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Interdecadal variability of the Atlantic meridional overturning circulation in the pre-industrial simulation of HadGEM2-AO

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Atlantic meridional overturning circulation(AMOC) has particularly important roles for the climate system because it, as a part of the ocean circulation, poleward transports the vast amount of heat and brings atmospheric chemicals into deep ocean layers. Here we investigated the temporal and spatial characteristics of AMOC using the 300-yr simulation data from the pre-industrial experiment of HadGEM2-AO. AMOC has the dominant periodicities of the both interannual (2-7 years) and interdecadal (20 and 40 years) time scales. The regression analysis reasonably well captured the relationship between the AMOC intensity and meridional temperature gradient, i.e. , the enhanced AMOC leads to the surface warming at high latitudes as well as thinning of Arctic sea ice. In addition, the lead-lag correlation analysis indicates that the instability caused by the out of phase between meridional temperature gradient and AMOC strength drive the natural AMOC fluctuation. This study has found that the variation of AMOC intensity can be explained by the only ocean circulation dynamics except the effect of external influences such as the atmosphere-ocean interactions.