Implementing a Coastal Ocean Circulation Model for the Parguera Ocean Acidification Testbed

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Background

A high-resolution 3D coastal ocean circulation model, with a high-resolution unstructured grid (1-350 m), is being implemented for La Parguera, Lajas; a region that comprises of a sharply varying bathymetry, islands, mangroves, and reefs. The Finite Volume Coastal Ocean Model (FVCOM) was used to simulate the nearshore currents and water levels.

Model forcing includes:

- Tidal (TMD)
- Baroclinic mode (HYCOM, Initial Temp. & Salinity)
- Heating & cooling
- Atmospheric (WRF-NMM)

This model has been implemented in order to understand passive tracers transport throughout La Parguera, Lajas. Passive tracer behavior can be associated with low pH water transport originating from local mangroves.

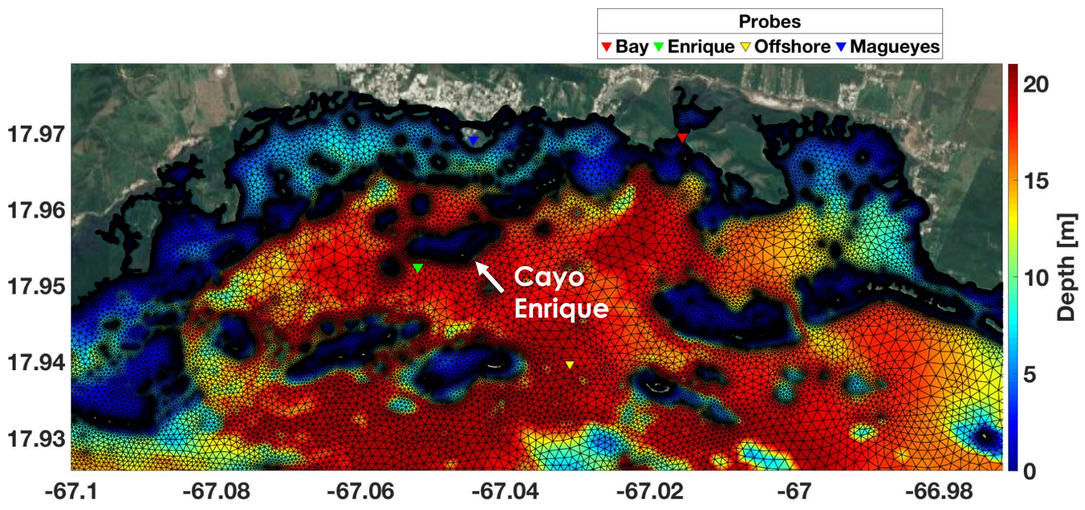


Fig. 1: Unstructured grid of La Parguera, Lajas for FVCOM. Colors represent depth in meters.

Preliminary Results – Surface Currents

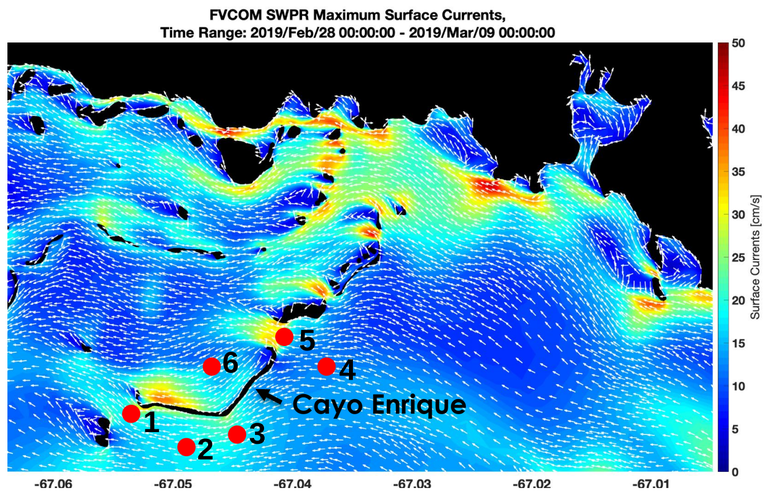


Fig. 2: 10-day simulated maximum surface currents speed. Strong surface currents can be seen in areas of flow impingement or constriction. The vectors show the surface current direction and colors indicate the surface current speed. Red circles mark the locations of the data probes.

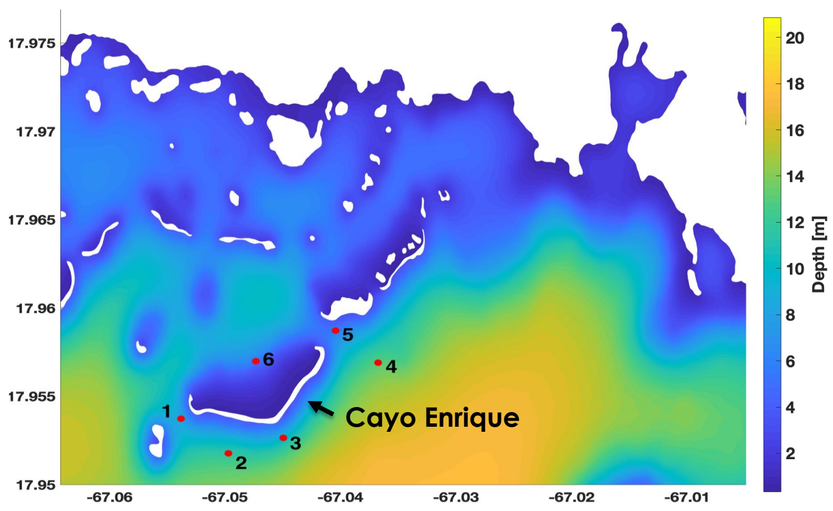
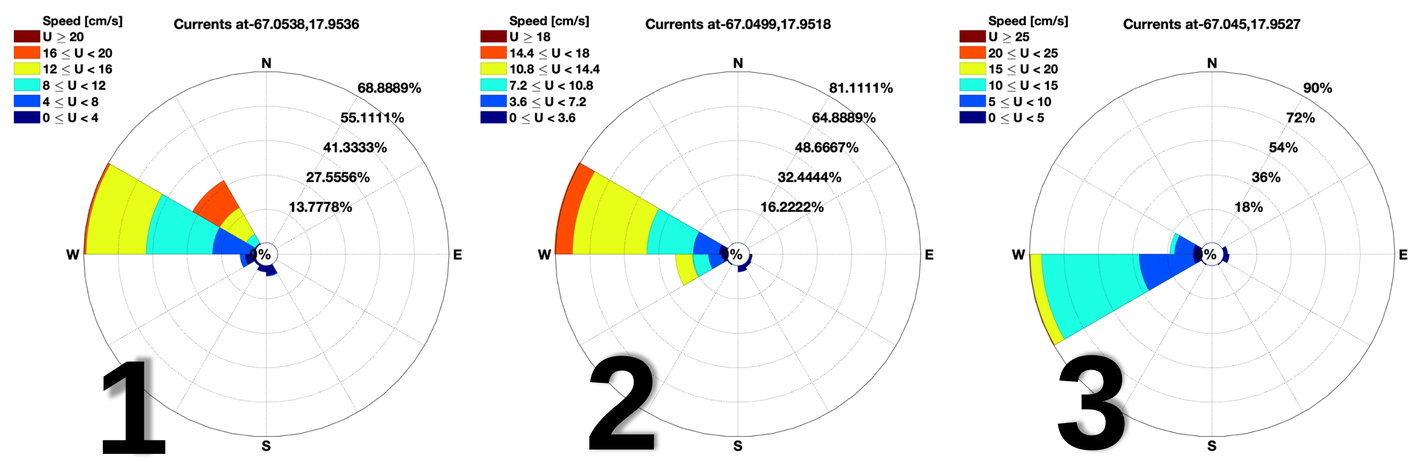


Fig. 3: Bathymetry of La Parguera, Lajas, used in FVCOM computational domain. Colors represent depth in meters



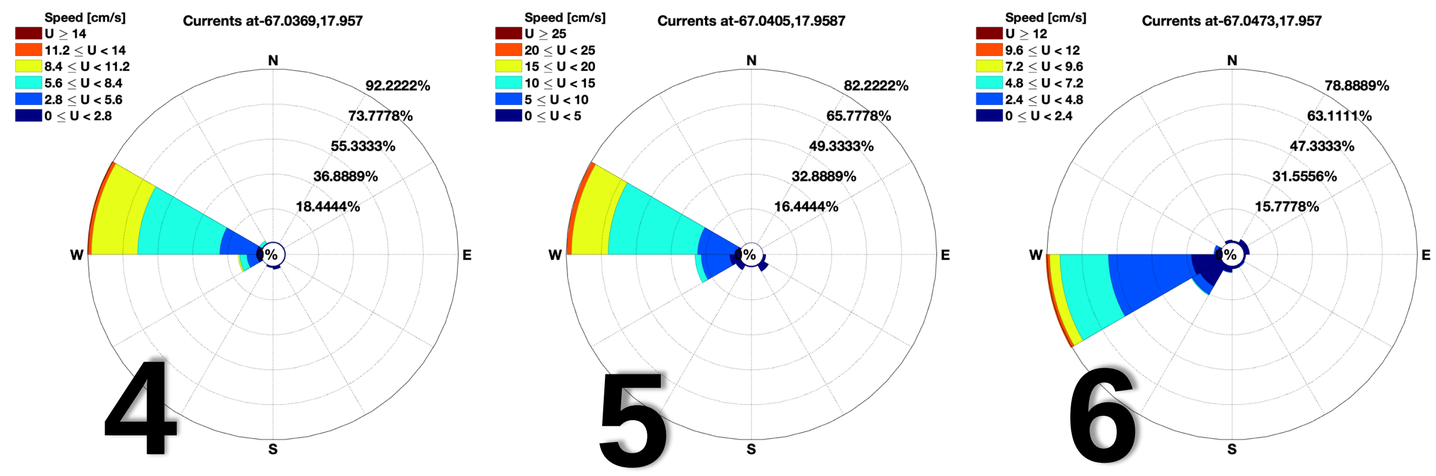
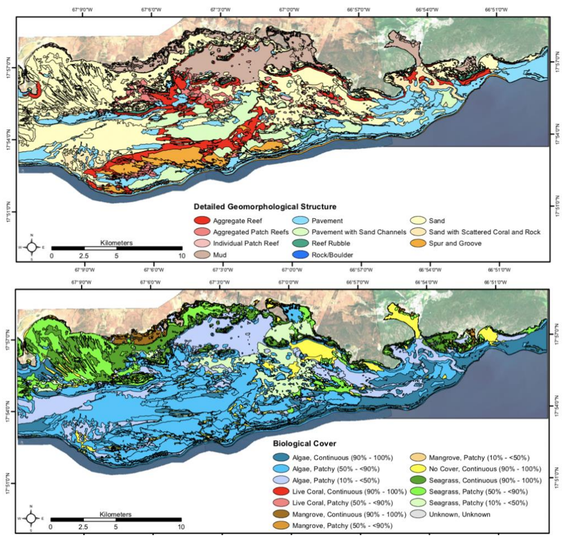


Fig. 4: Directional roses located around Cayo Enrique as specified in Figs. 2 & 3.

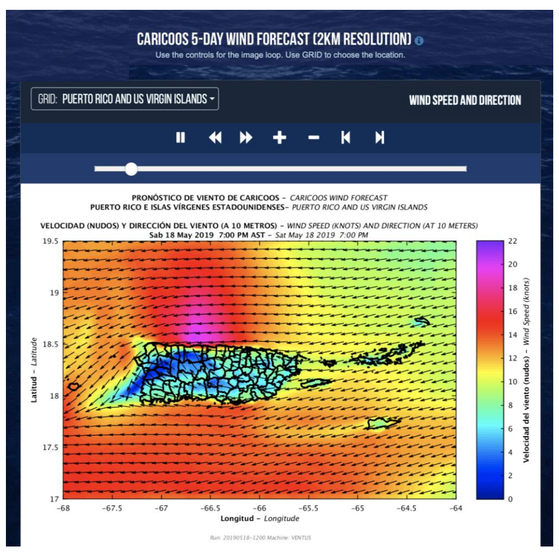
Future Work

- *The preliminary results show promise in becoming a reliable forecasting/hindcasting tool, but in order to capture localized physical phenomena, it is necessary to implement additional datasets into the model such as:*
  - *Changing atmospheric forcing files (atmospheric pressure, wind stress, radiation fluxes, among other parameters) to CARICOOS WRF-ARW .*
  - *Implementation of a variable bottom roughness map based on CFMC Benthic habitat Mapping for La Parguera.*
  - *The use of offline particle tracking (PTM) to study circulation patterns around La Parguera.*

<u>Benthic Maps</u>



<u>WRF-ARW</u>



<u>PTM</u>

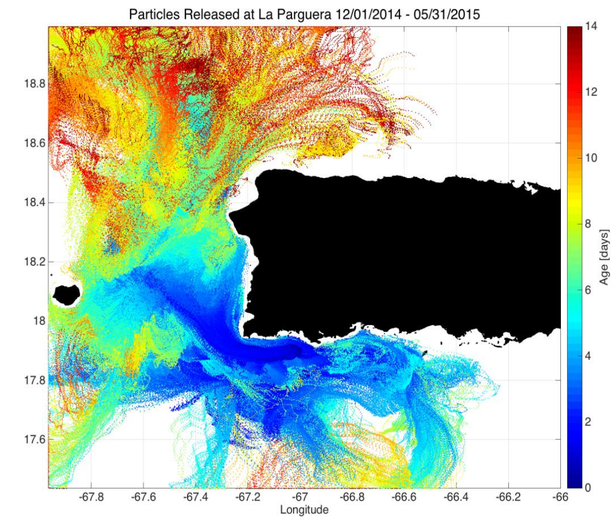


Fig. 5: (a) Benthic habitat maps depicting different sea bottom classes; (b) CARICOOS 2 KM WRF-NMM snapshot; and (c) Particle Tracking Model (PTM) runs released at Parguera using ROMS output. A similar study will be performed in the coastal waters of La Parguera in an attempt to understand the circulation/transport patterns.

References: *B. et al, Shallow-water benthic habitats of southwest Puerto Rico, Tech. rep., NOAA National Centers for Coastal Ocean Science Center for Coastal Monitoring and Assessment (2012).*