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The Dynamics of Submesoscale Eddies in the Coastal Ocean

High-resolution observations reveal the fast dynamics of submesoscale eddies in the coastal ocean. The eddies seem to play an important role in the ocean energy cascade and are thought to be important drivers for phytoplankton production. The eddies are frequently observed in the coastal and open ocean and are characterized by sharp gradients of $1^{\circ}\text{C}/\text{m}$ and high Rossby numbers >10 .

In order to simultaneously resolve the short temporal and spatial scales of submesoscale eddies, an observational multi-platform approach with planes, a zeppelin, several vessels, gliders, and floats was used yielding a horizontal and vertical resolution of <1 m with repeat observations every 1 to 15 min. The Submesoscale Experiments (SubEx) took place off Catalina Island, CA, and off Bornholm in the Baltic Sea. Observations were carried out with aerial sea surface temperature and hyperspectral measurements, rapid in situ measurements with a towed instrument array, gliders with turbulence probes, as well as surface and subsurface velocity measurements with drifters, as well as Radar and Acoustic Doppler Current Profilers. Additional SAR, SST and ocean color satellite imagery is used to investigate the occurrence of submesoscale eddies in the coastal ocean.

The observations indicate intense mixing, turbulent dissipation and subsequent restratification. The temperature distribution is closely linked to phytoplankton concentrations suggesting a strong bio-physical coupling. High chlorophyll concentrations in the cold core of the eddies indicate upwelling of nutrients or phytoplankton while other eddies indicate an export of phytoplankton to subsurface waters.