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The Atlantic Multidecadal Oscillation as persistent mode of climate variability during the Quaternary

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The Atlantic Multidecadal Oscillation (AMO) and its possible change during the Holocene are examined in this study, using long-term simulations of the Earth system model COSMOS. A quasi-persistent ∼55- to 80-year cycle characterizing in the North Atlantic sea surface temperature, highly associated with the multidecadal variability of the Atlantic Meridional Overturning Circulation (AMOC), can be found throughout the Holocene, the LGM, Eemian, as well as the Pliocene, indicating that the AMO is an internal mode of the climate system. During a warm phase of the AMO, stronger-than-normal AMOC results in warmer-than-normal surface temperature, spreading over almost the whole North Hemisphere, in particular the North Atlantic sector. There is no remarkable change of this general pattern throughout the Holocene and the Eemian. The LGM pattern is shifted more equatorwards compared to interglacials and the Pliocene. Furthermore, the results reveal that the influence of the AMO can be amplified under a more unstable background climate condition. Finally we find that the AMO variability is decreased in future scenarios of climate due to the strong transient character of ocean circulation changes.