

Detecting and tracking eddies in oceanic flows: A vorticity based Euler-Lagrangian method

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Algae blooms as recurrent events in the Baltic Sea are an increasing natural hazard. Sandulescu et al. show in numerical simulation in [1] that eddies can play the role of an incubator for an algae bloom. Inside the eddy nutrients and plankton are trapped and can then be transported across rather long distances. To gain insight in mechanisms of algae bloom evolution detection and tracking of eddies is of interest.

Based on the idea to interpret an eddy as a region that is bounded by manifolds and has an elliptic fixed point inside them, we develop an Euler-Lagrangian eddytracking tool using the idea of Lagrangian descriptors [2] and the vorticity. To test how well the tool detects eddy tracks and shapes, and estimates eddy lifetimes, the method is applied to a synthetic van Karman-Vortex Street. The results are compared to an eddytracking tool by Nencioli et al. [3]. Even velocity fields incorporated with different types of noise are taken into account to test the robustness of the tool. Finally, both methods are applied to velocity fields of the Baltic Sea.

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[2] J. Jimenez-Madrid and A. Mancho, *Chaos*, 19, 013111-1-18, (2009).

[3] F. Nencioli, C. Dong, T. Dickey, L. Washburn, and J.C. McWilliams, *J. Atmos. Ocean Tech.*, 27, 564-579, (2010).