Climate of the Past
An Interactive Open Access Journal of the European Geosciences Union

Clim. Past, 3, 51-64, 2007
www.clim-past.net/3/51/2007/

The modern and glacial overturning circulation in the Atlantic ocean in PMIP coupled model simulations

S. L. Weber[1], S. S. Drijfhout[1], A. Abe-Ouchi[2], M. Crucifix[3], M. Eby[4], A. Ganopolski[5], S. Murakami[6], B. Otto-Bliesner[7], and W. R. Peltier[8]
[1]Royal Netherlands Meteorological Institute (KNMI), De Bilt, The Netherlands
[2]Center for Climate System Research, The University of Tokyo Kashiwa, Japan
[3]Hadley Center for Climate Prediction and Research, Met Office, Exeter, UK
[4]School of Earth and Ocean Sciences, University of Victoria, Victoria, Canada
[5]Potsdam Institute for Climate Impact Research, Potsdam, Germany
[6]Meteorological Research Institute, Tsukuba, and Frontier Research Center for Global Change, JAMSTEC, Yokohama, Japan
[7]National Center for Atmospheric Research, Boulder, USA
[8]Department of Physics, University of Toronto, Toronto, Canada

Abstract. This study analyses the response of the Atlantic meridional overturning circulation (AMOC) to LGM forcings and boundary conditions in nine PMIP coupled model simulations, including both GCMs and Earth system Models of Intermediate Complexity. Model results differ widely. The AMOC slows down considerably (by 20–40%) during the LGM as compared to the modern climate in four models, there is a slight reduction in one model and four models show a substantial increase in AMOC strength (by 10–40%). It is found that a major controlling factor for the AMOC response is the density contrast between Antarctic Bottom Water (AABW) and North Atlantic Deep Water (NADW) at their source regions. Changes in the density contrast are determined by the opposing effects of changes in temperature and salinity, with more saline AABW as compared to NADW consistently found in all models and less cooling of AABW in all models but one. In only two models is the AMOC response during the LGM directly related to the response in net evaporation over the Atlantic basin. Most models show large changes in the ocean freshwater transports into the basin, but this does not seem to affect the AMOC response. Finally, there is some dependence on the accuracy of the control state.

Final Revised Paper (PDF, 1219 KB) Discussion Paper (CPD)

Citation: Weber, S. L., Drijfhout, S. S., Abe-Ouchi, A., Crucifix, M., Eby, M., Ganopolski, A., Murakami, S., Otto-Bliesner, B., and Peltier, W. R.: The modern and glacial overturning circulation in the Atlantic ocean in PMIP coupled model simulations, Clim. Past, 3, 51-64, 2007. Bibtex EndNote Reference Manager