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Abrupt Bølling–Allerød Warming Simulated under Gradual Forcing of the Last Deglaciation

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During the last deglaciation, a major global warming trend was punctuated by abrupt climate changes, likely related to Atlantic meridional overturning circulation (AMOC). One problem is that an abrupt increase in the AMOC during the Bølling–Allerød (BA) transition occurred when the melting of Northern Hemisphere ice sheets was significant, which tended to weaken the AMOC. Here, from transient simulations of the last deglaciation using an atmosphere–ocean general circulation model, we show that an abrupt increase in the AMOC during the BA transition could occur without reduction in glacial meltwater. The abrupt increase in the AMOC accompanied abrupt warming in Greenland and sea ice retreat in the North Atlantic, consistent with proxies and previous modeling studies. The results imply that abrupt BA warming during the middle stage of the last deglaciation was a response to gradual warming under the presence of meltwater from continental ice sheets.