Geophysical Research Abstracts
Vol. 12, EGU2010-4694, 2010
EGU General Assembly 2010

Lagrangian analysis by clustering. An example in the Nordic Seas.

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We propose a new method for obtaining average velocities and eddy diffusivities from Lagrangian data. Rather than grouping the drifter-derived velocities in uniform geographical bins, as is commonly done, we group a specified number of nearest-neighbor velocities. This is done via a clustering algorithm operating on the instantaneous positions of the drifters. Thus it is the data distribution itself which determines the positions of the averages and the areal extent of the clusters. A major advantage is that because the number of members is essentially the same for all clusters, the statistical accuracy is more uniform than with geographical bins.

We illustrate the technique using synthetic data from a stochastic model, employing a realistic mean flow. The latter is an accurate representation of the surface currents in the Nordic Seas and is strongly inhomogeneous in space. We use the clustering algorithm to extract the mean velocities and diffusivities (both of which are known from the stochastic model). We also compare the results to those obtained with fixed geographical bins. Clustering is more successful at capturing spatial variability of the mean flow and also improves convergence in the eddy diffusivity estimates. We discuss both the future prospects and shortcomings of the new method.