The Gulf of Mexico Coupled Regional Modeling System (*GoM-CRMS*)

Panagiotis Velissariou[1], Hannah R. Hiester[2], Steve L. Morey and Eric P. Chassignet

[1]pvelissariou@fsu.edu, [2]hhiester@coaps.fsu.edu

Center for Ocean – Atmospheric Prediction Studies, The Florida State University, Tallahassee, FL

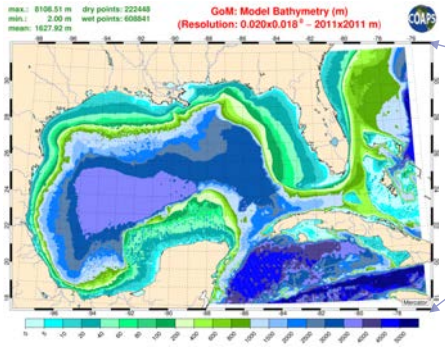


Figure 1: Target model bathymetry for the Gulf of Mexico region.

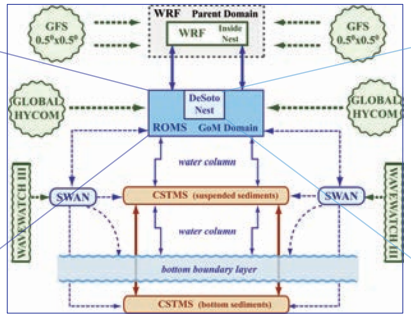


Figure 2: Coupling diagram of the ***GoM-CRMS*** modeling system.

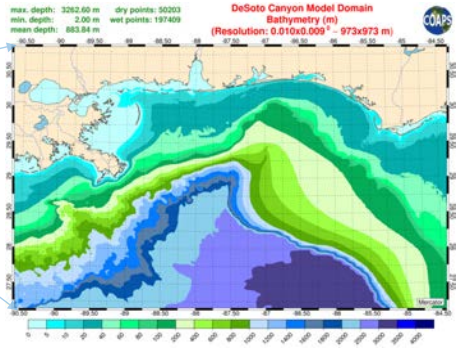


Figure 3: Target model bathymetry for the DeSoto region nest.

Introduction

GoM-CRMS is being developed under the umbrella of the Deep-C project to aid coastal and offshore engineering applications and supply quality, high resolution data to Deep-C collaborators. The system is under intense development and is currently being tested on both the whole Gulf of Mexico and the De Soto canyon region, Figs. 1 and 3.

The core modeling components of the system, Fig. 2, are: *(a)* Ocean: *ROMS* - The Regional Ocean Modeling System, *(b)* Atmosphere: *WRF* - Weather Research and Forecasting Model, *(c)* Waves: *SWAN* - Simulating Waves Nearshore, *(d)* Sediments: *CSTMS* - Community Sediment Transport Modeling Systems. Other key components are: *(a)* Coupler: *MCT* - The Model Coupling Toolkit and *(b)* Interpolation: *SCRIP* - Spherical Coordinate Remapping and Interpolation Package. The underlying code is based on the *Coupled-Ocean-Atmosphere-Wave-Sediment Transport Modeling System (COAWST,* http://woodshole.er.usgs.gov/operations/modeling/COAWST/).

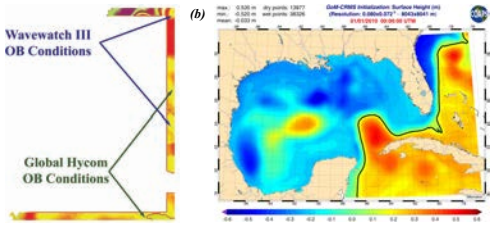


Figure 4: *(a)* Definition of the B.C buffer zone, *(b) ROMS* initial conditions for SSH (Global *HYCOM*).

Modeling approach

Development of the Gulf of Mexico configuration currently focuses on WRF-ROMS coupling. The *WRF* component uses 50 km resolution and is forced by *GFS* data. In operational mode, WRF will use 12 km or finer resolution and will be forced by *GFS* data (0.5°x0.5°). *ROMS* is forced by Global *HYCOM* output and has 8km resolution. The *ROMS* open boundaries are relaxed over a buffer zone of approximately 62 km in width, Fig. 4.

Development of the De Soto canyon configuration currently focuses on the ROMS component. In particular, the river input, not present in the Gulf of Mexico configuration, has been investigated. The 1km resolution domain is closed and uses an idealized initial condition. The river forcing uses USGS streamflow data, monthly climatological temperature data and a prescribed salinity.

Both configurations use a multi resolution bathymetry for the Gulf of Mexico, developed as part of *Deep-C* project and publicly available from *COAPS*: ftp://ftp.coaps.fsu.edu/pub/takis/. The target year used for both model configurations is 2010.

Gulf of Mexico Simulations

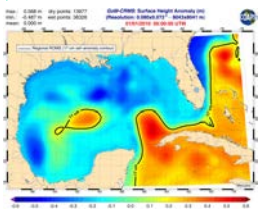


Figure 5: Sea Surface Height Anomaly map. *GoM-RCMS* initialization by global *HYCOM*.

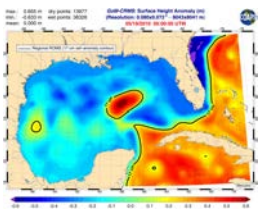


Figure 6: Sea Surface Height Anomaly map. Time of LC eddy shooting.

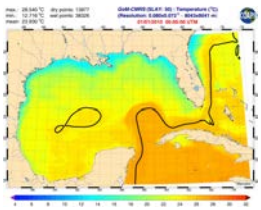


Figure 7: Surface Temperature map. *GoM-RCMS* initialization by global *HYCOM*.

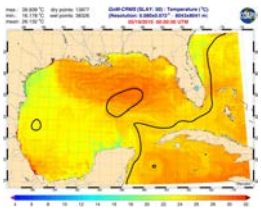


Figure 8: Surface Temperature map. Time of LC eddy shooting.

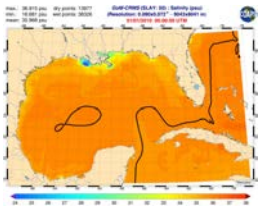


Figure 9: Surface Salinity map. *GoM-RCMS* initialization by global *HYCOM*.

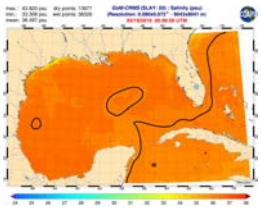


Figure 10: Surface Salinity map. Time of LC eddy shooting.

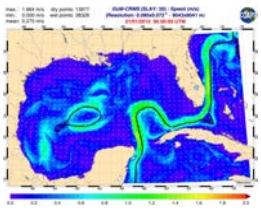


Figure 11: Surface Currents map. *GoM-RCMS* initialization by global *HYCOM*.

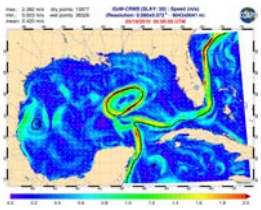
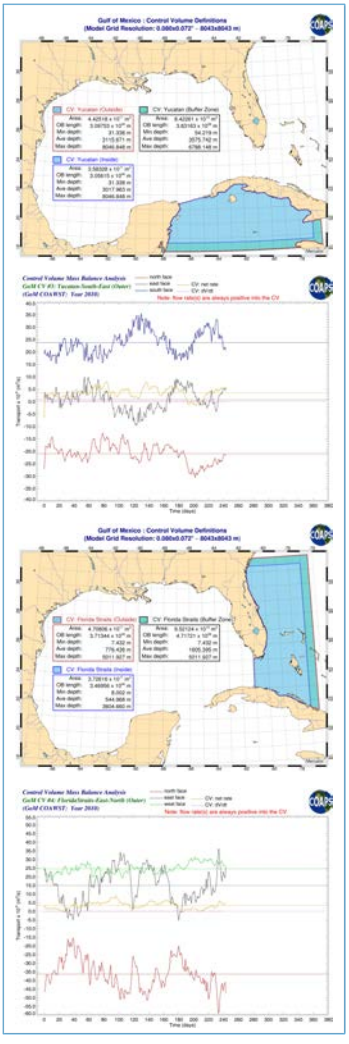


Figure 12: Surface Currents map. Time of LC eddy shooting.



De Soto Canyon Simulations

The idealized river forcing configuration shows successful implementation of the rivers in the ROMS component of the De Soto canyon region model, Figs. 13 and 14. This configuration will be combined with the open boundary protocol established in the Gulf of Mexico configuration and then the surface forcing and coupling with *WRF* will be investigated.

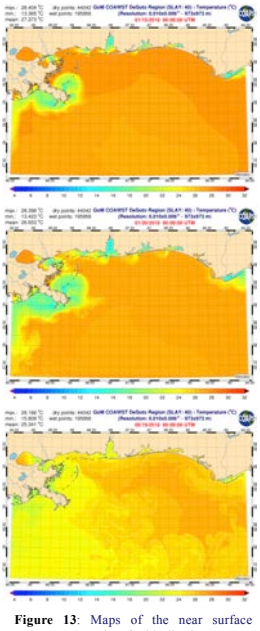


Figure 13: Maps of the near surface temperature over time for idealized ROMS set up with river forcing.

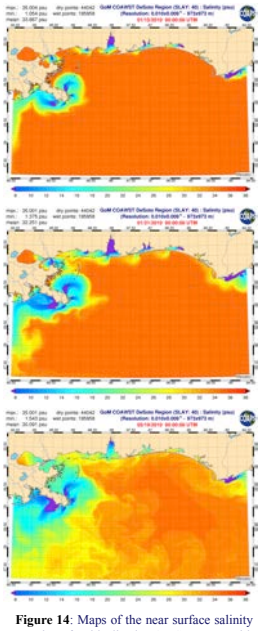


Figure 14: Maps of the near surface salinity over time for idealized ROMS set up with river forcing.

Conclusions and Outlook

Development of the Gulf of Mexico and De Soto canyon region models have moved the capabilities of *GoM-CRMS* forward. In particular, the coupled *WRF-ROMS* simulations demonstrate important progress in one of the key system features. The next component to be coupled is *SWAN* which will use *WaveWatch III* data and a horizontal resolution of 2 km (or finer).

This work will be extended through application of these protocols to the De Soto canyon region and nesting the De Soto canyon region within the Gulf of Mexico model. Furthermore, these models will facilitate further inter model comparison and investigation of the De Soto canyon region dynamics and their influence on the transport of hydrocarbons.