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Small scale transport processes from HF-Radar

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Coastal ocean ecosystems are major contributor to the global biogeochemical cycles and biological productivity. Physical
factors induced by the turbulent flow play a crucial role in regulating marine ecosystem. However, while large scale dynamics
in the open ocean is well described by geostrophy, the role of small scale transport processes in coastal regions is still
poorly understood due to lack of continuous high-resolution observations. Here, the influence of small-scale coastal dynamics
on surface phytoplankton structuring is studied using Lagrangian metrics computed from HF Radar currents and satellite
chlorophyll-a (Chl). The combination of complementary Lagrangian diagnostics, including the accumulated divergence of the
flow along fluid trajectories, provides an improved description of the 3D flow geometry which facilitates the interpretation of two
non-exclusive physical mechanisms affecting phytoplankton patchiness. Attracting submesoscale fronts, unveiled by backwards
Lagrangian Coherent Structures, are associated to negative Lagrangian divergence where particles and Chl standing stocks
cluster. Filaments of positive Lagrangian divergence, representing large accumulated upward vertical velocities and suggesting
accrued injection of subsurface nutrients, match areas with large Chl concentrations. Our findings demonstrate that an accurate
description of small-scale transport processes is necessary to comprehend bio-physical interactions in coastal seas and to
estimate biological productivity.