

# CINAR Storm!

*aka CINAR Integrated Rapid-Response  
Observations and Ocean Ensemble Optimization  
to Improve Storm Intensity Forecasts  
in the Northeast U.S.*

NERACOOS 2013 Annual Meeting  
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Gulf of Maine Research Institute





# Project Goals

- Improve forecasting of **intensity** of hurricanes and winter storms in the Middle Atlantic Bight and Gulf of Maine
  - Irene: overestimated, Sandy: underestimated
- Improve inundation forecasting with rapid response observations and numerical modeling
- Leverage extensive observation and modeling capabilities and experience of the region
  - CINAR partners, NERACOOS and MARACOOS, OOI Pioneer Array and IOOS Coastal Ocean Modeling Testbed



# 1. Construct and deploy a rapid response autonomous sampling

- Air-Deployed ALAMO Floats
  - (PIs: Jayne, Owens)
- 4 dedicated and reusable storm gliders deployed on cross shelf transects covering the mid to outer shelf for each storm
  - (PIs: Glenn, Pettigrew, Boicourt, Todd, Gawarkiewicz)
- 10 low-cost, reusable “portable” buoys in an alongshore array at key areas on the inner shelf where storm surge causes the most flooding and damage on the northeast Atlantic coast
  - (PI: Pettigrew)



## 2. Use an ensemble of ocean models

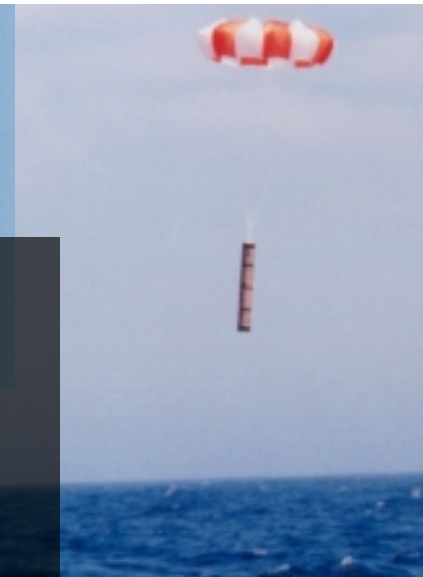
assimilate real-time data

- a) to define the initial temperature structure
- b) evaluate ocean model sensitivities
- c) refine the ensemble weighting for accurate specification of the rapidly changing storm conditions: vertical mixing, upper layer heat content, and air-sea fluxes

model storm surges & coastal inundation for the continental shelf & adjacent estuaries

- a) develop high-resolution inundation simulations and graphic visualizations in regions of greatest vulnerability (Chesapeake Bay, coastal New Jersey, and Scituate, MA)





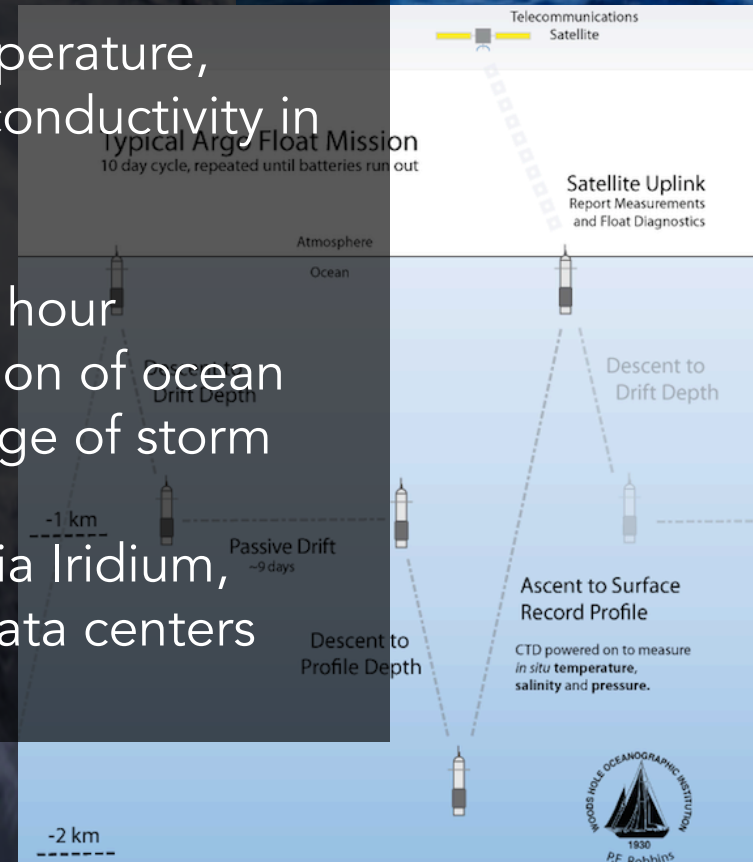
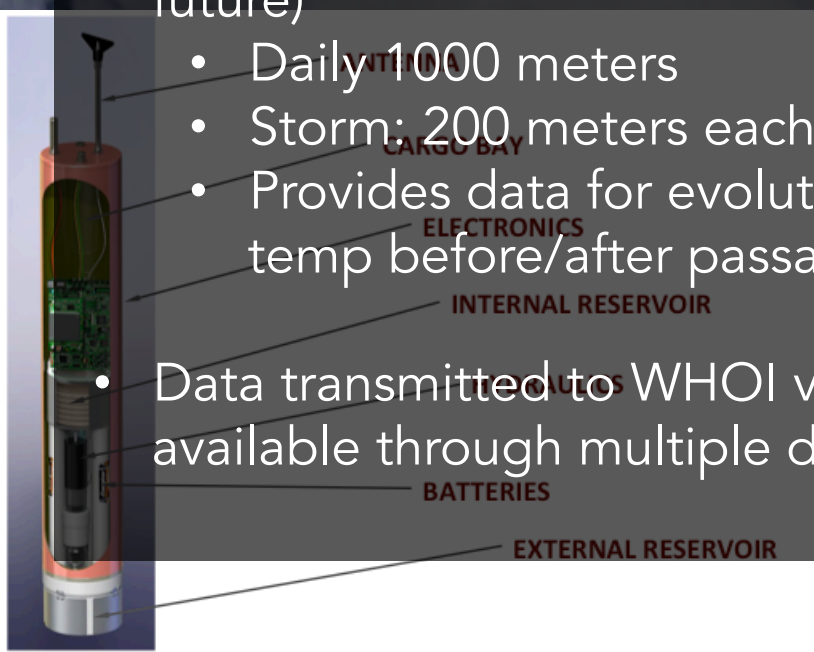
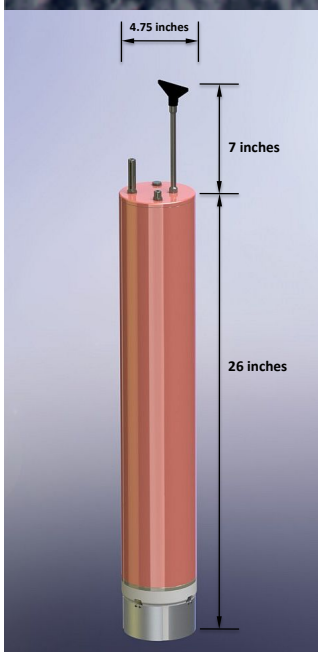
# ALAMO profiling floats

- Deployed from C-150 aircraft, "Hurricane Hunters" during summer storms in slope sea

- Multiple depth profiles: temperature, pressure, 3-D acceleration (conductivity in future)

- Daily 1000 meters
- Storm: 200 meters each hour
- Provides data for evolution of ocean temp before/after passage of storm

- Data transmitted to WHOI via Iridium, available through multiple data centers

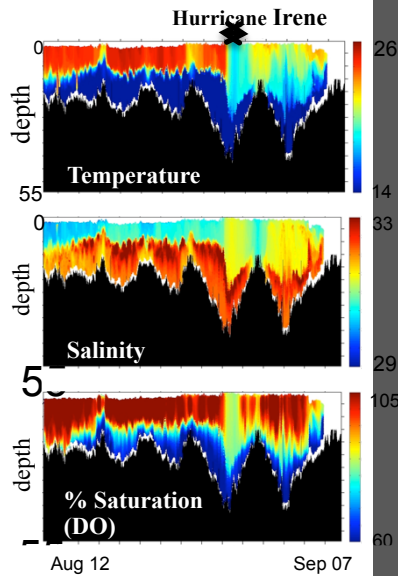
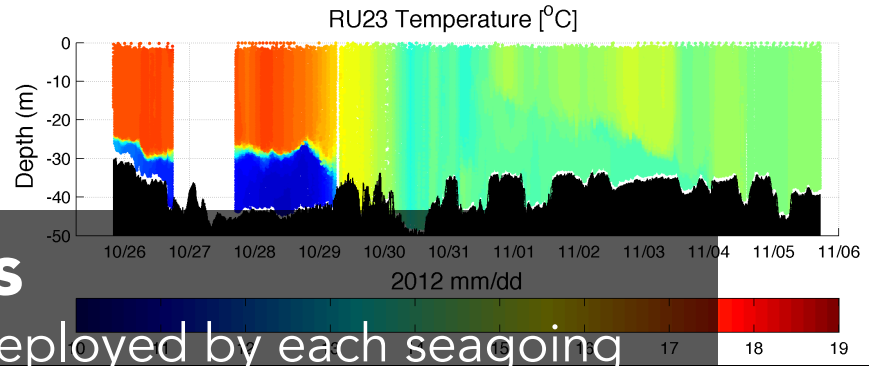




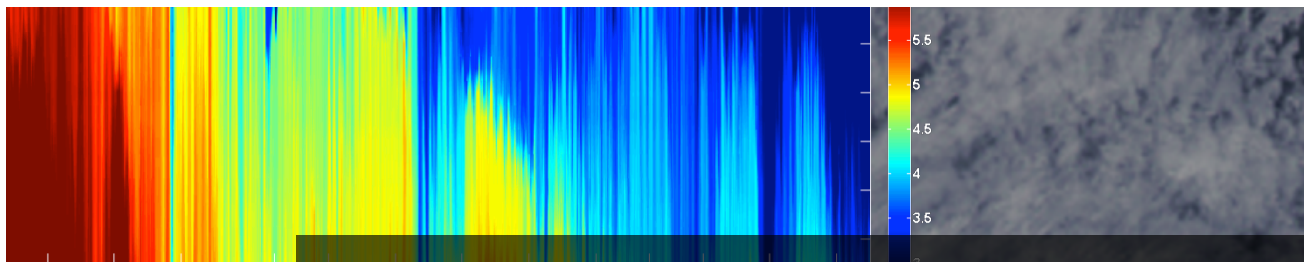


# Storm Gliders

- 4 gliders – one deployed by each seagoing research institutions in mid, outer shelf
- Specific sensor suites tuned to forecasting needs (not available on existing gliders)
  - CTD, optical sensor, accelerometer, current profiler
- Designed to sample parameters controlling mixing on continental shelf during storms
- Data available through NERACCOOS, MARACCOOS, NCEP, NAVO, CINAR, National Glider Plan data management

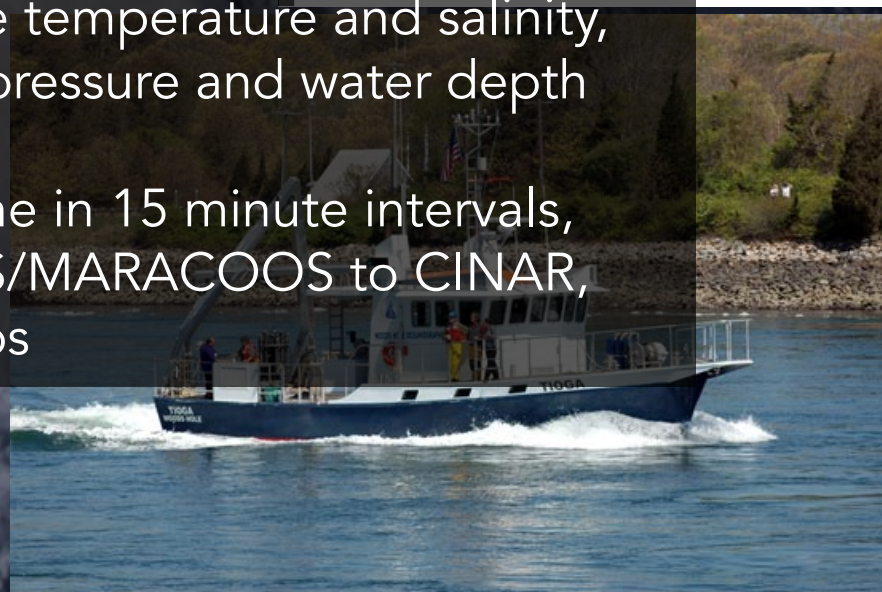
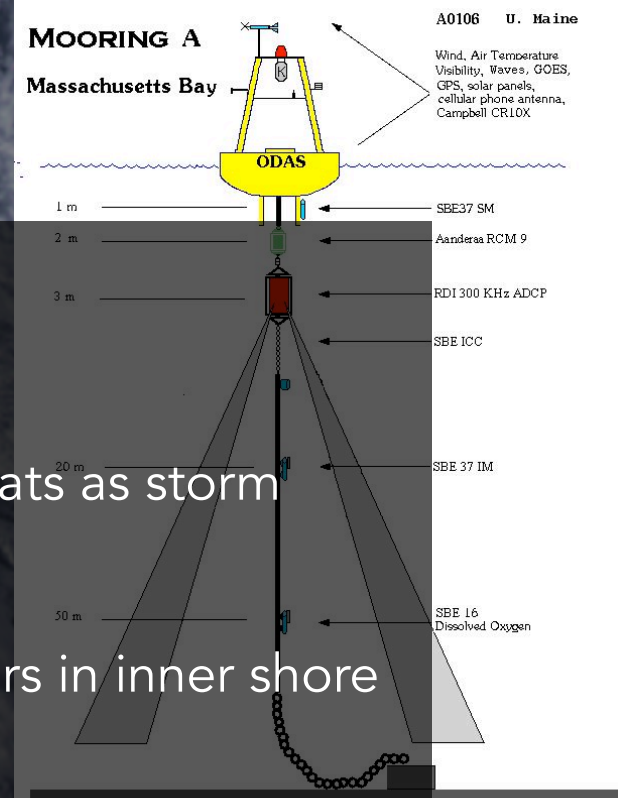
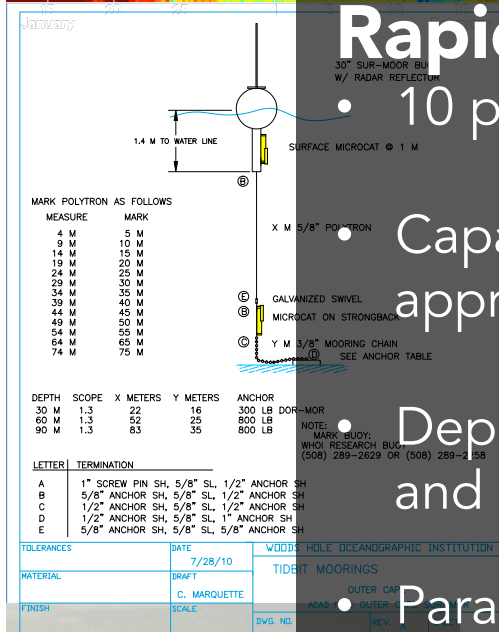






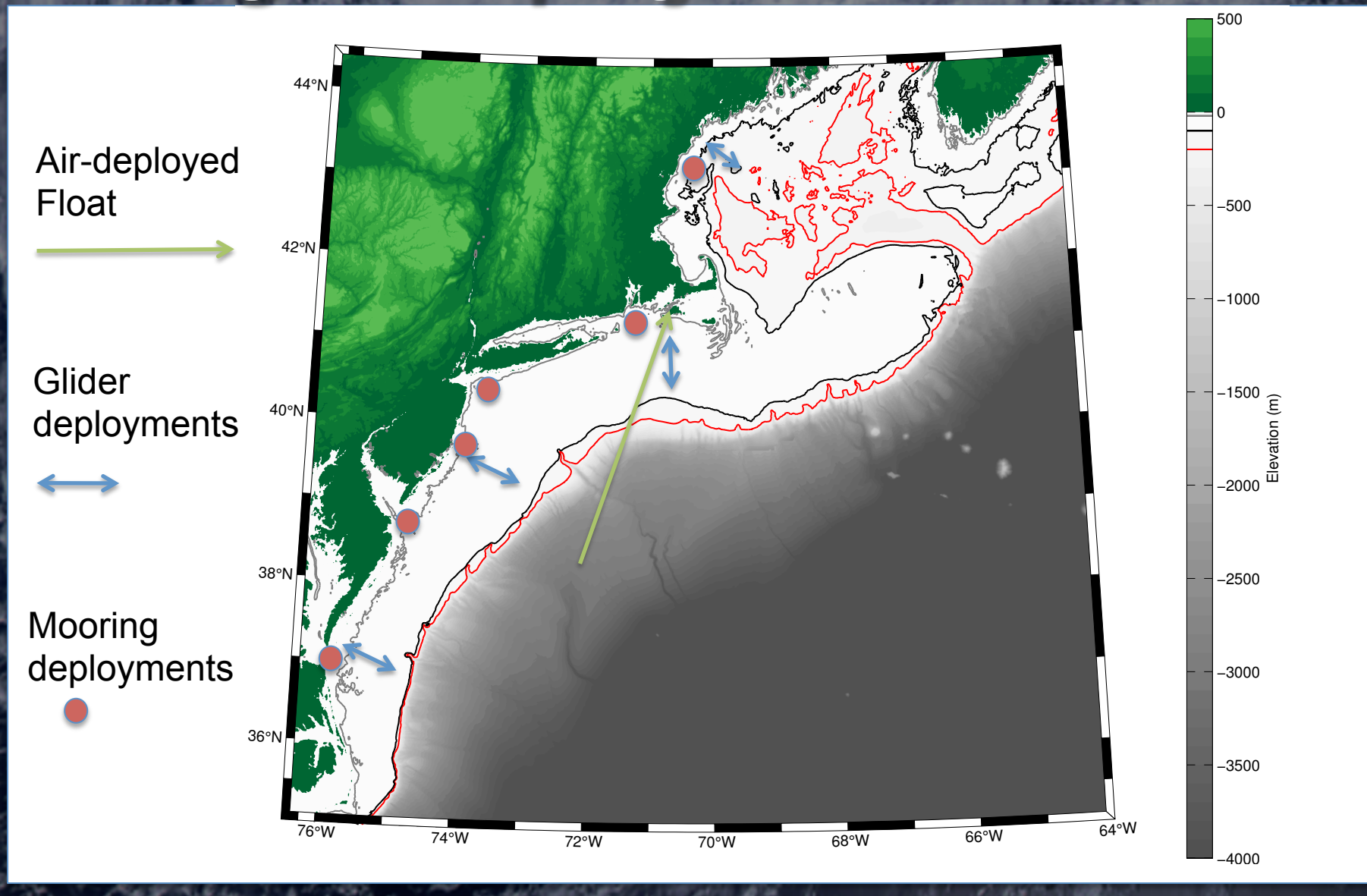
# Rapid response data buoys

- 10 portable buoys, simple moorings
- Capable of deployment from small boats as storm approaches
- Deployed in 10m – 30m depth contours in inner shore and estuaries
- Parameters include: surface temperature and salinity, wind, waves, atmospheric pressure and water depth
- Data telemetered to UMaine in 15 minute intervals, distributed via NERACOOS/MARACOOS to CINAR, IOOS, and modeling groups





# Target Deployment Locations





## 2. Use an ensemble of ocean models

Ensemble modeling (Wilkin & Curchitser - Rutgers, Chai - UMaine)

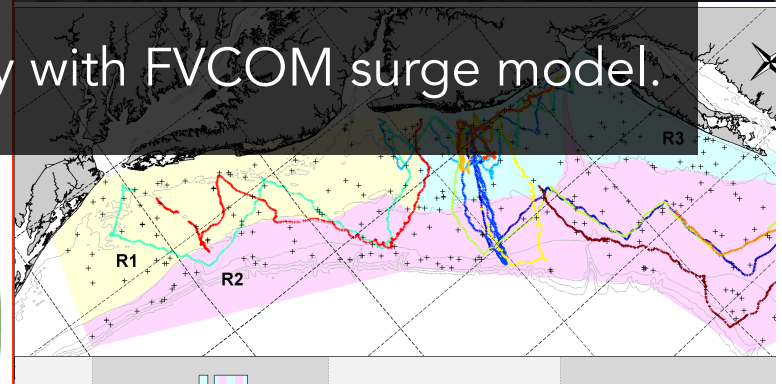
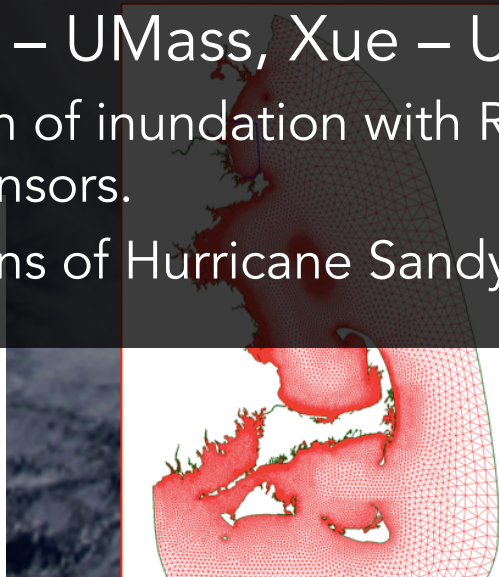
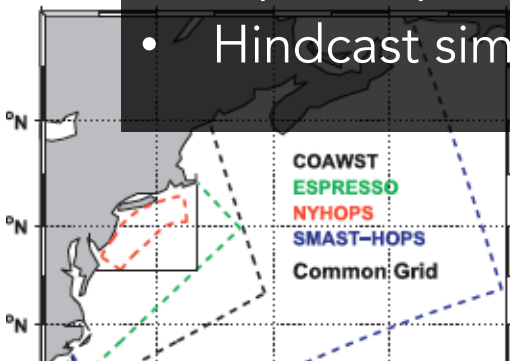
- Improve understanding of ocean mixing response to severe storms
- Improve predictability, quantify model uncertainty and sensitivity with rapid-deployed floats, buoys and gliders

Ocean inundation forecast simulations (Li – UMaryland, Chen & Beardsley – UMass, Xue – UMaine)

- Forecast simulation of inundation with ROMS/FVCOM models and rapid-deployed sensors.
- Hindcast simulations of Hurricane Sandy with FVCOM surge model.



Google





# Project Outcomes

- Share results with Joint Working Group with NCEP and NOS so observations and model results enter the stream of information and guidance available to advise NWS forecasters
- Leverage data management capacity of RAs (NERACOOS and MARACOOS) for wider distribution
  - PI: Young Morse - GMRI/NERACOOS

The logo for NERACOOS, featuring the word "NERACOOS" in white, bold, sans-serif capital letters. The letter "O" is replaced by a stylized compass rose with a yellow needle pointing towards the top-right.