

## Response of oceanic carbon cycle during Heinrich events

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Paleoproxy indicate that a substantial weakening of the Atlantic Meridional Overturning Circulation (AMOC) during Heinrich events was often accompanied by a notable atmospheric CO<sub>2</sub> increase. However, previous modeling studies show conflicting atmospheric CO<sub>2</sub> responses to an AMOC shutdown. In this study, we investigate the response of ocean carbon cycle to weakening AMOC using freshwater experiment conducted with a coupled atmosphere-ocean general circulation model MIROC and offline ocean biogeochemical model. The weakening of AMOC under mid-Glacial condition leads to an oceanic carbon reservoir decrease and to a 4 ppmv atmospheric CO<sub>2</sub> increase, which is smaller than the ice core date of 15 ppmv CO<sub>2</sub> rise. The weakening of the North Atlantic leads to a loss of DIC in the North Atlantic intermediate and deepwaters, resulting in CO<sub>2</sub> outgassing into the atmosphere. In contrast, the greater mixing in the Southern Ocean enhances biological pump and thus increases CO<sub>2</sub> uptake from the atmosphere. Because these two processes cancel each other out, our simulation underestimates the observed atmospheric CO<sub>2</sub> increase. We also discuss the potential mechanisms which cause the additional CO<sub>2</sub> increase of 10ppmv in this presentation.

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