Ocean Sci. Discuss.,
https://doi.org/10.5194/os-2020-38-RC1, 2020

Interactive comment on "Impact of a medicane on the oceanic surface layer from a coupled, kilometre-scale simulation" *by* Marie-Noëlle Bouin et al.

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Received and published: 29 May 2020

General Comments:

In this paper, the authors perform numerical simulations to show how Cyclone Qendreas (2014) impacted the upper ocean salinity and temperature structure near the Strait of Sicily. They show that the ocean response to wind stresses and the precipitation-driven water flux is similar to what occurs within weaker tropical cyclones, in that cooling within the oceanic mixed layer is mostly driven by radiative processes and less due to turbulent mixing below the thermocline. They also show how the ocean response varies in the vicinity of a cyclonic eddy and within a heavy rain region. The

work presented here is novel and highly impactful, and substantiates the existing body of literature regarding medicanes. Outside of a few minor grammar errors and typos, their interpretations of the results are mostly clear. My main critiques regard some inconsistencies in their analysis. Additionally, I would like an analysis about how well the model reproduces observations of the upper ocean. Therefore, I recommend minor revisions to be made based on my comments below.

Specific Comments:

- How well does the model simulate the initial upper ocean temperature and salinity profiles? You compare the NEMO SSTs with satellite observations in section 3.2, however nothing is said about the ability of the model to accurately reflect the vertical structure of this part of the Mediterranean.

- L236-240: add citations to back up what you say are typical flux values for TCs.

- Paragraph starting on L318, and shown in Fig. 9: Do you have an explanation for why the temperature tendency due to TM is stronger than FOR within 20 km? I'm surprised TM contributes so strongly at small radii. FOR is less surprising, as it seems to reach a maximum near the radius of maximum winds, where the wind stress is greatest.

- Following that last point, include what the RMW is in Fig. 9.

- L323: By "throughout the event", do you mean that the integrated effects of ADV-X,Y are to cool the OML by -0.12ËŽC?

- L329-L331 are also confusing and need clarification.

- L345: you say that the mean OML temperature increases between 04-07 UTC on the 7th, but looking back at Fig. 7, the mean temperature decreases throughout the simulation. Where do you see this increase?

- In section 4.2, you argue that the effect of precipitation on upper-ocean salinity drives the differences in cooling between HR and REF. However, from the previous paragraph it seems that some significant stratification due to salinity is already present at the start of the simulation, as the difference in mean OML depth between HR and REF is roughly the mean width of the BL in SFA. Additionally, Fig. 3 suggests that much of the region is already highly stratified. Based on the analysis that follows in section 4, I don't doubt that precipitation from the cyclone further drives differences in heat fluxes between HR and REF. However, I interpret this as HR being already preconditioned to some extent at the start of the simulation, which made the OML in this region more sensitive to the precipitation-driven water flux, a feedback you acknowledge within the discussion. Would you agree with this interpretation?

- Similarly, you say in L394-395 that the surface salinity in HR is only "slightly" fresher by roughly 0.1 psu, however in your earlier analysis of Fig. 10 in section 3.3.2 you claim that the freshening of the OML by 0.1 psu between the 2-21UTC on the 7th is "significant" (L337). Therefore, if the latter freshening is significant, it seems that the initial difference in surface salinity would be significant, further indicating that the upper ocean within HR was preconditioned. Please clarify this discrepancy.

- Lastly, in regard to L85-87 in the introduction, Hlywiak and Nolan 2019 touches on the response of the barrier layer to TCs of category 1-2 strength (see the analysis of the weakest set of idealized, simulated TCs in a high shear, relatively low SST environment). This comment doesn't affect my thoughts expressed above, but it may be worthwhile to compare your results this paper.

Technical Corrections:

- L33: "Surface heat fluxes also act to cool the upper-ocean . . ."

- L47: "Colder SSTs . . . generate weaker cooling and limit the cyclone intensity". I suggest rephrasing this so that it doesn't sound like weaker cooling is the reason that cyclone intensity is limited.

- L58: Re-writing this line as ". . . the BL shoals the ML and isolates it from the colder

waters below, thus making surface heat extraction more efficient" or something similar would make it more grammatically correct

- L69-70 is a bit hard to read because there are too many commas

- L83: "we use of a coupled . . ."

- L93: "The present study aims to investigate. . ."

- L268: ". . . the sea surface height has decreased of 10 cm . . ."

- L301: ". . . in the SFA is given in Fig. 7 . . ."

- L327: ". . . forcing is higher than that of the turbulent mixing,. . ."

- L332: "contributes significantly . . ."

- L341: ". . . 7 November deepens . . ."

- L374: ". . . the WEF is much weaker in EDDY than in REF, as the integrated . . ."

- L439: ". . . deepens the OML by a few meters . . ."

- Fig 10: what is the actual rain rate? Include an additional axis or make this a new subplot.

- Figs 11, 12, 13, and 14 need legends

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