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**Response to Referee #2**

We are grateful for the comments of the referee. We appreciate very much the time and effort which the referee has devoted to our manuscript. The report will enable us to improve the presentation of the material and to put it into the right context. Here we list all the critical remarks and questions (in italics) and give an explanation of our points.

General evaluation:

***RC2****: I am generally favorable of the work but have a few comments and questions that I hope the authors can address.*

**Response**: Many thanks for the supporting opinion.

Comments and questions:

***RC2****: In the abstract, please consider replacing "super vortex proxy" with "vortex proxy." As you mention in the text, the word "super" may be an overstatement.*

**Response**: Thanks, we deleted the term "super" from the abstract.

***RC2****: In Fig. 1, it is unclear from the caption if the quantity being visualized in (b) is* $|v_g - v_g'|^2$ *or* $|v_g|^2 - |v_g'|^2$*. Please be more explicit.*

**Response**: Thanks for this question, we reformulate the caption for Fig. 1. Actually, as described in Subsection 2.1, the AVISO data sets contain two velocities. The "raw" geostrophic velocities $[u_g, v_g]$ are determined directly from the measured SSH (sea surface height) data. Velocity anomalies $[u_g', v_g']$ are determined as deviations from the long term mean values over the period of 1993-2012 for each grid cell. The latter is assumed to represent short term anomalies related e.g. to drifting mesoscale eddies. The first kinetic energy snapshot (Fig. 1a) is determined directly from $[u_g', v_g']$ data as $\frac{1}{2}(u_g'^2 + v_g'^2)$ and called eddy kinetic energy. The second snapshot (Fig. 1b) is determined as the difference $\left[\frac{1}{2}(u_g^2 + v_g^2) - \frac{1}{2}(u_g'^2 + v_g'^2)\right]$. This appears now explicitly under Fig. 1.

***RC2****: On line 74, you compare the results to the dataset of Faghmous (2015). Is there a reason? Have you considered also using Chelton et al dataset? Can you please comment in the paper? Would doing so constitute too much additional work?*

**Response**: We do not know precisely which is the Chelton et al dataset you refer to. There is a continuously growing set of data repositories, most of them are based on AVISO altimetry. We recently do aware of the recent development by Pegliasco et al. (2022), which lists several alternatives (Chelton et al., 2007, 2011; Faghmous et al., 2015; Martínez-Moreno et al., 2019; Tian et al., 2020; Zhang et al., 2013). The first global database was presented in Chelton et al. (2011), covering the 1993–2008 period, and it was regularly updated until 2016. There is no any discrimination in our choice, one point was the large number of eddies recorded by Faghmous et al. (2015), plus the easy access and transparent data format. We will certainly use the newest data sets in the future, but to repeat everything takes certainly a longer time and more efforts. Furthermore, since the detecting algorithms are very similar, we do not expect any new added value by using different data set(s) in our coarse grained analysis. We inserted a related comment into the text.

***RC2****: In eqs. 1,2,3,4, do you use absolute or anomalous values? I suspect you are using SLA, but it is confusing when you use* $v_g'$ *to represent anomalies in Fig. 1 and* $v_g$ *(sometimes v, without subscript) to represent the same thing in the text and equations.*

**Response**: There is no velocity in Eq. (1), and we do not analyse SLA in this work. As for (2), (3) and (4), these are basic mathematical forms only. During the subsequent calculations, we use systematically velocity anomalies, because these are suspected in relation with mesoscale eddies. Nevertheless Fig. 1a illustrates that the so called eddy kinetic energy contain many contributions from the steady currents or their fluctuations around the mean. To be more precise, we indicite in Eqs. (2) and (3) that we are using velocity anomalies, and vorticities computed from them.

***RC2****: In eq. 5, you essentially define* $R_{eff}$ *as the ratio of the EKE to Z. But in eq. 2, R is a parameter representing the radius of the eddy. Can you please comment on the relation between* $R_{eff}$ *and R?*

**Response**: Thanks for pointing out this deficiency. These two parameters are equivalent in the case of an isolated vortex. However, when we use the spatially integrated kinetic energy and enstrophy ratios over the ocean, the integrals can belong to a couple of eddies. There is no any a priori argument why the real radius characterizing the shape of an isolated eddy should be closely related to an $R_{eff}$ parameter related to several eddies (apart from the dimension). We inserted this remark into the text below Eq. (5).

***RC2**: Line 122, the word "inevitable" is perhaps better replaced with another word? I could not understand the sentence.*

**Response**: Thanks for the correction. We changed the word, now the sentence read as: "On the global scale, an analogously detailed analysis would be computationally too excessive, and it does not seem unavoidable."

## References

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