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Ocean Science Discussions

Interactive comment on "Single super-vortex as a proxy for ocean surface flow fields" *by* Imre M. Jánosi et al.

Anonymous Referee #1

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In this work the authors focused on a well-studied area along the U. S. West Coast, where the mesoscale eddies are the dominating features. At first, they described the characteristics of an ideal Gaussian isolated vortex, highlighting the relationship between the total kinetic energy and the enstrophy in absence of dissipative forces. After that, the authors make use of daily gridded Sea Level Anomaly data for a period of 8035 days to show the time series of the total kinetic energy and the enstrophy. They found a not trivial strong correlation between the two quantities, which increases in function of the dimension of the area of integration and with the distance from the coast. From the relationship between the energy and the enstrophy, they extract the effective size of a hypothetical Gaussian super vortex which in some way may constitute a model for the eddies. The comparison between the hypothetical super vortex and the existing ed-

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dies has been computed thanks to an eddy geometrical census procedure developed by Chelton et al. (2011). In conclusion, the authors proposed a simple description of the geostrophic ocean surface flow fields, highlighting the fact that a shielded Gaussian super vortex has finite total kinetic energy and enstrophy and the ratio of them is proportional to the square of the radius of the vortex. Furthermore, they calculated the two quantities from altimetry data and computed the mean eddy size, which was comparable with the radius computed from the traditional eddy census. The method implemented cannot substitute the traditional eddy detection algorithms, but can be useful to extract coarse grained statistics. Furthermore, the authors computed, as an illustrative example, the westward drift velocity of eddies from a simple cross correlation analysis of kinetic energy integrals.

The paper is well structured and the results are original. I think it can be very relevant for the international community.

I just suggest some minor remarks:

Pg 1 ln 15: You can add “some exceptions to the remote sensing of eddies are the in situ description of an anticyclone in the North Atlantic by Martin and Richards (2001) and the sampling of an anticyclone in the Algerian basin along its main axes by Cotroneo et al. (2016)”

Pg 2 ln 17: You should add the aim of this work that is missing in the section “Introduction”

Fig 1: add the geographical references, the square and the stripes of integration and finally the “visual contour” of the super vortex (see pg 4 ln 17).

Pg 3 ln 11: Why the core of such a vortex is surrounded by a ring of opposite vorticity? Add references or explain better

Pg 8 ln 23: algorithm

Pg 8 ln 33: why did you chose 60 days? Please, provide a reason.

In general, I suggest in the future (not for this work) to test your method in other regions, where the properties of the eddies and the altimetry data may be have different characteristics.

References:

Martin, A. P. & Richards, K. J. Mechanisms for vertical nutrient transport within a North Atlantic mesoscale eddy. Deep Sea Res. Part II Top. Stud. Oceanogr. 48, 757–773 (2001)

Cotroneo, Y. et al. Glider and satellite high resolution monitoring of a mesoscale eddy in the algerian basin: Effects on the mixed layer depth and biochemistry. J. Mar. Syst. 162, 73–88 (2016).

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