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Simulated DO-like AMOC transitions driven by salt-oscillations and interactions with the North Atlantic subpolar gyre

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We present a set of simulations with the coupled climate model MPI-ESM, in which the Atlantic Meridional Overturning Circulation (AMOC) oscillates between a weak and a strong state on multi-centennial to millennial timescales. Each simulation has a different CO_2 concentration; insolation and ice sheets are identical in all simulations. All forcings are constant throughout the respective simulations. The oscillations are self-sustained and occur under medium to low CO_2 concentrations of approximately 207 to 190 ppm in combination with prescribed preindustrial ice sheets. The strong AMOC state is characterised by a warm and salty North Atlantic, a weak subpolar gyre, high 2m temperatures over Greenland and partially ice free Nordic Seas with active deep convection. The weak AMOC state is characterised by a cold and fresh North Atlantic, a strong subpolar gyre, low 2m temperatures over Greenland and extensive sea-ice cover. The transition between the two states is driven by a redistribution of salt between the tropical and the subpolar North Atlantic and interactions between the North Atlantic subpolar gyre and deep convection in the Nordic Seas and eastern North Atlantic. Changes in the temporal AMOC variability suggest that the AMOC transitions are the result of oscillations between two weakly unstable states. The timescales of the oscillations of 700 to 1500 years are comparable with the timescales of reconstructed Dansgaard-Oeschger (DO) events. Even though the simulated oscillations occur with prescribed preindustrial ice sheets, they support the hypothesis that DO-events could occur as a result of unforced abrupt changes in the ocean circulation.