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On the importance of initial conditions for simulations of the Mid-Holocene climate

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Abstract. Three simulations of the Mid-Holocene (6 ka) climate were performed with the ECBilt-CLIO-VECODE coupled atmosphere-ocean-vegetation model to study the impact of initial conditions. These experiments were forced with identical 6 ka forcings (orbital parameters and atmospheric greenhouse gas concentrations) and differed only in initial conditions. Two simulations were designed as equilibrium experiments, with one being initialized with preindustrial conditions as required by the protocol of the Paleoclimate Modelling Intercomparison Project (PMIP), while in a second experiment early Holocene (9 ka) initial conditions were used. These equilibrium simulations were run for 2100 years with 6 ka forcings. The third experiment was set up as a transient simulation, also starting from early Holocene conditions, but forced with annually changing orbital parameters and greenhouse gas levels. The results of the last 100 years are compared and reveal no statistically significant differences, showing that in this model the initial conditions have no discernible impact on the 6 ka climate. This suggests that the PMIP set-up for 6 ka simulations is valid, with the condition that spin-up phase should be long enough (at least 550 years) to allow the deep ocean to adjust to the change in forcings.

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