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Mesoscale vertical motion from satellite and in situ observations: potential impacts on primary production

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The vertical motion associated with mesoscale structures is of fundamental importance for the exchanges of heat, fresh water and biogeochemical tracers between the oceans surface and interior. In this study we present a new data set of mesoscale vertical velocities derived from applying a quasi-geostrophic diagnostic model to an observational-based product that combines satellite and in-situ data. A first analysis of the vertical velocity field is performed in the extended Gulf Stream area over a 12-year period (1998-2009). It is shown that, for single snapshots (monthly fields), upwelling/downwelling takes place upstream/downstream of meander troughs, with maximum values of around 20 m/day. We further investigate the potential impacts of vertical motion on biogeochemical parameters. Very high correlations (~ 0.98) are found between the latitudinal dependence (zonal and temporal averages) of vertical velocities and primary production. The hypothesis behind these relationships relies on the fact that significant variations in the vertical exchange associated with mesoscale dynamics could impact on the nutrient availability for phytoplankton growth. This study is a contribution towards improving our understanding of the net effect of mesoscale variability on water mass formation and transport at global scale, as well as on its impact on the biochemical tracer redistribution and consequent marine ecosystem response.