**Climate
of the Past
Discussions**

Interactive
Comment

Interactive comment on "The modern and glacial overturning circulation in the Atlantic ocean in PMIP coupled model simulations" *by* S. L. Weber et al.

S. L. Weber et al.

We thank the referee for the suggestions for improvement. Most will be followed in the revised paper. The referee comments are repeated below, together with a point-by-point reply.

What I was missing, however, is more detailed discussion of how well the models reproduce present day climate and how this might influence the AMOC response, leading to an evaluation rather than just an account of AMOC changes. For example, the inclusion of the observed (e.g. Levitus) salinity profile might help to see how water masses (e.g. AAIW) are represented in the model. Since there are only five figures, there might be even space to display all the models stream functions and to discuss if they show a

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realistic form (e.g. deep water formation in Nordic Seas).

We will include the salinity profile based on Levitus salinity data. We will also include more information on the models stream functions, such as the latitude of the down-welling branch and discuss how realistic they are in the revised paper.

Minor points: Page 926, para. 2: how long is long enough ? Maybe the experiment lengths could be included in table 1.

Integration times differ from model to model, as do spin-up strategies. Some models start from a cold state of a previous model version, some from a warm state (section 2). Total integration times have limited information value, as the switch to a new model version can induce substantial drift in an equilibrated glacial state. In our experience the deep ocean temperature reaches equilibrium first, while the deep ocean salinity seems to have a longer adjustment timescale. We compute the Atlantic freshwater budget (section 4), which results in an estimate of the imbalance for the control and the glacial state. Fig. 4 showes clearly that most models have equilibrated. However, some models definitely cannot have equilibrated in the deep ocean salinity. This will be rephrased in section 2 of the revised paper, with reference to section 4.

Page 930, para 4.2: Is there any explanation for this discrepancy of observed and modeled fresh water transports?

Yes, models generally overestimate net evaporation and underestimate the azonal transport. The latter is due to an underestimation of the zonal salinity contrast in the southern Atlantic. As a result, Mov is misrepresented in most models. Correcting the zonal salinity contrast results in increased Maz and values for Mov that even change sign (Vries and Weber, 2005). This explanation will be added in the revised paper.

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Fig. 3: Include observed profile **(see above)** Fig. 4: Better display the relative role of T and S in their contribution to the density anomaly.

Some measure of the relative role of T and S will be added to Figures 4 and 5.

Reference
Vries, P. de, and Weber, S.L.: The Atlantic freshwater budget as a diagnostic for the existence of a stable shut-down of the meridional overturning circulation, Geophys. Res. Letters, 32, L09606, DOI 10.1029/2004GL021450, 2005.

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