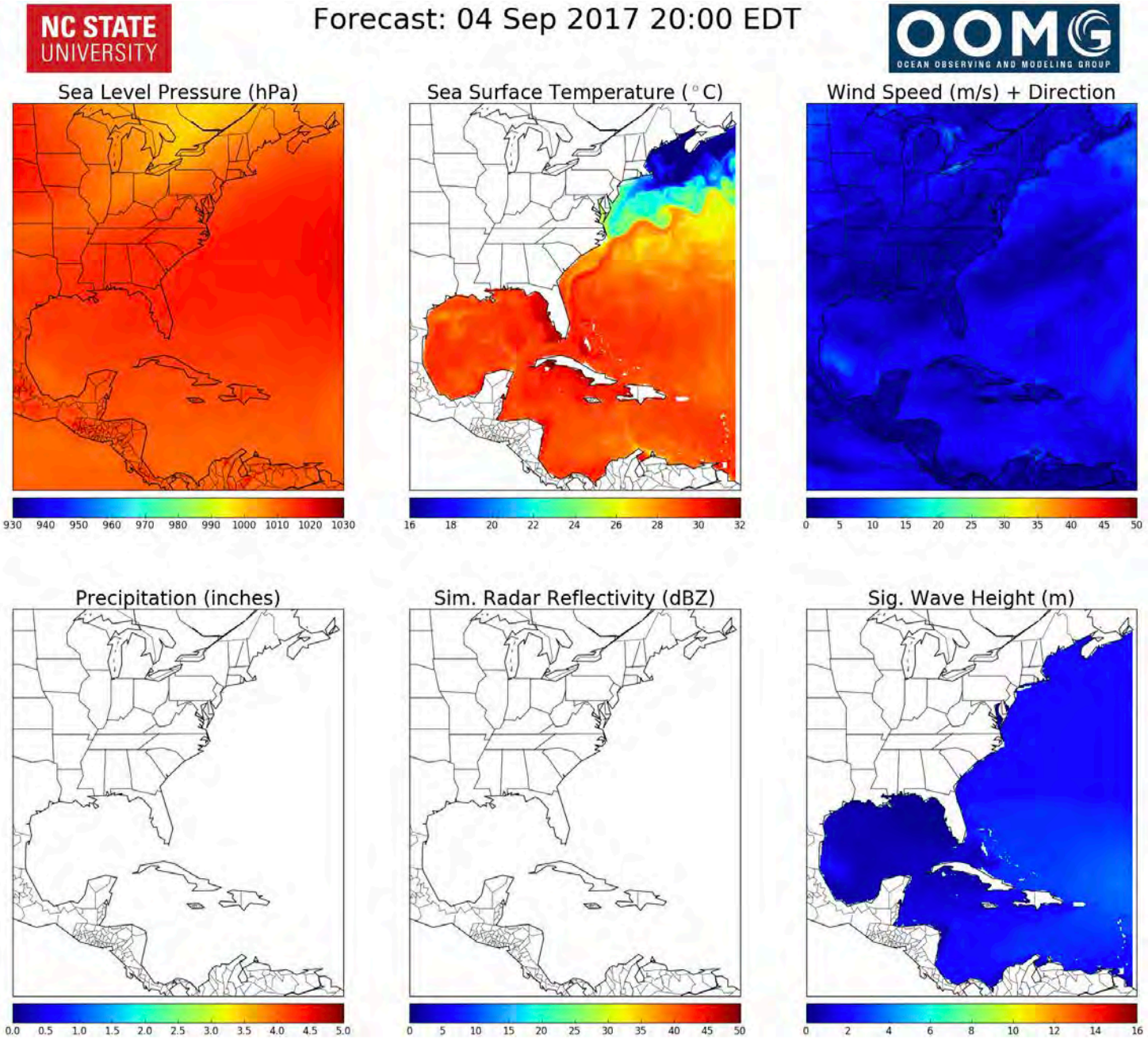








Coupled simulation for Hurricane Irma, 2017



Accomplishments

Conference Presentations and peer-reviewed publications (8)

- **He, R**., H. Zong, Z. Xue, K. Fennel3, H. Tian, WJ Cai and S Lohrenz, Predicting marine physical-biogeochemical variabilities in the Gulf of Mexico and southeastern U.S. shelf sea, AGU Fall meeting, New Orleans, Dec 2017.
- McGee, L., **R. He**, Mesoscale and Submesoscale Mechanisms Behind Asymmetric Cooling and Phytoplankton Blooms Induced by Hurricanes: A Comparison Between an Open Ocean Case and a Continental Shelf Sea Case, Ocean Sciences Meeting, Portland, OR, Feb 2018.
- Muglia, M., P. Taylor, L. Dubbs, S. Lockhart, B. Edge, J. Bane, S. Haines, H. Seim, **R. He**, A. Mazzoleni, S. Bin-Karim and C. Vermillion (2017) Gulf Stream Marine Hydrokinetic Energy Off Cape Hatteras, North Carolina U.S.A. Proc. of Offshore Energy and Storage, Cape Cod, MA, USA July, 2017.
- Zeng, X., **R. He**, J. Bane, Modeling processes driving exchanges near Cape Hatteras, NC, E44A0310, Ocean Sciences Meeting, Portland, OR, Feb 2018
- Zong, H. **R. He**, Marine biogeochemical reposes to a large Gulf Stream offshore meander, OM31A-07, Ocean Sciences Meeting, Portland, OR, Feb 2018.
- He, J., **R. He**, and Y. Zhang (2018) Impacts of air-sea interactions on regional air quality predictions using a coupled atmosphere-ocean model in southeastern U.S., Aerosol and Air Quality Research, 18(4):1044-1067 doi: 10.4209/aaqr.2016.12.0570
- Lohrenz, S., W. J. Cai, S. Chakraborty, W. Huang, X. Guo, **R. He**, Z. Xue, K. Fennel, S. Howen, H. Tian (2018) Satellite estimation of coastal pCO2 and air-sea flux of carbon dioxide in the northern Gulf of Mexico, Remote Sensing of Environment, doi: 10.1016/j.rse.2017.12.039
- **He, R**., A. C. Todd, C. Lembke, T. Kellison, C. Taylor, and D. A. Mann (2018), Cross-Shelf Exchange Associated with the Gulf Stream in the South Atlantic Bight: Direct Observations Using an Autonomous Underwater Glider, Marine Technology Society Journal, in press.

Impact

- Stakeholder groups include:
  - U.S. Coast Guard
  - NOAA National Marine Fisheries Service
  - NOAA Office of Response and Restoration
  - Bureau of Ocean Energy Management
  - NC Department of Environmental Quality
  - Florida Fish and Wildlife Conservation Commission
  - the South Atlantic Fishery Management Council
  - individual fisherman
  - Students (graduate, undergraduate, k-12)

- Benefits include the ability to inform public and coastal managers of
  - the paths and intensities of storms and the resulting wave and water level buildup along the coast,
  - when and where polluted water could move across the shelf into our coastal areas,
  - define habitat interconnectivity for commercially important fish or crustacean species, and
  - determine physical processes affecting the lifecycles of those species.

Public Outreach

NCSU OOMG Teaches Weddington Middle Schoolers About Oceanography

Laura McGee explaining marine modeling to a young scientist

Jeff Willison delivers Lecture at the North Carolina Museum of Natural Sciences