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Nonlinear Processes in Geophysics
Discussions

Interactive comment on "Detecting and tracking eddies in oceanic flow fields: A vorticity based Euler-Lagrangian method" *by* R. Vortmeyer-Kley et al.

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A theory and computational procedure of identifying material eddies objectively from the Lagrangian-Averaged Vorticity Deviation (LAVD) has already been developed in the following manuscript:

http://arxiv.org/abs/1506.04061

This manuscript has been posted on-line in arxiv.org since June 2015, and it is now in press at the Journal of Fluid Mechanics.

The above JFM manuscript gives:

(1) A precise mathematical definition of vortex cores and vortex boundaries through the notion of rotational coherence, valid both in 2D and 3D

(2) An exact decomposition of the deformation gradient that isolates an objective material rotation angle (dynamic rotation) for the assessment of rotational coherence.

(3) A theorem this objective material rotation angle is precisely equal to the LAVD.

(4) A theorem on how LAVD-based vortex cores will prevail as attractors/repellers for inertial particle motion in geostrophic eddies.

(5) A related instantaneous Eulerian vortex definition that is also objective, using the derivative of the LAVD.

(6) A total of 6 (six) numerical examples, both 2D and 3D, both steady and unsteady, including a 2D unsteady and a 3D unsteady ocean data set.

(7) Illustration in all examples that all LAVD-based material eddies do remain rotationally coherent under advection (no transverse filamentation arises in their boundaries)

(8) Comparison with two other available objective eddy detection methods.

Therefore, a rigorous and frame-independent theory has already been developed for the same objective that is pursued by the Authors of this NPG submission in a heuristic and frame-dependent fashion. A new feature in their manuscript is the lifetime assessment for a larger set of eddies. This can, however, be carried out (now in an objective and mathematically precise fashion) with LAVD, at the same computational cost, with precisely defined eddy boundaries and eddy cores, and with mathematically guaranteed rotational coherence under Lagrangian advection.

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