

ANSWER TO REFEREE II

I like the changes that the author has made. The paper is clearer. I think it is an interesting set of results, and it would be good to publish this work.

I thank the comments and suggestion of the reviewer to improve the manuscript. The text has been modified according to the comments in the way detailed below.

The experiment shown in Fig 10 (running the wind period for longer) suggest that these are not steady state results. This somewhat contradicts the plots of the evolution of the temperature and depth of the local maximum (Fig 8 - which I initially interpreted as converging, but perhaps they are simply steadily and slowly cooling/deepening?). I am struggling a bit to understand the implications for the real world. I guess one could argue that we always see calm periods followed by windy periods, but I'm not entirely sure how to think of all these variables and represent the somewhat stable and widely distributed NSTM that we observe. This is a bit different than the discussion of the 'layered' structure (L612)

This concern shouldn't prevent the publication, but perhaps the summary should discuss this a bit.

It is now mentioned in line 617: The location of the NSTM layer in the water column converges to depth values where eroding surface mechanisms (mixing and surface stress) are not effective, with only diffusion remaining as a thermal homogenization process. The latter requires longer time scales than those considered in this study.

The study investigates a mechanism for the formation of the NSTM but does not exclude other possibilities. The observed NSTM could result from the contribution of diverse formation processes. This aspect is mentioned in L 629:

While the present results show that the sequence of calm and windy/ice motion periods in summer leads to the formation of an NSTM layer, this local mechanism does not exclude other processes or locations. Steele et al. (2011) reported the generation of the NSTM layer at the basin scale, where large-scale ocean dynamics play a significant role. Therefore, certain combinations of dynamic mechanisms, either on a local or global scale, can result in the formation of NSTMs.

L9: It's a bit unclear what "this period" refers to, since previous sentences are about both winter and summer. Just write "summer"

L9 It is now written: remain largely unexplored during summertime

L50: Except in this paragraph, the definition of "lead" is an ice-free area. It might be better to stick with this, and specify throughout this paragraph that the author refers to "refrozen leads" here.

L50 it is now written: During the early melting season, refrozen leads become preferential melting sites

L353: I think it would be useful here for the text to explicitly refer to what runs Fig 9a (half melt rate) and Fig 9b (double) represent, as opposed to just the figure. It is confusing (particularly the sentence on L353).

L353 it is now written: A comparison of Figure 9a (run with half melt rate) with Figures 7b and 9b (run with double melt rate) raises

The same comment applies to the caption of Fig 14, for example. Please state what these simulations are, it will make the paper easier to read.

It is now written in Caption Figure 14: Thermal distribution at the end of a 5-day simulated wind period with wind intensity 6 ms⁻¹ and wind factor of 2% without considering the calm period. The upper panel (a) shows the results when the run is initialized with the profile shown in Figure 1. The lower panel (b) display the temperature field when the run is initialized with the profile shown in Figure 12a.