Coastal Ocean Observing in the Straits of Florida using HF Radar
An Overview of Recent Work

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1 INTRODUCTION

- The Florida Current is one of the fastest ocean currents in the world, connecting the Loop Current in the Gulf of Mexico to the Gulf Stream in the North Atlantic.
- At the large scale, this current system plays a key role in redistributing heat in the ocean, and can impact climate on a global scale.
- At the small scale offshore of Miami, the Florida Current influences both local ecosystems and maritime operations (e.g. search and rescue, tracking an oil spill).
- Since transient eddy events in coastal regions are not easily observed by traditional in-situ instruments or satellites, there is still uncertainty about the small-scale variability of the currents.

2 HF RADAR DATA

- Since 2003, VERA radars have been deployed in phased array mode along the southeast Florida coastline to collect remote measurements of ocean surface currents, waves and winds.
- Operating at frequencies of 12 and 16 MHz, the radars collect data at 20-min intervals with a typical range of 80-km, and 1.2 km resolution in the horizontal.
- Advantages of HF radar for ocean observing in the Straits of Florida include:
  1) High resolution in time and space
  2) Long-term monitoring of the same area
  3) Coverage over areas never before measured

3 ON THE WESTERN FRONT

- During the eddy passage, the vorticity field revealed a Rossby number that greatly exceeded unity, implying the flow field was governed by submesoscale dynamics.
- Strong horizontal current divergence near the core of the eddy was associated with anomalously cold water brought to the surface by upwelling, observed in MODIS SST satellite imagery.

4 ON THE EASTERN FRONT

- A transient, coherent signal in the near-inertial passband was identified for the first time. This energetic fluctuation can increase cross-shelf exchange of water properties across the continental shelf.
- The strongly sheared Florida Current partially masked the structure of the near-inertial oscillation, which manifested as a succession of clockwise-rotating eddies in the observed surface currents. The wave train was not evident when embedded in a laterally sheared northward background flow.
- The dominant frequency was shifted by 13% below f in the embedded bands.
- Near-inertial energy peaked in the negative vorticity trough of the Florida Current, including:
  1) Examination of how the flow field kinematics are significantly altered during the passage of a frontal eddy; and,
  2) Analysis of a near-inertial velocity signal in the anticyclonic shear zone that has not been previously addressed in the literature.

References


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