Ocean Sci. Discuss., 6, C359–C360, 2009
www.ocean-sci-discuss.net/6/C359/2009/

Ocean Science
Discussions

Interactive comment on "Barents Sea heat – transport, storage and surface fluxes" *by* L. H. Smedsrud et al.

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Received and published: 18 August 2009

I am sorry to say that the results concerning the heat transports presented in this manuscript are wrong because they are based on an erroneous concept of the oceanic heat budget. This is particularly distressing as the Barents Sea is an important region of the Arctic system with large changes, and thus serious heat budget estimates are needed to properly assess the mechanisms of the Arctic Ocean in a changing climate.

Advective heat transports can only be computed over a closed volume with net zero volume flux (e.g. Montgomery, 1974). "Heat transports" computed over partial sections, as done here, are arbitrary since they depend on the chosen temperature scale (reference temperature). A review of the physical background and of the respective consequences of such arbitrariness, not only of absolute heat transports but

also of intercomparisons, can be found in this journal, http://www.ocean-scidiscuss.net/6/1007/2009/osd-6-1007-2009.pdf.

This kind of error is very common among oceanographers, which does not make it less fatal – science is not a democratic procedure. It seems that the authors are somewhat aware of their error: On p 1439, line 22, they note that they "refer" their inflow temperatures to 0°C "which is close to the temperature of the outflow to the Arctic Ocean (Schauer et al., 2002)". Apart from the fact that "close to 0°C" is a very generous perception of an outflow temperature that varies spatially and seasonally between +1.5°C and -1.7°C (Fig. 3 of Schauer et al.) - , even IF the outflow temperature were that constant in the year analyzed by Schauer et al., there is no reason to expect this to be true for other years. On the contrary, the assumption of a constant outflow temperature would imply that a variable "heat transport" through the BSO (Fig. 3) would cause immediate compensation by heat flux to the ice/atmosphere and/or warming. There is no physical reason why the atmospheric thermodynamic forcing in the Barents Sea should follow the properties of water flowing through the BSO.

The first hint to the misconception of the authors is given in the abstract, line 13 ff. Small ocean heat transport does not "lead to a mixed layer at the freezing point ... and significant ice production"; it is the difference between oceanic heat transport (no matter how large or small it is) and the surface heat flux that determines the ice production. Even with a very small oceanic heat flux the ocean temperature would increase gradually if it were not compensated by cooling through the surface flux or ice melt.

And so on. Maybe the authors could use the model to come up with estimates that are methodologically correct. But the numbers as presented here should not be published.

Interactive comment on Ocean Sci. Discuss., 6, 1437, 2009.