

Ocean Sci. Discuss., referee comment RC2
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Comment on os-2021-120

Anonymous Referee #2

Referee comment on "The Levantine Intermediate Water in the western Mediterranean and its interactions with the Algerian Gyres: insights from 60 years of observation" by Katia Mallil et al., Ocean Sci. Discuss., <https://doi.org/10.5194/os-2021-120-RC2>, 2022

General comments

The ms presents an analysis of an extensive amount of thermohaline data in the Algerian basin from the 60s to almost the present day. From this large dataset, Mallil and coauthors investigate the role of the Algerian Gyres in the transport of the Levantine Intermediate Water (LIW) throughout the basin. Dividing the basin into distinct zones, they estimate temperature and salinity trends in the LIW density classes over different time periods. From a cooling signal detected in the LIW during one of these periods, first off Sardinia and subsequently in the rest of the considered regions, they estimate LIW spreading time periods throughout the Algerian basin.

The ms is rigorous and the conclusions are well supported. It is also well organized and clearly written. The wording of some sentences seems odd to me, but this rarely happens. I urge the authors to revise the use of symbols and units throughout the manuscript (see comments).

In my opinion, this paper is a significant and relevant contribution to the research community, and deserves to be published once the following comments and corrections are taken into account.

Specific comments

L6. Indicate the values within the results section as well. It is stated on line 180 that the LIW is warmer and saltier in the eastern Algerian basin than in the Provençal basin, but the estimated values are not explicitly given there.

L6. Remove salinity units (practical salinity is unitless).

L6-L7. Is the sinking not presumed produced by the regular presence of anticyclonic AEs coupled to the circulation of the Algerian Gyres (L270-L272)? I think it would be appropriate to clarify.

L14-L31. I recommend restructuring this part of the introduction slightly and checking the wording to improve clarity, especially for a reader unfamiliar with the topic and area of study. All the necessary information is already included there, but I find a bit confusing the way it is structured.

For example, one option might be: after explaining the thermohaline functioning of the basin, the exchange across the Strait of Gibraltar and the MOW, one could then describe the LIW as an important constituent of the MOW (describing the origin, properties and general circulation pattern of the LIW in the Western Mediterranean), to conclude by indicating that the circulation of the southwestern region of Mediterranean has been relatively unexplored compared to other areas of the basin, especially regarding the LIW, even though the presence of the Algerian current and the generation of meanders and eddies are well known. Subsequently, in the next paragraph, proceed to describe the results of the MATER program in the region, and so on.

L17. Relatively warm and fresh

L30-L31. LIW core is identified by an absolute salinity maximum and a relative temperature maximum.

L41. 'AEs transport LIW from the vein flowing northward along the continental slope of Sardinia...'. In relation to the previous comment (L14-L31), I think it would be helpful to include a general description of the LIW circulation in the Western Mediterranean so that the reader can more easily follow the introduction. Perhaps (if possible), even include a simple schematic in Figure 1 to help the reader? A subplot/inset?

L64-65. Wording seems odd to me. Please, check it.

L66-L70. I suggest indicating also here briefly what type of observational data will be used in the study.

Figure 1. Indicate in the caption the meaning of the background contour lines and specify

units of the axes in the figure on the left. Also, use lowercase theta for potential temperature in the caption (correct this elsewhere in the manuscript and figures). Uppercase theta denotes conservative temperature.

L103. General comment on 'Removal of outliers': why don't you set an upper density threshold for outliers in the deepest layers (>2000 m)? In Figure 2, one can observe a profile (from the 80-90s approx.?) that reaches a maximum σ_{θ} value around 29.27 kg/m^3 , and which I assume corresponds to the deepest layers. I understand that these values are outside your region of interest in the T-S plane, but why is this profile in Figure 2 not considered an outlier?

Linked to this comment, I think it would be convenient to indicate somewhere in the manuscript the maximum depth of the basin, just to contextualize the depth range of the profile.

L113. Since it has been indicated above (L107) that lowercase theta denotes potential temperature, you might use it here instead. At any rate, temperature and potential temperature are used interchangeably throughout the manuscript, therefore I recommend using one or the other consistently (if temperature is used, clearly state that it means potential temperature throughout the ms)

L114. I suggest explaining here what these data will be used for.

Figure 2. Remove salinity units (practical salinity is unitless), and replace uppercase theta (conservative temperature) with lowercase theta (potential temperature) as indicated above.

L129. General comment on 'Regions of interest': this subsection presents the distinct polygons defined from the different circulation features of the basin. The inclusion of a schematic in Figure 1 sketching those features as recommended before, would also greatly help the reader here.

L131-L132. This sentence sounds strange to me. Check it and consider rephrasing for clarity.

L137. Replace 'south of Sardinia' with 'south and west of Sardinia' since the polygon extends all over that region, and not only off south Sardinia.

L140. Replace 'along-slope LIW vein' with 'Sardinian along-slope LIW vein' for clarity.

L148-L152. I suggest explaining this part at the end of Section 2.1.

L163-L165. I recommend including this information in the explanation of the SOMBA-GE 2012 survey provided in Section 2.1.

L165/Figure 4. Why do you only use layers from 1200 m to bottom (well beneath the LIW core depth range)?

L177. Check 'Western Algerian Gyre'. Do you mean the Eastern Algerian Gyre?

Figure 6. Indicate also in the caption what the white isoline denotes. Add the axes units.

Figure 7. Add axes units. Replace 'density' with potential density anomaly. Check 'Western Algerian Gyre' (Eastern?)

L190. I wouldn't say 'overall increase' since that increase has a lot of uncertainty, only in 2/8 areas R^2 is greater than 0.5. The general increase is much clearer in the case of salinity.

L197. Check wording.

L205. 'A brutal decrease'. Wouldn't it be better to use another word such as 'prominent'?

L212. Indicate that in this period, potential temperature trends present very low R^2 values.

L214-L215. This is a bit difficult to observe in the graph. I recommend changing the vertical grid in Figure 8 so that each dotted vertical line corresponds to the beginning of each year.

Figure 8. Since monthly means are used in the cross-correlation, I understand that the vertical bars refer to the average number of points in EACH polygon (not in ALL polygons). The right y axis label in Figure 8 is a bit confusing to me. I may be missing something. Could you clarify this point?

Caption in Figure 8. Indicate that these are annual means.

Table 1. Could you include the basin-averaged trend as well? Same for Table 2.

Table 2. Check MAI_g (NaNs in Period 1 and 2).

L266. I think the reference should be placed earlier in the sentence.

L270-L272. Just a comment: wasn't the presence of one of them captured during the SOMBA-GE 2014 survey?

L299. Clarify that the cross-shelf transport occurs over the Sardinian continental shelf.

L309. Why 'some positive trends'? According to Table 1, all potential temperature trends are positive for the full period.

L.354. Explain why is it alarming.

Technical corrections

L8. Replace 'the signal' with 'a signal'

L15. Change 'is' to 'are'

L16. Preconditioning

L20. AEs acronym should be defined here, right after 'Algerian Eddies'

L23. water masses

L23. of the whole Mediterranean

L24. MOW acronym should be defined here, following 'Mediterranean Outflow Water'

L35-L36. Delete brackets in the coordinates

L41. Use AEs instead of 'Algerian Eddies' (also in L47)

L54. missing 'r' in further

L60. Sea

L68. broad

L109. Below

L119. Figure 1 must be referenced before Figure 2 (Figure 1 is referenced for the first time on L130. Section 2.3).

L120. Indicate that the 'maximum values' are maximum values within the selected range

L144. Use MOW instead of Mediterranean Outflow Waters

Figure 3. Add axes units in (a) and colorbar units in (b), (c), (d) or indicate them in the caption.

Caption of Figure 5: helpS TO identify

L193. Replace 1969 with 1960.

Caption of Table 1. Replace 'temperature' with 'potential temperature'

L227. Replace 'along-slope circulation' with 'basin-scale along-slope circulation'.

L227. What do you mean by 'shear red'?

Table 2. Delete '(unit)' in caption.

Figure 9. Correct 'PRincipal'. Add axes units.

Caption of Figure 9. L2. Replace 'were' with 'was'

L254. Replace 'right' with 'easternmost'

L264. Indicate that the LIW vein is that off Sardinia.

L283-L284. Specify after 'could be identified' that it was south/west of Sardinia.

L292. The anticyclonic

L317. Vargas-Yáñez (check the spelling). Also in L325.

L342. has

L343. replace 'but' with 'and'?

L359. conTributed