

***Interactive comment on “Indian Ocean subtropical mode water: its water characteristics and spatial distribution” by T. Tsubouchi et al.***

**Anonymous Referee #1**

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General: The authors present a careful description of the Indian Ocean Subtropical Mode Water (IOSTMW) using a three-dimensional hydrographic dataset. They show that IOSTMW represents a robust signal in the southwestern Indian subtropical gyre and calculate their properties. The paper presents a first estimate of the distribution area and water properties since early studies based on synoptic surveys.

So the paper is certainly worth publishing. However, I think the paper could be polished up a bit and I offer some suggestions on ways to do that.

1) No clear IOSTMW definition is given which makes the first part of the study confusing. I would recommend clarifying that in the first part of the paper.

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- p.728 lines 10-20: the authors show that two cores of layer of minimum vertical temperature gradient (LMVTG) are observed in the in the South Indian Ocean. They observe that the lighter core ( $T \sim 15.5$ – $17.5^\circ\text{C}$ ) is robust and shows a maximum of occurrence in the western basin. Then they conclude that IOSTMW has a robust structure in the western basin. So is the definition of IOSTMW a layer of LMVTG between  $15^\circ\text{C}$  and  $18^\circ\text{C}$ ?

- p.728 lines 20-25: the second core is associated with a mode formed north of the STF and another mode formed north of the SAF. SAMW is said to be the mode formed North of SAF. So what is the mode water formed north of the STF? Why wouldn't it be IOSTMW?

- P.729 lines 1-5: the authors prefer not answer this question in this study. Although I understand that a detailed answer to this question would be another paper, I feel like there is a need to better define what is the IOSTMW in a paper specifically on this subject.

- Why not plotting a longitudinal (or even better, an along Agulhas Retroflexion) section of  $dT/dz$  or PV (distance from Africa, versus density)? Then we could clearly see if there is any link between the LMVTG on 26.1 and the LMVTG on 26.6. The low frequency of occurrence of LMVTG in the density class 26.2–26.5 could be due to the fact that the surface circulation is not inline with surface isopycnals in the central Indian Ocean. The Agulhas crosses very quickly surface isopycnals of 26.2 to 26.6, because, in the central Indian, surface isopycnals have a strong SW-NE direction, while streamlines have a strong NW-SE direction. So STMW could be continuously formed north of the Agulhas with density ranging from 26.1 to 26.6, but with a core in the 26–26.1 and a core in the 26.6–26.7.

- It wouldn't change the nice results of this study if the 26.1 and 26.6 LMVTG were in fact connected. It is just a matter of definition of these water masses. But I think having this piece of information could greatly improve the definition and help in understanding

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author's choices.

2) P. 729 line 3: the authors state that it would be difficult to separate the two mode waters using the IOHB climatology. Why? Is it not accurate enough?

3) P. 731 line 2: It is said that the salinity stratification is 0.07 psu/100m without explanation. Is it an assumed vertical stratification or is it calculated? If it is calculated, it could be great to add a standard deviation. If it is assumed, it could be great to mention whether this assumption is sensitive on the PV calculation.

4) Fig 5 displays close PV contours with a minimum in the center. The minimum PV is really inside closed streamlines contours. Is it any related to a Rhines and Young (1982) homogenization of PV? Where do the 26.1 layer outcrop? It's maybe not really the issue of the present paper, but would have important implications for thermocline ventilation. Why not providing IOSTMW Oxygen content? Is it a layer as ventilated as SAMW?

5) The author conclude that the IOSTMW is about 1°C lower than in previous studies. Why is there such a difference? Previous studies were based on synoptic surveys, which I believe are included in the IOHB. Was the water at 32°S during the survey, colder? Or is it due to a different definition of IOSTMW?

6) I am wondering why the author chose not to use Argo data. The Argo array provides an unprecedented amount of data, especially in the poorly sampled Southern Ocean and could be of great support for describing IOSTMW characteristics and distribution area.

7) Figures are very small, especially Fig. 4.

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