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Observation of mesoscale horizontal chlorophyll Stirring: comparison of Finite-size Lyapunov Exponents and chlorophyll structures in SeaWiFS images.

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We wish to understand the role of horizontal stirring on the creation of Chlorophyll (Chl) filaments observed in the region of the POMME experiment in the Northeast Atlantic. The region is characterized by a strong meridional gradient in productivity, with rich waters in the north and relatively poor waters in the south. This variability is mainly the result of a meridional differences in winter mixed layer depth. We compared between spatial patterns of chlorophyll distribution in 1 km SeaWiFS images, and manifolds that describe the filamentation of the geostrophic surface currents derived from satellite altimetry data. The manifolds are calculated by applying the finite size Lyapunov exponents (FSLE) technique. We found several cases where there is similarity between spatial structures of Chl and the manifolds. In these cases there is an intrusion of rich waters to the south and poor waters to the north. This evidence small scale horizontal mixing between the two regions, through horizontal stirring associated with eddies. This provides observational evidence of this mesoscale mixing process, at the scale of filaments. When taking into account the relatively low spatial (1/3 of a degree) and temporal (output file every 7 days) resolution of the satellite altimetry data from which we extract the geostrophic velocities, there is a surprisingly good agreement between spatial structures of Chl distribution and the manifolds. The FSLE technique seems to be a useful tool for describing mesoscale Chl patterns that are associated with horizontal stirring.