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Ocean Science Discussions



# *Interactive comment on* "Technical Note: Is radiation important for the high amplitude variability of the MOC in the North Atlantic?" *by* D. Nof and L. Yu

**D. Nof and L. Yu**

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After reading the "Technical Note" by Nof and Yu I was quite confused. This short manuscript leaves the reader with many unanswered questions. For example:

1) The authors discuss the role of longwave radiation in the surface heat flux budget of the ocean but neglect downwelling longwave radiation. Why? It is crucial for the heat flux balance and challenges the whole argumentation.

*We only address heat fluxes at the ocean-atmosphere interface. Fig.1 shows the **net** radiation, which incorporates the downwelling longwave radiation. We see now that, indeed, the caption is misleading. However, the figure title is correct.*

2) The whole argumentation of Nof and Yu relies on the surprising idea, that a smaller ocean-air heat flux results in a warmer (!) atmosphere. I wonder where the heat for warming the atmosphere comes from?

*The heat comes from the ocean. Consider an oceanic convecting flow (i.e., an MOC) coupled upstream via Ekman layers to an atmospheric flow with the same mass flux. The reduced MOC corresponds to a smaller heat flux but also to a smaller amount of air participating in the exchange. Since the sensible and latent heat flux is proportional to the temperature difference between the ocean and the atmosphere and, since the ocean is usually warmer than the atmosphere, a reduced (radiation free) heat flux means a cooler ocean and warmer air, not the other way around. As mentioned in the note under discussion, this aspect is discussed in detail in Sandal and Nof (2007, SN hereafter), which is available on line as publication #100 at (www.doronnof.net). Furthermore, itwas indicated that the SN article plays a pivotal role in the material under discussion implying that, for a complete understanding of the note, the reader is expected to first go through SN in detail.*

3) What is exactly shown in Fig. 1a? In other data sets (e.g. NCEP) one can clearly see enhanced longwave radiation fluxes over the warmer ocean surface in the North Atlantic compared to the North Pacific (in harmony with the Stefan-Boltzmann law).

*We are not sure what are the "other data sets" that you are referring to. If you kindly give us the references, then we will address this issue accordingly.*

Last but not least, I would like to comment on the authors' claim that millennial-scale temperature fluctuations during the glacial were much weaker in the surface ocean than in the overlying atmosphere. To underpin this statement they cite a



OSD
4, S275–S277, 2007

"Physics To- day" paper by Edouard Bard. In this paper, two curves are shown: an air temperature reconstruction from a Greenland ice core along with a sea surface temperature recon- struction from a sediment core from the mid-latitude Atlantic Ocean. It is important to realize that these two locations are some 3000 km apart, i.e. the ice core record is not representative for the air directly above the sediment core site. The authors seem to compare apples with oranges.

*Since we are talking about differences, not absolute values, and since the correlation between the two records is very high, it is perfectly legitimate to make the comparison in question. This is why that comparison was originally made by Bard (2002). Furthermore, at the latitude under discussion, the synoptic atmospheric scale is* $\sim o\ (1000km)$*, suggesting that comparing records 3000 kilometers apart is very reasonable. We also note here in passing that, while any reader is allowed to make any comments that she/he wishes, authors are equally allowed to use all previously unchallenged published literature. Hence, even if your last comment had been valid, it should have been addressed to Bard (2002), not our note.*

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Interactive comment on Ocean Sci. Discuss., 4, 699, 2007.