

Ocean Sci. Discuss., referee comment RC2  
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## **Comment on os-2021-33**

Anonymous Referee #2

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Referee comment on "Characteristics and robustness of Agulhas leakage estimates: an inter-comparison study of Lagrangian methods" by Christina Schmidt et al., Ocean Sci. Discuss., <https://doi.org/10.5194/os-2021-33-RC2>, 2021

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This manuscript studies the Agulhas Leakage estimates and changes in its thermohaline properties after leaving the Agulhas Current and before entering the South Atlantic. The authors use two offline Lagrangian tools, Parcels and Ariane, based on the velocity field obtained from a 1/20 degree ocean sea ice model covering 1958-2014. They find a robust estimation between the two tools regarding the variability and trend of the leakage, although the mean (climatological) value could vary a lot. They also identified cooling and freshening occurs when the water moves from the Indian Ocean towards the Atlantic Ocean, and a density increase since the thermal effect dominates.

This work confirms the results from Parcels, which is recently developed, are overall consistent with those from the well-established tool Ariane. This encourages the future applications of Parcels as it is getting more and more widely accepted by the community. This work also compares and discusses different experimental designs in the leakage estimation, which is insightful. The presentation is very clear. I would recommend publication of the work only with a few minor suggestions.

L52: The discussion of Lagrangian particles vs. Eulerian tracers is not clear to me. The authors first say both methods are 'widely used', then the authors say the tracking of Lagrangian particles is 'the most widely used'. This is confusing. I understand the authors want to say they are used to estimate different things. Please consider rewriting this part.

L62: Somewhere in the Introduction, it will be nice to explicitly state that both Ariane and Parcels are offline tools instead of online. (Or maybe they can also be implemented into the GCM and run online?)

L113: It is mentioned the hindcast simulation using JRA55-do covers 1958-2019. But here it says 1958-2014. Did I miss anything?

L136: What if a single simulation of 57-years is performed with the particles continuously released at the 32S section? What is the advantage of the current design compared to this one? Could a recirculated particle that could 'pollute' the source be the reason?

Fig. 1: It will be nice to label Cape Basin on the map. Plus, please indicate what the red dots represent in the caption.

L411: There are two 'for example's in this sentence. Please consider rewriting.