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Discussions

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

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The Barents Sea is an important region of the Arctic system. The system is currently experiencing large changes, and correct heat budget estimates are central in assessing the mechanisms of these changes. We believe that this indeed what we have done in this paper, based on the observations that are available.

First of all, our advective heat transports are computed over a closed volume, with net zero volume flux (e.g. Montgomery, 1974). The Barents Sea is a closed system, if some volume of water enters in the Barents Sea Opening (BSO), exactly the same volume of water will have to leave in one of the other openings. We are fully aware of the recent work by Schauer and colleagues in the Fram Strait (Schauer et al 2008 and Schauer and Beszczynska-Möller 2009), and appreciate the correction made to

earlier heat flux estimates. All our heat transport estimates are given for the Barents Sea as a "box" and not just for the section at which temperature and velocities are measured. In the review process we will seek to improve the description of the heat transport estimates to make this issue as clear as possible.

Our heat transport estimates are correct given that the volume fluxes in the two other openings are small as we have assumed (Fig. 1). No observations are available here, and we have given a volume flux estimate of 0.3 Sv based on numerical models. The major uncertainty in our calculations is probably the use of a constant exit temperature in the BSX. This is based on 1 year of current meter moorings in the 1990's. If the exit temperature has changed in recent years, this will change the heat transport estimates.

The assumption of a constant outflow temperature does not imply that an increase in heat transport through the BSO (Fig. 3) would cause immediate compensation. What happens in the model is that the ocean column warms gradually, and that the extra heat is gradually mixed towards the surface. Here the atmosphere forces it to loose more heat depending on the sea surface temperature. The response in the model takes about 2.5 years, comparable to the flushing time of the Barents Sea. The extra heat is not allowed to exit the Barents Sea in the model. In nature this could happen, but given the limited observations at the BSX we have no data to guide us on the issue, and we chose to keep the temperature constant. Model sensitivity runs could be performed to discuss changes in outflow temperature.

Our main focus here is to study the sensitivity of the Barents Sea towards variation in ocean heat transport. The Barents Sea is a complex system, and our simple model approach is based on a number of assumptions. We have tried to state these assumptions as clearly as possible and support them by the observations available to us. We are working to improve the observational data base, but also hold our results as valuable and the best possible estimates available today.

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