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Sensitivity of mid-Holocene climate simulations to changes in boundary conditions in Eastern North America

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Simulations of the mid-Holocene (6000 cal yr B.P.) have been unable to reproduce the observed change in vegetation patterns in the Eastern North America region: a southward shift of cool vegetation types (e.g. tundra, boreal forest) and a northward shift of warm types (e.g. warm temperate forest). Such experiments typically differ from the present day only in their insolation and greenhouse gas concentrations. It has been suggested that the failure to reproduce the climate required for the observed vegetation is due to the absence of the relict Laurentide ice sheet which persisted until after 6000 cal yr B.P. Here we test the hypothesis that the relict ice sheet and local land mask changes (due to persisting isostatic depression) have an effect on mid-Holocene climate over Eastern North America through sensitivity experiments using HadCM3. We find that they contribute a cooling effect in the summer and a warming effect during the winter, tempering the amplification of the seasonal cycle of the mid-Holocene insolation. The new boundary conditions thus improve the agreement between the climate simulations and the palaeodata.