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Discussions

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

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We thank the Referee for the report and the supporting remarks. Please find here our responses to the critical comments. We attached the revised manuscript as Supplement to the previous Response to Referee #1, we refer to its figure-page-line numbers here.

Referee remark (1): "Major comments: The Relationship of IKE vs Iz in case of Gaussian shape vortex is not surprise for me, which was previously noted in Li et al. (2018). They used area instead of 1/2Rˆ2, then applied to census of global ocean eddies without any validation [Li et al., 2018]. It is interesting that the direct integration of oceanic data (Figure 2) supports this relationship. Nevertheless, this notation should be clearly

presented as this study has done. Please add a short notation addressing this issue after equation (5) in section 2."

Response (1): Many thanks for pointing out the reference. We inserted the citation and mention it where it is requested (page 4, lines 19-20). Nevertheless we think that the context of Liu et al. (2018) is rather different, and not only the lack of validation is missing there.

Referee remark (2): "Figure 3. I don't understand what Red crosses (black squares) mean from the caption of figure. For example, why there are so many red crosses at a given area, e.g., 3.0*10ˆ5 km2, what's the difference? Even I have read the explanations in Lines 10-13, page 4. The authors should add both some notations in figure caption and some explanations in result."

Response (2): We inserted a new Figure (Fig. 4 in the revised manuscript) in order to better explain the integration frames. As for the red and black symbols in Fig. 3 (now Fig. 5), we clearly describe (page 5, lines 9-13) that they belong to equal-area meridional stripes of width of 1 and 2 degrees (vertical stripes on Figs. 1 and 4), the difference between them is their main distance from the shoreline.

Referee remark (3): "The result in Figure 3c implies that there is a linear relationship between the eddy amplitude and the eddy scale. The larger the eddy is, the higher the amplitude is. Authors may want to address this in revision."

Response (3): We do not entirely understand this remark. Fig. 3c (Fig. 5c in the revised version) refers to the "super-vortex" amplitude parameter obtained from Eq. (4). The linear behavior (or stable saturation after proper normalization shown in Fig. 5c) indicates only that the total kinetic energy is almost homogeneously distributed over the study area.

Referee remark (4): "Figure 4. I suggest authors trying eddy area other than eddy scale in Figure 4a, since authors have already noted that area is an important parameter in the study. The result of eta_0ˆeff (∼0.7 m) in average may be 10 times of that obtained by eddy identification method (e.g., Chelton et al., 2011; Li et al., 2016), which can be also seen from histogram for eddy height in Figure 4b, where the height peaks at about 0.07 m. So I simply suspect that authors might incidentally make some mistake for this parameter by ignoring the gravitational acceleration g in the calculation."

Response (4): We do not think that 'g' is missing from our estimate. As explained in details, eta_0ˆeff (∼0.7 m) is derived from the total kinetic energy integrated over an extended region (direct sum of velocity component squares), see Eq. (4). It can easily be higher by a factor of 10 than the mean height of individual eddies. Actually, as it is pointed out, the sum of squared eddy heights is related to eta_0ˆeff.

Referee remark (5): "Figure 5. It is surprising that the difference between eddy radius and eddy scale minimizes at near shore region, but maximizes at off shore region. Could authors address more about this?"

Response (5): Thanks for this remark, it is an interesting point. We think that this behavior is related to the fact that the near shore region is the main place of mesoscale eddy formation, which is a complicated process including wind forcing, interaction with the California Current System, rough shoreline effects, bottom friction in the shallow regions, etc. At the moment we have not enough knowledge on the transient phases of ME formation, nevertheless the height of an eddy must have an increasing phase at the beginning. We need more detailed analysis to go beyond speculations.

Referee remark (6): "Figure 5. The square of the fitted height parameter is proportional to the sum of the square of all individual eddy amplitudes. Could authors go further to find a simple relation between them, like IKE/IZ = 1/2Rˆ2?"

Response (6): We do not entirely understand this remark. The first quantity is derived from the total kinetic energy integrated over an extended region (direct sum of velocity component squares). The second quantity is derived from vortex census, amplitudes are from SLA values. Their stable ratio is around 2 (Fig. 7b), and we do not know

where to go further.

Referee remark (7): "The cyclonic eddies have relatively faster westward propagation speeds than anticyclonic eddies, which is seldom mentioned as far as I know. Could authors make some further explanations?"

Response (7): As requested, we inserted a related statement (p. 10, l. 30-32 in the revised version) as follows: "Theoretical considerations suggest that anticyclonic eddies might drift faster than cyclonic ones (Cushman-Roisin et al., 1990), however we could not detect statistically significant difference between the two subgroups of trajectories."

Referee remark (8): "Minor comments: Figure 1. Add the point 40N, 130W in this figure with a notable symbol."

Response (8): Following the suggestions of both Referees, we inserted a new Figure (Fig. 4 in the revised manuscript) to illustrate all the integration frames and locations.

Referee remark (9): "Figure 2. Add the coefficient of two curves in the figure, if possible."

Response (9): We are sorry, we cannot understand this request. The rescaling factor of integrated kinetic energy is clearly printed in both panels, and repeated in the caption.

The typo is corrected, thanks.

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