SYMPOSIUM OP'24 ADVANCING OCEAN PREDICTION SCIENCE FOR SOCIETAL BENEFITS

Ocean Circulation Prediction in Shelf Seas

Development of a Coastal Forecast System for the Guanabara Bay - Rio de Janeiro - Brazil

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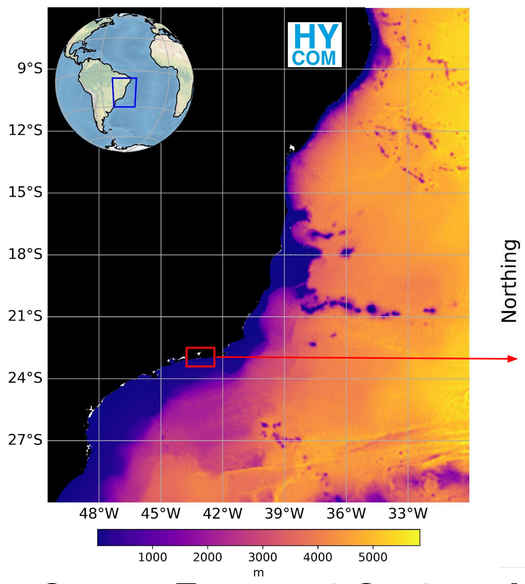
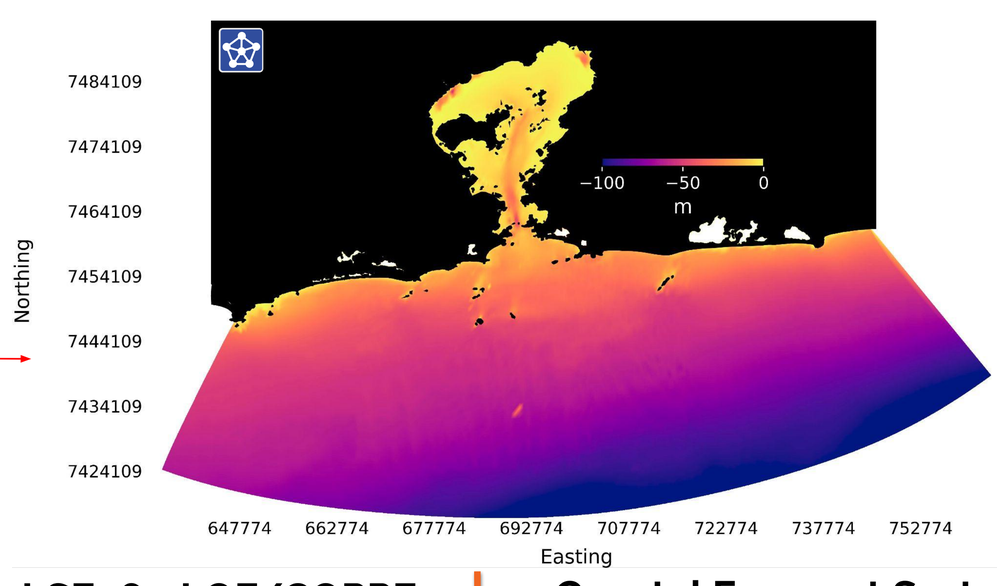
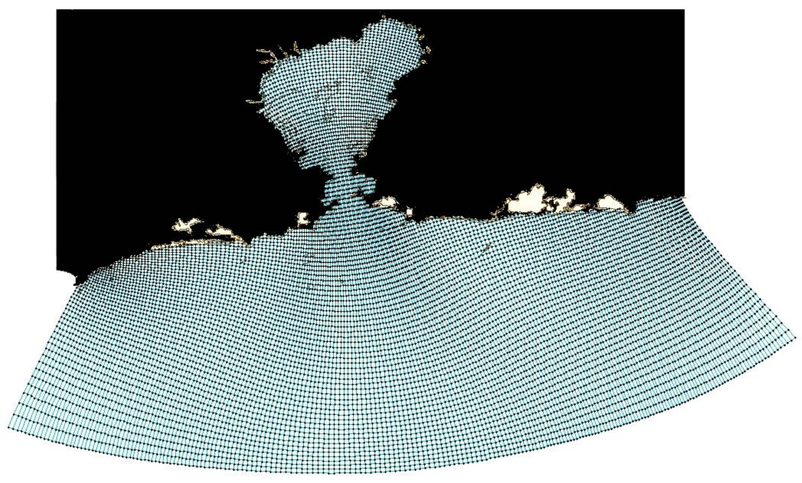
Introduction

- **The Physical Oceanography Laboratory - LOF/COPPE, the Brazilian Coastal Monitoring System (SiMCosta), and Deltares are collaborating to develop a 3D hydrodynamic coastal forecast system for Guanabara Bay (GB) in Rio de Janeiro.**
- **GB is an important coastal embayment in Brazil, supporting a variety of economic activities and experiencing intense marine traffic.**
- **Located in the greater Rio de Janeiro metropolitan area, the bay's margins are home to numerous communities, and sewage-related pollution is a major concern.**
- **In this context, an open-access modeling system will be valuable for providing environmental forecast information to the general public and navigation communities, as well as offering tools for ecological studies.**
- **This project combines a regional ocean model with a coastal model focused on the Rio de Janeiro region.**





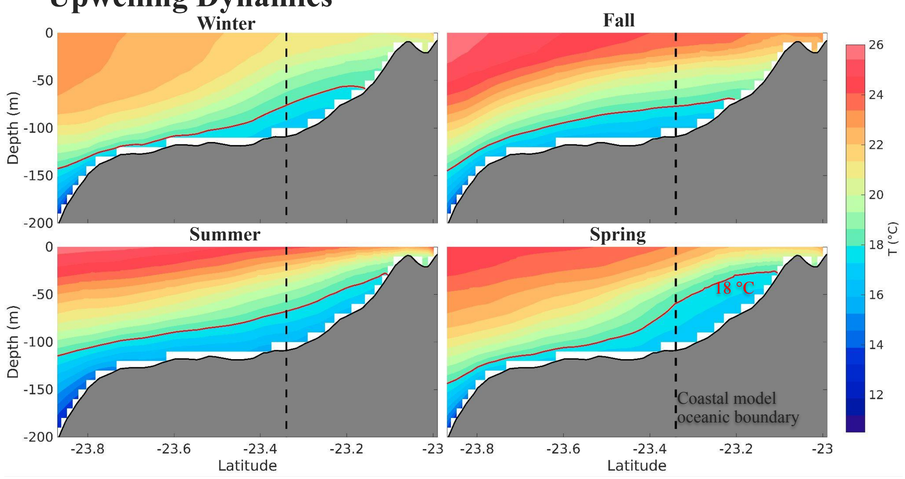


LSE36-LOF/COPPE ocean model domain and bathymetry (left), coastal model domain and bathymetry (center), and coastal model grid (right).

Ocean Forecast System LSE36 - LOF/COPPE

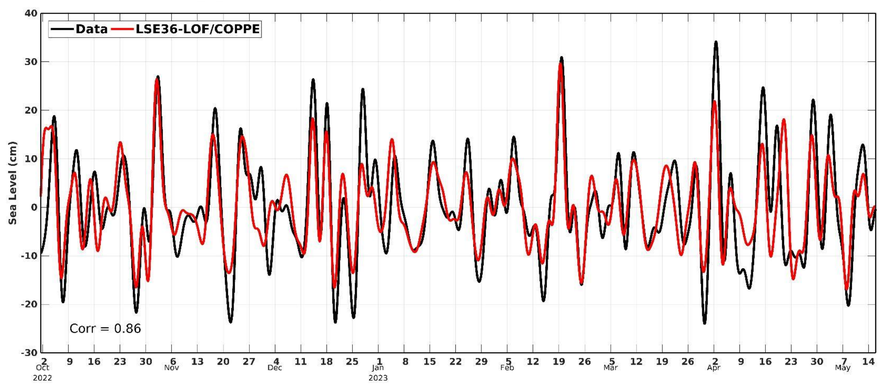
- **Active Ocean Forecast System**
- **Hydrodynamic model: HYCOM 2.3.01**
- **Grid resolution: 1/36°**
- **Data assimilation system: T-SIS**
- **Surface forcing: GFS**
- **Lateral forcing: GOFS 3.1 + tides**
- **Daily forecasts, 5 days horizon**

Upwelling Dynamics



The ocean model effectively represents the upwelling dynamics, with denser subsurface waters approaching the coast during summer and spring. The figure above shows vertical seasonal average temperatures for 2023 from the LSE36-LOF/COPPE ocean model along a meridional transect south of the mouth of GB.

Coastal Trapped Waves (CTW)

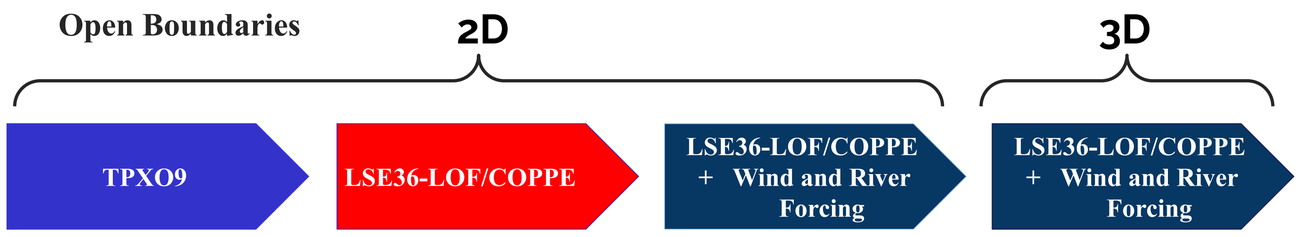


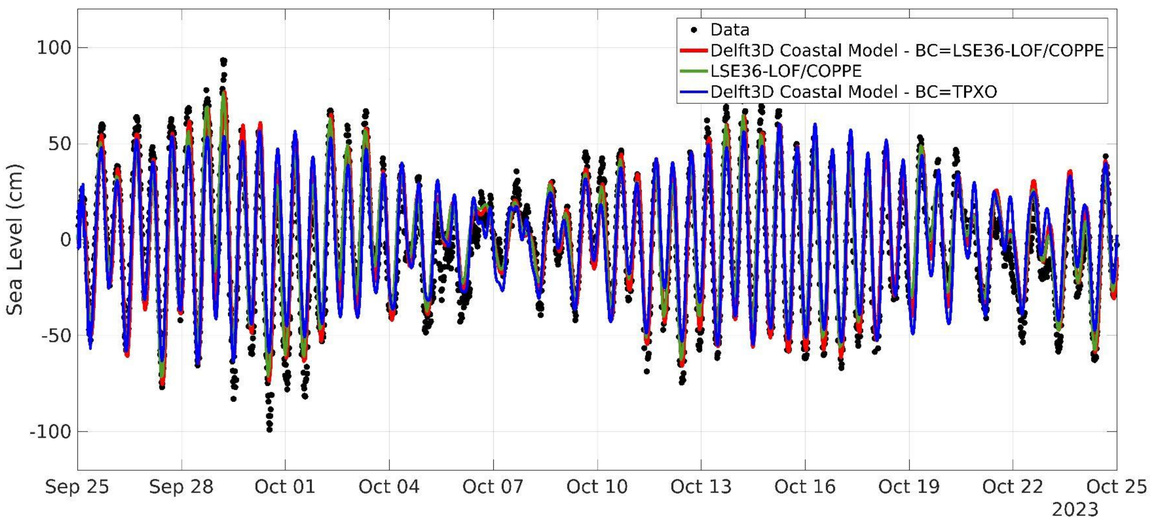
CTWs are well represented along the Brazilian coast, as shown by the comparison between observed data (black) and LSE36-LOF/COPPE (red) sea level variations. The time series were filtered in the 3 to 30-day band.

Coastal Forecast System

- **Hydrodynamic model: Delft3D FM**
- **Lateral forcing: LSE36 - LOF/COPPE**
- **Daily forecasts, 5 days horizon**
- **Surface forcing: GFS / Regional Atmospheric Modeling System**

Implementation Steps of the Coastal Forecast System





Sea level variations inside GB: The coastal Delft3D model nested within the LSE36-LOF/COPPE model (red) more closely matches observed data than the coastal model forced only by the TPXO9 tide model (blue). The use of LSE36-LOF/COPPE model at the oceanic open boundary allows oceanic subinertial processes to propagate into the coastal domain, reducing the error.

Upcoming Steps

- **3D Delft3D FM hydrodynamic model nested within LSE36 - LOF/COPPE model.**
- **Make the results available for community use.**

SiMCosta – Sistema de Monitoramento da Costa Brasileira

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