EGUsphere, author comment AC2
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Reply on CC1

Yingli Zhu and Xinfeng Liang

Author comment on "Characteristics of Robust Mesoscale Eddies in the Gulf of Mexico" by Yingli Zhu and Xinfeng Liang, EGUsphere,
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Both Lagrangian and Eulerian methods have been widely used to detect eddies. The selection of the detection method depends on the mesoscale features people are interested in and the definition of eddies also varies with the detection methods. Both methods can provide useful information. It is not fair to claim one is certainly better than others without stating the specific purposes.

In this study, we focused on the mesoscale features with closed SSH contours or streamlines and we called those mesoscale features "mesoscale eddies", which were clearly stated in the method section and widely used in a large number of publications. These mesoscale eddies identified with the Eulerian methods may change form and exchange material with background fluid, but are still interesting mesoscale features with different temperature, salinity characteristics (e.g., Brokaw et al., 2020). In addition, we did not consider the coherence of eddies based on the condition that the rotational velocity of the eddy exceeds its translational velocity and U/C was only used to characterize the advective nonlinearity in this study. For those who are interested in the mesoscale features with closed streamlines, the characteristics of eddies detected with the Eulerian methods are useful. And the results here are comparable to many studies carried out in other regions of the global ocean that used the Eulerian detection methods. Although Eulerian eddy detection methods are likely not perfect, they have been widely used and greatly advanced our understanding of the dynamics and impacts of mesoscale eddies over the past few decades. The Eulerian methods of detecting eddies are still under development and used in recent studies. For example, one Eulerian method was still used in the eddy trajectory product released by AVISO (Pegliasco et al., 2021a, 2021b; Pegliasco et al., 2022). Based on Eulerian methods, many eddy characteristics in other oceans and the global ocean were reported in recent studies (e.g., Escudier et al., 2016; Schütte et al., 2016; Keppler et al., 2018; Laxenaire et al., 2018; Pessini et al., 2018; Trott et al., 2018; Mason et al., 2019; Martínez□Moreno et al., 2019; Chen et al., 2022; Atkins et al., 2022; Evans et al., 2022; López-Álzate et a., 2022).

Please note that in this study we did not draw any conclusions on eddy-induced transport, for which Lagrangian detection methods are indeed better choices. In addition, although we are aware of your recent paper (Andrade-Canto et al. 2020) that focused on the coherent Lagrangian vortices with boundaries that withstand stretching or diffusion, because as you said we utilized the Eulerian rather than Lagrangian based methods in this study, we did not cite your paper.

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