

Review of the manuscript egusphere-2025-5038 “**Polarity and direction dependence of energetic cross-frontal eddy transport in the Southern Ocean’s Pacific sector**” by Huimin WANG, Lingqiao CHENG, Erik BEHRENS, Zhuang CHEN, Jennifer DEVINE, and Guoping ZHU submitted to *EGUsphere*

I believe the manuscript has improved substantially after revision, and the authors have made a considerable effort to address the reviewers’ comments. For this reason, I would like to congratulate the authors on the work they have done. The study is very interesting and, although it presents some limitations, these are now clearly acknowledged and appropriately discussed.

I was particularly surprised by the number of cross-frontal eddies identified, although only a limited fraction of these appear to be fully cross-frontal. It could be interesting, in future work, to compare these results with those obtained using a different eddy detection and tracking method, and to assess the impact of using daily frontal positions instead of climatological fronts. However, I do not consider these additional analyses necessary for publication.

Overall, I think this work represents another important step toward a fuller understanding of the mechanisms by which ACC eddies contribute to the meridional transfer of heat and tracers, as well as their influence on the carbon cycle. In my opinion, the manuscript is now suitable for publication.

Minor issues

In the Supplementary Material, I could not find the section titled “Sensitivity Analysis Based on a ± 25 km Half-Width.” Perhaps I overlooked it, or it may have been omitted from the Supplementary Material by mistake.

At lines 90–91, you could consider adding a more recent reference, such as Ferola et al. (2023, The Role of the Pacific-Antarctic Ridge in Establishing the Northward Extent of Antarctic Sea-Ice), which shows that the Pacific-Antarctic Ridge deflects ACC and associated eddies northward and constrains their trajectories until they can cross the topographic barrier near the Udintsev Fracture Zone.

At line 366, please replace “pro-crossing” with “pre-crossing.”