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## Impact of mid-glacial ice sheets on the recovery time of the AMOC: Implications on the frequent DO cycles during the mid-glacial period

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Paleo reconstructions such as ice cores have revealed that the glacial period experienced frequent climate shifts between warm interstadials and cold stadials. The duration of these climate modes varied during glacial periods, and that both the interstadials and stadials were shorter during mid-glacial compared with early glacial period. Recent studies showed that the duration of the interstadials was controlled by the Antarctic temperature through its impact on the Atlantic Meridional Overturning Circulation (AMOC). However, similar relation was not found for the stadials, suggesting that other climate factors (e.g., differences in ice sheet size, greenhouse gases and insolation) might have played a role. In this study, we investigate the role of glacial ice sheets on the duration of stadials. For this purpose, freshwater hosing experiments are conducted with an atmosphere-ocean general circulation model MIROC4m under early-glacial and mid-glacial conditions. Then, a sensitivity experiment is conducted modifying only the configuration of the ice sheets. The impact of mid-glacial ice sheets on the duration of the stadials is evaluated by comparing the recovery time of the AMOC after the cessation of the freshwater forcing. We find that the expansion of glacial ice sheets during mid-glacial shortens the recovery time of the AMOC. Partially coupled experiments, which switch the surface winds between the two experiments, show that the differences in the surface wind cause the shorter recovery time under mid-glacial ice sheet. The wind shortens the recovery time by increasing the surface salinity and decreasing the sea ice at the deepwater formation region. Thus the results suggest that differences in the surface wind between mid-glacial and early glacial ice sheets play an important role in causing shorter stadials during mid-glacial period.