Ocean Science Discussions, 2, S144–S146, 2005
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European Geosciences Union

Ocean Science Discussions

Interactive comment on "Influence of the Southern Annular Mode on the sea ice-ocean system: the role of the thermal and mechanical forcing" *by* W. Lefebvre and H. Goosse

Anonymous Referee #2

Received and published: 8 August 2005

The authors present results from a range on model experiment using their coupled ice-ocean circulation model. While the paper addresses an interesting and up to date problem, I have some reservations with regards to the experimental design and the significance of the results presented.

As it is often done with coupled ice-ocean circulation models the lower surface air temperature is prescribed in order to derive the sensible (and small latent) heat fluxes over the sea ice. While near the continents this might be an acceptable way to proceed in the open ocean the surface air temperature is a result of the presence (or not) of sea ice and just not an ideal parameter to use to force sea ice thermodynamics. This can easily be checked by diagnosing the implied heat fluxes, which would require much more thermal intertia in the lower atmosphere than can be attributed. There are alter-

native approaches short of a fully coupled atmosphere-ocean-ice system that involve parameterizations or simple advective diffusive models of the atmospheric boundary layer (for example Krahmann and Visbeck, GRL 2003).

As the authors point out there is also a potential issue with the time dependant response of the ice-ocean system to the SAM. In some sense here the subdecadal response is analyzed. This could be stated more clearly in the conclusions.

No attempt was made to asses the significance of the regressions. While this might be a little harder for the special maps (although a signal to noise number can be generated and could indicate to regions where the interannual variability is much larger than the SAM forced response), it is easy to do for the zonal means and regression plots. For example Figure 9 and 10 should show the variance for each zonally averaged point maybe as a thin lineĚ

As for figure 6 one might ask how much of the apparent “non linear” response is due to the “background” SAM trend in the NCEP data. I assume that it more towards a positive SAM between 1980 and 1987 (if that are the first seven years referred to). At the minimum please provide the “natural” SAM index or trend in the paper.

Given my concern with the experimental design I think the results of the role of thermal forcing are as described in their model system. But I would hesitate to draw any conclusions about the real world (or what a coupled model might do). I think statements about the significance of the thermal forcing should be toned down. Note, that in the Weddell and Ross sector, where the ice extends far from the coast their findings are consistent with air temperature being a consequence of the mechanical (wind) forcing of the sea-ice.

In summary this is an interesting paper, but I would question the robustness of the findings in a more serious way than indicated by the last sentence in the conclusion section.

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Interactive comment on Ocean Science Discussions, 2, 299, 2005.

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