Performance Evaluation of HYCOM Gulf of Mexico

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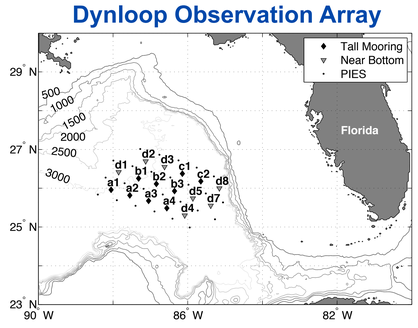
Abstract

In 2009, a study began to investigate Loop Current (LC) circulation dynamics, eddy-shedding mechanisms, and forcing of lower-layer flows in the Gulf of Mexico (GOM). This study utilized a mapping array centered (26°N 87°W) consisting of 9 full-depth and 7 near-bottom moorings, as well as 25 bottom-mounted pressure equipped inverted echo sounders (PIES). Moorings were deployed in April 2009 and data recovered via rotation or telemetry in July and November 2010. Measurements were compared to output from the 1/25th degree resolution Gulf of Mexico HYCOM (GOM HYCOM) model. Model-to-mooring comparison revealed high temperature correlations and moderate to high correlations for both zonal and meridional velocity, with array-averaged correlations in the thermocline of 0.83, 0.71, and 0.79, respectively. Time-averaged eddy kinetic energy (EKE) showed comparable, but higher, values of deep EKE in the mooring array. A case study of upper and lower layer flows during the separation of Loop Current Eddy (LCE) Franklin showed similar features between model and mooring array. In particular, both indicate that deep cyclones are generated beneath the Loop Current during the separation process.

Introduction

Dynloop Observation Array



Goal: Assess GOM HYCOM simulation of Loop Current Eddies.

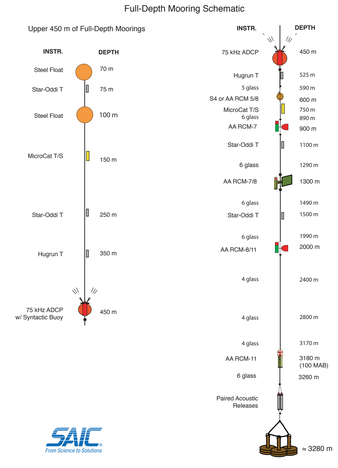
Motivation: Deep-water Horizon spill highlighted the need for accurate simulations of full water-column circulation.

Mooring Array

- Placed in LCE formation region
- Provided full water-column measurements
- 9 tall and 7 near-bottom moorings
- 25 PIES

The Model:

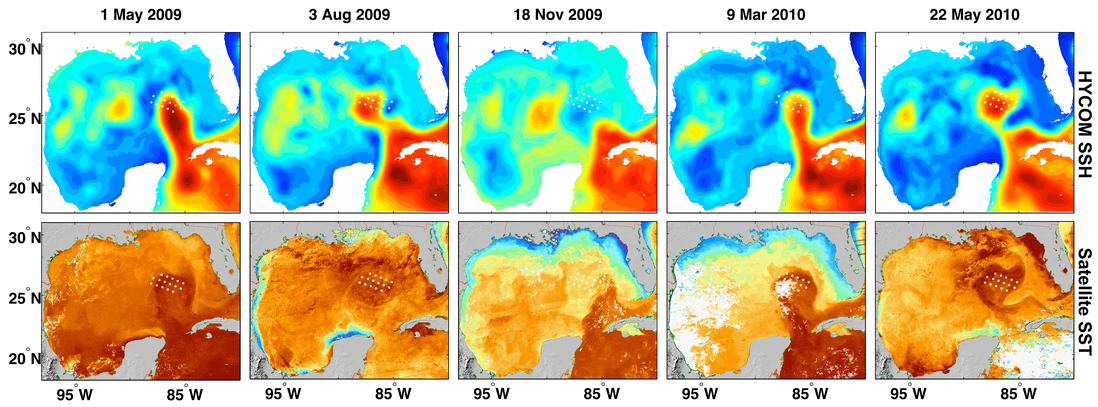
- Gulf of Mexico Hybrid Coordinate Ocean Model (I0.04, 20.1)
- 1/25th° latitudinal resolution
- Assimilates satellite altimetry and temperature



Data was filtered using a 3-day, 4th-order Butterworth Filter.

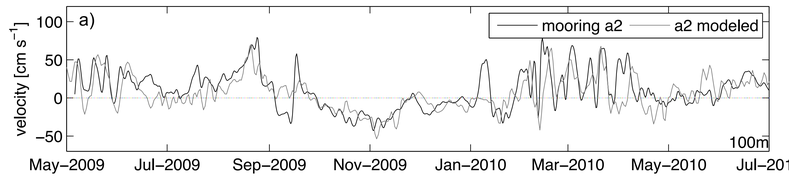
Hello,
I'm Kellen Rosburg. I will be at my poster from __:__ to __:__ on Tuesday the 22nd.
rosburk@students.wwu.edu

Observations & GOM HYCOM

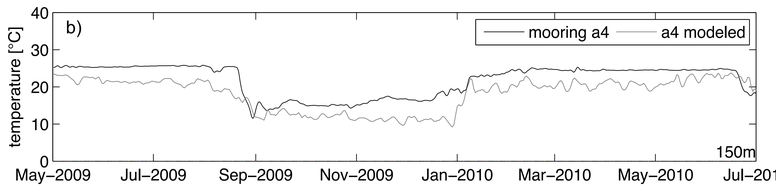


In the 15 months of data acquisition (Apr. 2009 – Jul. 2010), two LC eddies formed and separated. The August 3rd and May 22nd panels show the formation of LCEs Ekman and Franklin respectively.
Mooring locations indicated by white dots.

Satellite SST Images: Johns Hopkins Univ. Ocean Remote Sensing Group



A time-series comparison between mooring a2 (black) and modeled (gray) velocity at 100 m shows coinciding peaks of high/low velocity. Bunched peaks correspond to eddy separation events.

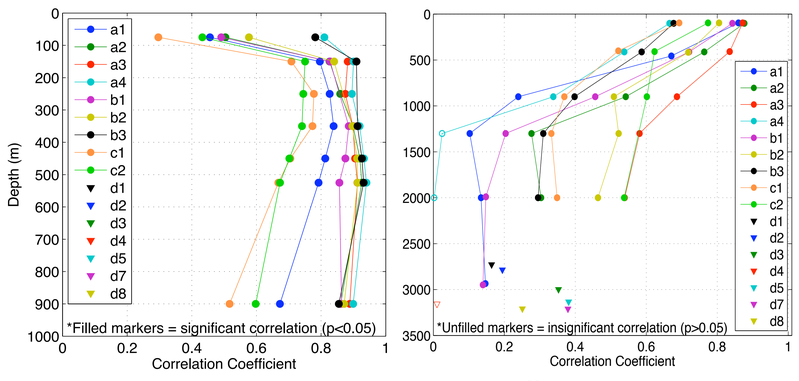


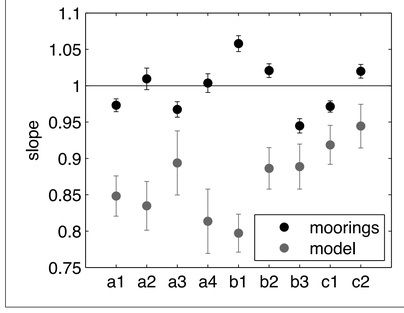
Temperature time-series compare well between a4 (black) and HYCOM-a4 (gray) at 150 m.

High model-to-mooring correlations exist for temperature (left panel).

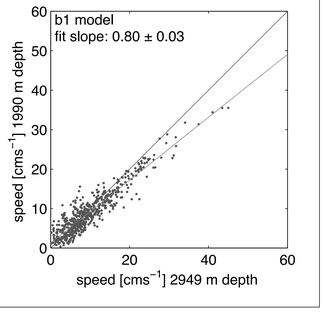
Correlations decrease with depth for meridional velocity (right panel).

Correlations are highest in the thermocline.





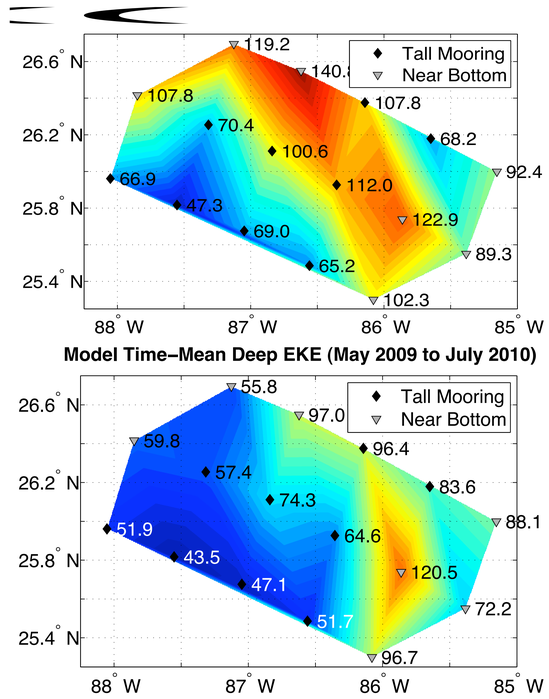
A comparison of bottom trapping between array tall moorings (black) and GOM HYCOM modeled tall moorings (gray) shows greater trapping in the model.



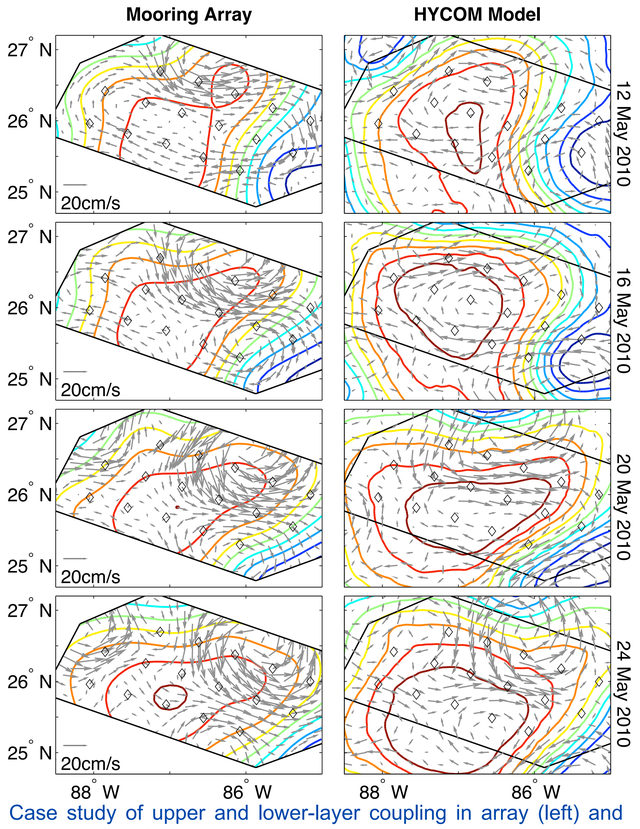
Conclusions

- Mooring and model velocity and temperature time-series are well correlated in the thermocline.
- Similar patterns of time-averaged deep EKE, slightly higher values in array.
- More bottom trapping in GOM HYCOM than observed.
- Pattern of array and model deep velocity compares well during eddy Franklin separation.
- Deep cyclones are generated beneath the LC during eddy separation process in both model and observations.
- **Favorable comparison indicates analysis of GOM HYCOM will improve understanding of GOM circulation.**

Case Studies



Similar patterns of time-averaged deep EKE were observed in the model and array. Units are $cm^2\ s^{-2}$.



Case study of upper and lower-layer coupling in array (left) and HYCOM (right) with mapped bottom current vectors and sea surface height (SSH; contours) during Franklin separation shows matching patterns of deep velocity.

Acknowledgements

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