

Referee's Report on "**Assessing the Material Coherence of Mesoscale Eddies as described from In Situ Data**" by Barabinot et al. submitted to Ocean Science explored the material coherence of mesoscale eddies using in situ data.

From my point of view, this manuscript is not well **organized**. The key points/findings are not clearly shown in the abstract and conclusion sections. This introduction is very long, but the scientific questions are not well introduced/addressed, and I do not think the authors need some many short paragraphs in the introduction section. The authors also use two sections (Section 3 and section 4) to introduce the methods, it may be better to incorporate them into one section. The results shown here are not very convincing to me. There are no discussion section in this manuscript. Without discussions, the reader would not know the limitations and implications of the manuscript. Last but not the least, there are many typos and nonstandard writing. I suggest the authors carefully double check the writing, calculation and statements.

Main concerns:

1. I do not think the authors need to get the climatology temperature and salinity profiles from two different datasets (ARGO and WOA2023). How

are the temperature and salinity anomalies calculated? Are the seasonal cycle removed?

2. In the vertical, eddies will tilt with depth. In horizontal, most eddies are not circular or elliptical in shape. The 3D reconstructions of eddies shown in figures 10-12 are not convincing.

3. The authors argue that surface mesoscale eddies detected from satellite altimetry data do not match with subsurface eddies from in situ data. There are many factors may cause this, such as the TOEddies algorithm, the methods and data used to extract the subsurface temperature/salinity anomalies here. The authors should double this before they draw any conclusions.

Monir comments

1. Section 3.2

$1.10^{-6}^{\circ}\text{C.m}^{-1}$, $0.6.10^{-4}^{\circ}\text{C.m}^{-1}$, $7.6.10^{-6}^{\circ}\text{C.m}^{-1}$ and $2.5.10^{-2}^{\circ}\text{C.m}^{-1}$ are incorrect.

2. Each panel should be labeled as in figures 4-5. The top right colorbar for the salinity seems incorrect to me.