Deep Ocean Current Prediction

U.S. NAVAL RESEARCH LABORATORY

AT A GLANCE

What is it?

A multi-scale modeling system that will quantify the variability of deep ocean (depths greater than 1000m) and bottom boundary layer currents.

How does it work?

A new Generalized Vertical Coordinate system in regional ocean models will resolve previously unseen deep ocean currents. Furthermore, Large Eddy Simulation (LES) of bottom boundary layer dynamics and flows will inform high resolution regional ocean model turbulence and mixing parameterizations.

What will it accomplish?

A transition to Navy operations of global and regional scale models capable of reliably predicting deep ocean currents, mixing and dissipation, even within the bottom boundary layer. The quantification of deep ocean current structures supports the defense of pipelines and other critical civilian infrastructure present on the sea floor.

R&D Sponsor(s)

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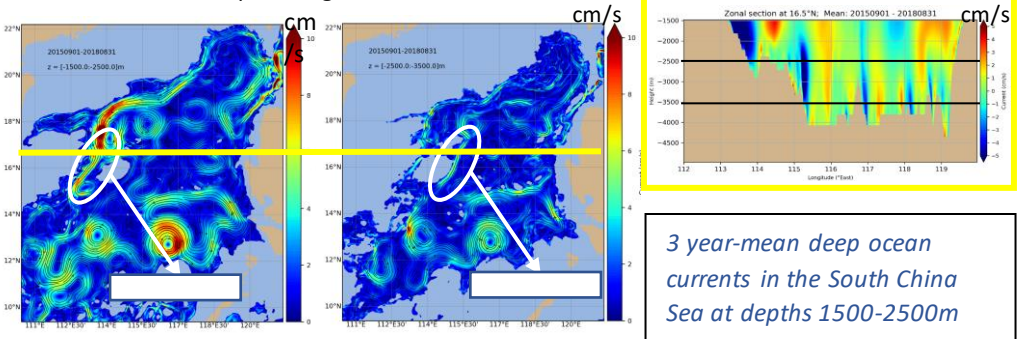

1500m-2500m

Strongest flow on **West** side of Zhongsha Island

2500m-3500m

Strongest flow on **East** side of Zhongsha Island

3 year-mean deep ocean currents in the South China Sea at depths 1500-2500m (left), 2500-3500m (middle), and a vertical profile of current magnitude at 16.5 deg N (right).

Deep Ocean Currents in the South China Sea

The Navy Coastal Ocean Model is configured at 2km resolution with 100 vertical levels over the entire South China Sea Basin, creating 300-400m resolution in water depths 2000m and below. This level of horizontal and vertical resolution is unseen in ocean models for this region to date. Simulations to date reveal extremely energetic deep circulation with complex eddy pairs with high variability both seasonally and annually. In the deepest parts of the South China Sea, circulation is increasingly influenced by topography, most especially the NE-SW chain of sea mounts that extends from Luzon and divides the basin. We have identified Deep Western Boundary Current intensification shifts from the western slope of Zhongsha Island in upper depths to the eastern slope at depths ranging from 2500-3500m with maximum currents at 1500-2500m depth. These results are a significant departure from results in the published literature. Work is underway to quantify the never before seen nature of the deep circulation eddy structure by examining the frequency content of the eddy kinetic energy field. We seek to further understand and quantify the role of the Luzon Strait inflow and the influence of the strong internal wave signature on deep ocean circulation and the dynamics of the bottom boundary layer.

Post-Doc Opportunity

We are currently seeking a post-doctoral applicants with skills in any of: ocean physics, numerical modeling, observation analysis, data assimilation, high performance computing, and many others. For further information, visit our website (https://www7320.nrlssc.navy.mil/jobs.php) or contact us using the information at left.