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The Atlantic freshwater budget for present and glacial boundary conditions: a model intercomparison study

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Which pysical processes effectively determine the response of the Atlantic meridional overturning circulation (MOC) to Last Glacial Maximum boundary conditions is not yet fully understood. Different climate models have shown varying results: the MOC strength (strongly) increases in some models and reduces in others, while the location and depth of deep-water formation also varies. We aim to diagnose the different MOC responses by analysing the simulated freshwater budget of the Atlantic basin for present-day and LGM boundary conditions. This is done for a number of coupled AO-GCMs participating in the Paleo Modeling Intercomparison Project. The terms in the budget are net freshwater forcing at the air-sea interface, ocean transports through Bering Strait and through the southern boundary. All models show a reduced net evaporation over the Atlantic basin during the LGM, which partly compensates for the loss of freshwater import through Bering Strait. Models differ considerably in their response in the MOC-related component of the transport through the southern boundary, reflecting different responses in MOC strength as well as in the vertical salinity profile. A reduced MOC seems to be associated with an enhanced vertical stratification during the LGM.