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NEW HIGH-RESOLUTION IMAGING OF SUBMESOSCALE SURFACE DIVERGENCE IN A MACRO TIDAL ENVIRONMENT

Jakub W. Michalski 1,2, Adrien C.H. Martin 3, ,Robert Marsh 1, David L. McCann 4, Christine Gommenginger 2
1 University of Southampton, Southampton SO17 1BJ, UK
2 National Oceanography Centre, Southampton SO14 3ZH, UK
3 NOVELTIS, 31670, France
4 National Oceanography Centre, Liverpool L3 5DA, UK8

Submesoscale surface current divergence and vertical velocities are important physical ocean variables in oceanographic studies. They are strongly related to mixing and upwelling: directly affecting critical transports and shelf sea ecosystem processes such as nutrient fluxes, and consequently, primary production. To investigate current divergence and vertical velocities, we utilize fine-resolution (200 m) instantaneous surface current velocity fields from the Ocean Surface Current Airborne Radar (OSCAR) demonstrator: a unique three-azimuth along-track interferometric synthetic aperture radar instrument. The derived divergence and vertical velocity fields at submesoscale allow us to observe the impact of tidal flow over bathymetry on fine surface dynamics. The instrument overflew Ushant Island in the Iroise Sea, west of Brest, France in May 2022, as part of the European Space Agency funded ˜SEASTARex" campaign. This area's strong tidal currents of up to 3m/s, complex bathymetry and coastlines serve as a prime example where submesoscale processes play a crucial role in shaping coastal ocean dynamics. We found that, at 200 m resolution, the divergence is on the order of 10 f (where f is the planetary vorticity), and vertical velocities reach O(0.1m/s) at tidal jet fronts. After coarsening the data to 1km resolution, the divergence is an order of magnitude smaller, highlighting the importance of high-resolution data in accurately capturing the magnitude of these dynamics. Our findings emphasize the need for high-resolution (better than 1 km) 2D observations of total surface current vectors to understand the interplay between submesoscale processes and mesoscale dynamics within coastal and shelf sea regions.