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Estimating global 3D ageostrophic motion at the mesoscale: operational perspectives and future challenges

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First order dynamical balances in the ocean describe a predominantly horizontal and quasi-stationary circulation. However, the small departures from geostrophy that drive the evolution of (sub)mesoscale features generally cause intense vertical exchanges at depth, affecting the marine ecosystem dynamics as well as modulating ocean thermohaline circulation. The synoptic estimation of 3D vertical velocities from observations thus remains one of the main challenges for physical oceanographers. In the framework of the Copernicus Marine Environment Monitoring Service (CMEMS), an observation-based global dataset of vertical velocities at the mesoscale has been developed and will be soon distributed through the CMEMS Multi-Observation Thematic Assembly Centre. Vertical velocities are inferred by applying a diabatic version of the quasi-geostrophic Omega equation to a 3D reconstruction of density and geostrophic velocities, based on the statistical combination of surface information from satellite data and in situ profiles.