



## Sub-Mesoscale Flows in the Coastal Ocean

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Sub-mesoscale flows are characterized by scales between 10 km and 100 m where the strict constraints of geostrophy are being relaxed. This allows for a very specific dynamical regime. Flows at these scales are important because they, in contract to geostrophic turbulence, allow a forward cascade of energy towards the scales of dissipation. In this sense they are an essential conduit as part of the global ocean energy balance. Additionally, the ageostrophic part of the flow allows for significant vertical velocities, which, through enhanced vertical exchanges, have a strong impact on biochemical processes in the ocean.

From both a modelling and an observational perspective, flow at these scale present a challenge. Sub-mesoscale flows are a result of secondary (and higher order) instabilities of a mesoscale straining field. This implies the need to capture both larger and smaller scales. Recent advances in nested computation make it possible to pre-compute a mesoscale eddying field that provides the environment of fronts and straining in which the sub-mesoscale flows exist. Open boundary conditions provide the larger scale information while the higher resolution of the nested domain resolves explicitly the smaller scale processes. This technique of nesting can be repeated several times where the resolution of the finest grid can be down to tens of meters.

The fact that these flows are intermittent, both in space and in time, implicates the need for a very specific observational platform that incorporates the need to find a sub-mesoscale event in a timely matter, together with the capability of the in-situ platform to arrive rapidly and survey at high speed with very high horizontal resolution. Traditional ocean observing methods do not meet these criteria very well. In this presentation, I will present recent modelling results using the Regional Ocean Modelling System (ROMS) as well as observational results from a coordinated rapid response observing system that involves both aerial and in-situ platforms that is designed specifically to observe Sub-mesoscale phenomena in the coastal ocean.