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# *Interactive comment on* "Eddy characteristics in the South Indian Ocean as inferred from surface drifter" *by* Shaojun Zheng et al.

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This manuscript presents an analysis of eddies detected using GDP drifter trajectory data. There are two categories of data which can be used for eddy detection: the one is Eulerian data, and the other is Lagrangian data. The GDP data belong to the latter one. Using the GDP drifter trajectory data to study eddy characteristics is not new, but its application into the SIO is the first time so far as I know. The trajectory sampling number shown in the manuscript assures the analysis is statistically significant, especially in the center of SIO. The topic is very interesting to readers of the journal and the study will make a contribution to the scientific understanding of the physical processes in the SIO. The manuscript is well written. I enjoy reading the manuscript. However, in general, the analysis of the eddy data set needs to be enhanced. Given the large area of the



study, though it is difficult to discuss the mechanisms of eddy generation, evolution and termination, it is useful to make some attempts in this aspect.

Reply: Thank you very much for your valuable and constructive suggestions to our work, and our replies are as follows.

Specific Comments:

1) A loop is not equal to an eddy. Given the complexity in the physical processes in the ocean, a loop made by a drifter could be not enough to make sure it is trapped just by an eddy. Applying the inertial criteria is a good start but not enough. I suggest that the authors use two or more loops made by the drifter as another criteria in eddy detection and see if it significantly affects the result. And also removes those loops with the scale as the basin scale.

Reply: Thank you very much for your comments. We use two loops as criteria in eddy detection (see fig.1 below), and the result is similar. Actually, eddies with period less than double local inertial oscillation period are not included to remove inertial oscillation in our study, and loops are clustered to one eddy in detection algorithm. And eddies are under basin scale from Fig.6 in the manuscript.

2) Another concern is that the background current mean should be removed in the analysis, especially near the western boundary current. When the mean current is removed, the reconstruction of a trajectory will not affect results in other areas but near the jet.

Reply: Thank you very much for your comments. Indeed, in the western boundary, current is near the jet. While eddies based on in situ observations (de Ruijter et al., 2002; Swart et al., 2010) and altimetry (Schouten et al., 2003) show similar character with our result in the Mozambique Channel. At same time, mesoscale eddies appear mainly along center line of Mozambique Channel (see fig.1 below ), and western boundary current does not show strong influence in mesoscale eddies in this region.

Therefore, we don't discuss the interaction of eddies with background current in our manuscript.

de Ruijter, W. P. M., Ridderinkhof, H., Lutjeharms, J. R. E., Schouten, M. W., and Veth, C.: Observations of the flow in the Mozambique Channel, Geophys Res Lett, 29, 2002.

Schouten, M. W., de Ruijter, W. P. M., van Leeuwen, P. J., and Ridderinkhof, H.: Eddies and variability in the Mozambique Channel, Deep-Sea Research Part Ii-Topical Studies in Oceanography, 50, 1987-2003, 2003.

Swart, N. C., Lutjeharms, J. R. E., Ridderinkhof, H., and de Ruijter, W. P. M.: Observed characteristics of Mozambique Channel eddies, Journal of Geophysical Research-Oceans, 115, 2010.

3) Some speculations about why there are more anticyclonic eddies detected than cyclonic eddies should be presented in the text. 10 % difference between the numbers of cyclonic and anticyclonic eddies guarantees an explanation.

Reply: Thank you very much for your comments. In our study, the number of anticyclonic and cyclonic eddies is comparable with mesoscale eddies. However, in submesoscale eddies, submesoscale anticyclonic eddies number is more than submesoscale cyclonic eddies, and the submesoscale anticyclonic eddies mainly appear in the center South Indian Ocean. The spatial distribution of submesoscale anticyclonic eddies may affect by convergence of surface current in this region, and is similar to "garbage patches" mentioned in our manuscripts page 9, line 12-15.

4) More discussion about small scales of eddies (submesoscale) should be presented.

Reply: Thank you very much for your comments. We add more discussion in the Paragraph 4 as in follows: In Paragraph 4, "From model study in the Southern California Bight, most of eddies are in geostrophic balance, but some submesoscale eddies are ageostrophic balance for a finite value of local Rossby number (Dong et al., 2012). The spatial of submesoscale eddies are different from large eddies, which may be



controlled by above different type of dynamic balance. The distribution of large eddies is corresponding to large EKE region (Fig.9a and Fig.12), while submesoscale eddies are densely distributed over entire SIO, with high number of submesoscale anticyclonic eddies in the subtropical basin in central SIO (Fig.9d)."

Dong, C., Lin, X., Liu, Y., Nencioli, F., Chao, Y., Guan, Y., Chen, D., Dickey, T., and McWilliams, J. C.: Three-dimensional oceanic eddy analysis in the Southern California Bight from a numerical product, Journal of Geophysical Research-Oceans, 117, 2012.

5) The availability of the data samples will affect the results. It should be discussed in the text.

Reply: Thank you very much for your comments. We discuss data samples and eddies in the page 8, line 5-11. The method of eddy detecting works well in the sparse drifter region, and the data samples do not obviously affect the results for large data samples in the study region.

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Interactive comment on Ocean Sci. Discuss., 11, 2879, 2014.

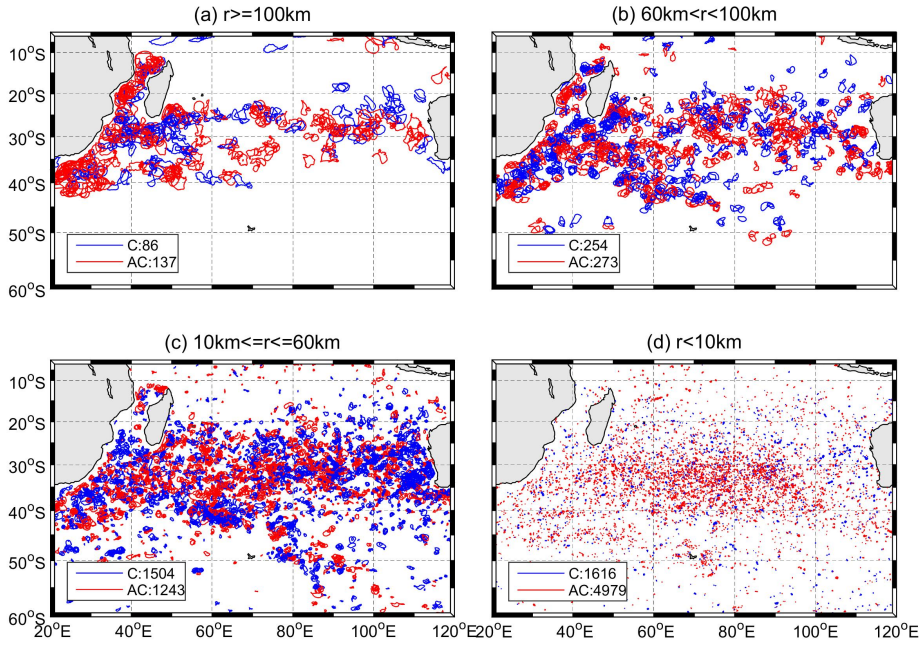


**Fig. 1.** Spatial distribution of cyclonic and anticyclonic eddies detected from drifters in the SIO.