Changes of the AMOC seasonal cycle in MPI-ESM CMIP5 climate projections

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We examine potential changes of the Atlantic meridional overturning circulation (AMOC) and its seasonal cycle in future climate change projections performed with the global coupled climate model MPI-ESM. Initially, we focus on the AMOC at 26°N. At 26°N, the time mean AMOC weakens from 19.1 Sv (1850-2000) to 8.7 Sv (2150-2300) in the RCP85 scenario (most extreme scenario of CMIP5 experiments). The weakening of the AMOC results from a weakening in the geostrophic transport. The reduction in strength of the AMOC is accompanied by a change in its seasonal cycle. For the simulation of the past century (1850-2000), the simulated 26°N-AMOC shows a pronounced minimum in April, a stronger AMOC towards summer and a maximum in fall/winter, similar to the observed seasonal cycle from the RAPID-array. In RCP85, we find a weakening of the AMOC spring minimum and of the fall maximum starting at the 22nd century. This change occurs coherently between ~20°N and ~40°N. The change in the seasonal cycle of the AMOC in RCP85 prominently results from a poleward shift of the atmospheric jet in winter and an equatorward shift in summer, which in turn leads to a shift of the surface winds. This yields an increase in Ekman transport in winter and spring, and a decrease in summer. The AMOC seasonal cycle is in addition modified by a weakened seasonal cycle of the geostrophic transport. These findings may have important implications for the impact of climate change on the decadal predictability of the AMOC and the meridional heat transport.

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