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The glacial Atlantic overturning circulation in PMIP coupled model simulations

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The simulation of the Atlantic meridional overturning circulation (MOC) during the Last Glacial Maximum (LGM) provides an important benchmark for models used to predict future climatic changes. This study analyses the MOC response to LGM forcings and boundary conditions in nine PMIP simulations, including both GCMs and Earth system Models of Intermediate Complexity. It is examined whether the mechanism put forward in the literature for a glacial MOC reduction in one model also plays a dominant role in other models. In four models the MOC reduces during the LGM (by 20-40%), there is a slight reduction in one model and four models show an increase in MOC strength (by 10-40%). It is found that a major controlling factor for the MOC response is the density contrast between AABW and North Atlantic Deep Water (NADW) during the LGM as compared to the modern climate. Relatively more saline AABW is consistently found in all simulations, while all models but one show less cooling of AABW as compared to NADW. In five out of nine models a reduced (enhanced) MOC during the LGM is associated with relatively more (less) dense AABW at its source region. In only two models is the MOC response during the LGM directly related to the response in net evaporation, while the accuracy of the control state has some impact too.