U.S. NAVAL RESEARCH LABORATORY

Submesoscale Eddy Lifecycles

AT A GLANCE

What is it?

Research study to gain a fundamental understanding of ocean submesoscale eddy lifecycle progression and the associated impacts on the surrounding ocean environment.

How does it work?

High-resolution ocean models are used to simulate submesoscale physics. Individual submesoscale eddies are identified and tracked within the model simulations. The dynamical balances, physics, and impacts of the submesoscale eddies will be quantified throughout their lifecycle.

What will it accomplish?

- Understand the dynamics and physics of ocean submesoscale eddies throughout their lifecycle (generation, evolution, and dissipation).
- Know the impacts of the submesoscale eddies on the surrounding ocean environment (ocean re-stratification, heat fluxes, momentum transport), both within and below the mixed layer.

R&D Sponsor(s)

ONR

Point(s) of Contact

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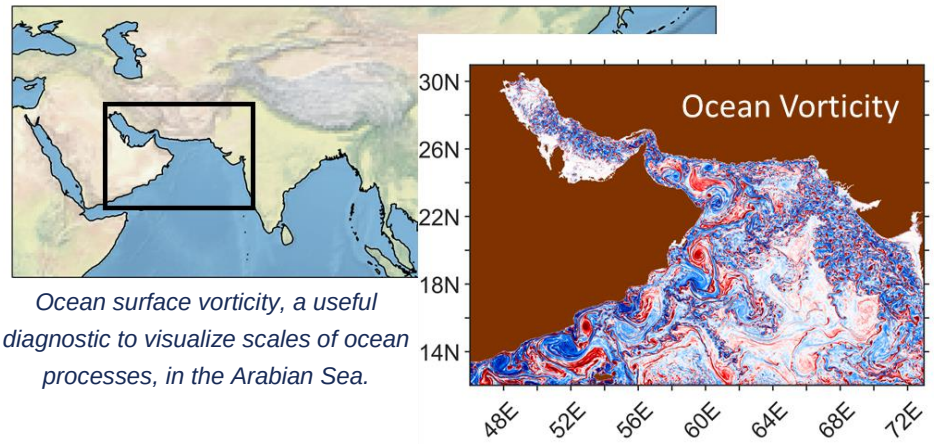
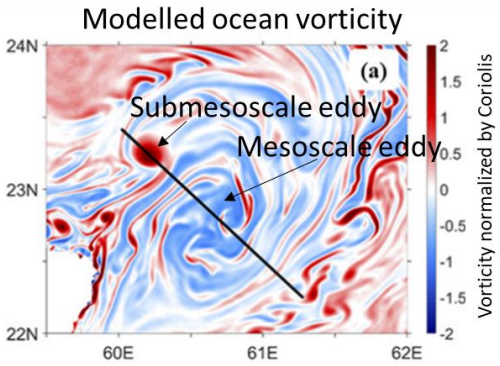


Ocean surface vorticity, a useful diagnostic to visualize scales of ocean processes, in the Arabian Sea.

Submesoscale Eddies

The ocean is a highly variable environment that is impacted by a wide range of processes at varying spatial scales. Mesoscale processes are on the order of 10-300 km, routinely resolved in ocean modelling, and generally accepted to dominate the ocean variability. Submesoscale processes – consisting of small-scale fronts, filaments, and eddies on the order of 1-10 km – have been shown to significantly impact local dynamics. However, submesoscale processes are only resolved in modelling systems with very fine horizontal and vertical resolutions.



Ocean surface vorticity of an isolated mature submesoscale eddy with its parent mesoscale eddy (adapted from D'Addezio et al. 2020).

Currently, there are many uncertainties within the scientific community about submesoscale eddy processes and their impacts on the surrounding ocean environment. In this study, we use high-resolution hydrostatic and non-hydrostatic ocean models to simulate submesoscale eddies in different dynamically active regions and seasons. From these model simulations, we are able to identify, isolate, and track individual submesoscale eddies throughout their lifecycle evolution. This allows us to determine the dynamical balances, physics, and impacts on the surrounding environment at each stage of the eddy lifecycle. Understanding submesoscale eddy processes and impacts in various regions and seasons will allow for representing the effects in ocean forecasts.

Post-Doc Opportunity

We are currently seeking post-doctoral applicants with expertise in one more areas of: oceanography, ocean modelling, HPC, applied mathematics, meteorology, physics, data analysis, numerical analysis, and in situ data processing. For further information, contact us using the information to the left.