**Ocean Science
Discussions**

Interactive comment on "On the export of dense water from the Weddell and Ross Seas" *by* R. Kerr et al.

Anonymous Referee #1

Received and published: 4 September 2011

General Comments

The authors present results from a 20-year model run focusing on seasonal and inter-annual variability of transports and properties of Antarctic bottom water from the Ross and Weddell Seas. As the authors point out, such a long-term study is not feasible using only observational data (at this point anyway) so models offer an alternative to examining interannual variability. This is a timely study, given the increasing published evidence of long-term changes in the thermohaline properties of the Ross and Weddell Seas.

Generally, I found the ms to be worthy of publication, but there are some sections which I found difficult to follow, and I had a very hard time viewing some of the figures. These problems I'm sure can be easily rectified, and so I recommend publication with the

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minor revisions indicated below.

Specific comments

2 Model description and forcing:

It is well known that export of deep and bottom water from the Ross Sea is particularly sensitive to tides (Padman, et al. 2009). How well does the model chosen for this study represent the effect of tides on the exported bottom water properties and transports?

Why is sea ice thickness set to 1.5 m everywhere? This seems too thick, especially for the Weddell. And the snow cover of 0.15 m seems too small, especially for the western Weddell and Amundsen Sea regions, where snow cover routinely exceeds 1 m. Maybe this is fine for initializing the model.

The model bathymetry is based on a very old data set. In particular, the shape and slopes of the NW Ross Sea continental shelf-slope break in the digital bathymetry data sets were greatly revised in the years after 2002. Getting the bathymetry right is important in regions where the Rossby radii are quite small, and where the outflow of deep and bottom water is strongly influenced by the bottom topography. Would the use of a more appropriate model bathymetry influence the results presented?

3 Southern Ocean representation

Figure 2. This figure is too small to convey the important information embodied in the graphics. Even viewing it on the computer and enlarging it, I am still unable to see important details in the T/S diagrams, and I'm unable to read the water mass labels and density values. This figure deserves more space, as it's essential for evaluating the success of the model in representing the water mass characteristics

Fig 3 - also too small. I can't see the increase in surface later temperature to $\sim$0C described in the text. In addition to making these larger, perhaps blowup figures of the Weddell and Ross shelf areas would help the reader discern the details of the high salinity distributions on the shelves, which are so crucial to the deep water formation

processes.

5 Correlations

I had a difficult time following the explanation given for the lag-0 correlation between AABW export and AABW source water T/S properties, especially in light of Figure 14, which clearly shows a non-zero lag between changes in the properties in the SW Weddell and those in the Weddell Export Section. I suspect my trouble with this may stem in part from the small size of the panels in Fig 10 and Fig 11; I could not see many of the features being discussed in the text. It might be interesting to somehow present the lagged cross correlation between the transport and the salinity anomaly in say, a representative box in the SW Weddell. There may be structure in the lagged correlations which might be related to the source-export transit time. Figure 12 is also too small, Maybe circumpolar maps are not as useful here as individual maps of the Weddell and Ross?

I suppose one way to test the assertion that the lag-0 correlation is due to gyre-scale wind field changes would be to calculate the correlation directly between transport and the wind.

Technical comments

P1660 line 23 _".. and almost uninterrupted properties" perhaps "measurements" or "observations would be a better choice than "properties"

l 25: "historical observed subsurface Southern Ocean databases lack long historical records" the second "historical" is redundant

". . . are seasonally biased and suffer from scarcity of data in some areas of difficult access due to environmental conditions and/or logistic operations, therefore modelling results are an alternative way to study the impact of source water variability on AABW export".

Perhaps make this two sentences. drop the "therefore.."

P1673 lines 25: "Similar negative values of volume transport anomaly is observed during this year" should be " are observed"

Reference cited

Padman, L., S. L. Howard, A. H. Orsi and R. D. Muench (2009). "Tides of the north-western Ross Sea and their impact on dense outflows of Antarctic Bottom Water." Deep Sea Research Part II: Topical Studies in Oceanography 56(13-14): 818-834.

Interactive comment on Ocean Sci. Discuss., 8, 1657, 2011.