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GLACIAL ATLANTIC OVERTURNING CONTROLLED BY ICE SHEETS AND ATMOSPHERIC CARBON DIOXIDE

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Deep Ocean circulation indicated by geochemical tracers varied during the ice age cycle with climate and the Milankovitch cycle (Lynch-stieglitz, Liesicki). Here we analyse the latest multi models of CMIP5 and PMIP experiments and show that the deepening of AMOC simulated in most of the models come from the warm bias in Southern ocean. We further show that the models which fail to have shoaler glacial AMOC is even strengthened because of the existence of ice sheets, through the feedback between the AMOC, sea ice and wind stress in the north Atlantic. The winter sea ice in the North Atlantic governs the AMOC by playing as a “shutter” on/off not only for the deep ocean convection, but for the wind stress. It is consistent with a hypothesis that the weakening of the AMOC is caused by the cooling due to the Lower Greenhouse Gas level and larger Antarctic ice-sheet, while the strengthening of the AMOC is caused by the Northern Hemisphere ice sheet. We suggest that the improvement of cloud scheme in GCM atmosphere-ocean-ice processes in the high latitude region and sufficient calculation to obtain the equilibrium state especially around Antarctica is crucial for more appropriate AMOC simulation both for the past and future climate change.