

Review Seyfried et al. 2018

The Northwestern Mediterranean is an important region for the Mediterranean Overturning Circulation through the formation of Western Mediterranean Deep Water. The authors provide an original study of the north Balearic front, bordering the open-ocean deep convection area of the Western Mediterranean. They combine observations and a realistic air-sea coupled model to analyse the thermal and dynamical air-sea coupling for different wind regimes in the north Balearic front region. Particularly, they highlight the importance of the adiabatic Ekman buoyancy flux in destratifying the frontal zone during strong wind event (three times greater than the air-sea buoyancy flux).

I really enjoyed reading this manuscript which I think was clearly written and well structured. I was particularly amazed by the excellent agreement between the coupled model system and the met-ocean observations.

I think the work is significant and deserve prompt publication. I have however a few comments I would like the authors to address before the manuscript is considered for publication.

Minor comments:

p5, l 12: By looking fig 6c), the MLD doesn't seem to deepen only by a few meters, it looks like it deepened from ~25m to ~40m. To avoid this interpretation problem, you should indicate the MLD on the different profiles of the figure, particularly because you mentioned it in the text.

P5, l14: slight is not very quantitative can you be more accurate?

P7, l3-4: Any explanation why these small-scale structures were not observed?

P7, l8: can you quantify how much smaller (10%, 100%,...)?

p7, l 10-11: What about the large 0.2 bias between model and obs in Oct. 26? Is it also due to the fact that the modelled profile was not in the same region/regime? Adding small maps on fig6, with the modelled and observed SST, zooming on the location of the profiles, would help understand if the profile were taken from the same type of region.

P9, l2: "the density does not increase" → the density appears to increase when looking the position of the isopycnal and the colorbar

p9, l11: when you speak about correlation you should give the correlation coefficient in the text, otherwise you should find another term.

P10, l22: E and P are not variables shown in the equation E (4). You should rather introduce  $Q_{net}$  and  $F_w$ .

P11, l2: Can you give the origin or the kind of processes which are part of R? Later on, you speak about advective processes, you should also introduce it here.

P11, l15-16: you could precise that the stratification faint is of the same order of magnitude than the cumulated EBF effect.

P12, l14: in the BNF zone → in the eastern part of the NBF (down-front wind)

p13, l25: "This process is not reproduced in our real case study." → Do you have an explanation why?

#### Typos/ spelling mistakes:

p1,l5: ... modelling system and focused... → modelling system. We focused

p1,l9: I will split the sentence l8-l10 in two, I found it hard to follow.

p4, l19: '..., the horizontal resolution of which is about' →..., with an horizontal resolution of

p6, l12: (of all the .... → from all the ?

P7, l4: marked → intense?

P7, l7: was shown by the model on October 26<sup>th</sup>.

P7, l8: ... an increase in salinity and density [...], except for salinity. → something is not clear, can you double check the meaning?

P7, l15: obviously → slightly?

P7, l22: red → yellow-red?

P7, l28: less strong → reduced?

P8, l17: and after IOP16 (blue lines in fig 8)

p8, l27: The EW section (Fig. 8.b) before IOP16, which crosses the meander (Fig. 7c), intersects the NBF → The EW section (Fig. 8.b) crosses the meander (Fig. 7c) before IOP16. It intersects the NBF

p9, l1: in the heart → in the core?

#### Figures:

fig3: You should add the ticks for all the time mentioned in the text (e.g. 18 UTC on October 27). Did you display the ticks for 0000UTC or 1200UTC?

fig4. Drawing the NBF position on figure 4 would help to follow the text (p7,l9)

fig5: - Can you add an indication of the period of strong wind mentioned in the text (e.g. by an horizontal line on top of the sections?)

- The tick labels cannot be seen clearly. Can you make sure to make them visible?  
You should also plot the MLD on figure (d)-(g) as you discuss it in the text, but it's difficult to locate it on the subplots.

Fig6: You should need the MLD on all profiles and add the criterion used (density based?), for example by a small horizontal line on obs and model profiles.

It's difficult to clearly localised the green dash profile location on figure 4. Could you a subplot where you indicate the position of argo profiles in Oct. 26<sup>th</sup> for both model and obs SST maps? (by zooming on a box such as 42.5N-42.2N / 4.5E-5.5E). Can you also do it for the locations of the 2 profiles taken in October 31<sup>st</sup>? It could help understanding why the profiles doesn't exactly match.

Fig7: - 14: line (a-c) → do you mean (a-b)?

- You should keep a numbering consistent between all figures (increasing from left to right and top to bottom)

Fig8: This figure is difficult to read.

- For clarity, you should leave more horizontal and vertical spaces between the colorbar and vertical sections.

- Can you add axe labels for plots and colorbar?

- Do we need to see all these isopycnals? The superposition of isopycnal doesn't make the figure easy to read. What about keeping the 27 and 28 isopycnals as plain lines and the other as small dash lines? Could you also make sure that the contour labels are visible? (by adding them manually in the middle of the contour line for example?) Can you indicate the surface position of the front on the 25/10 and on 30/11 on top of the section by a specific marker (e.g. reverse triangle, arrow, ...)? You could indicate the cyclonic gyre extension you are mentioning in the text.

Fig 14: Could you indicate, on figure 13 for example, the area chosen for the two regions a and b?