EGU2020-8911
https://doi.org/10.5194/egusphere-egu2020-8911
EGU General Assembly 2020

Large-scale features and evaluation of the PMIP4-CMIP6 midHolocene simulations

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The mid-Holocene (6,000 years ago) is a standard experiment for the evaluation of the simulated response of global climate models using paleoclimate reconstructions. The latest mid-Holocene simulations are a contribution by the Palaeoclimate Model Intercomparison Project (PMIP4) to the current phase of the Coupled Model Intercomparison Project (CMIP6). Here we provide an initial analysis and evaluation of the results of the experiment for the mid-Holocene. We show that state-of-the-art models produce climate changes that are broadly consistent with theory and observations, including increased summer warming of the northern hemisphere and associated shifts in tropical rainfall. Many features of the PMIP4-CMIP6 simulations were present in the previous generation (PMIP3-CMIP5) of simulations. The PMIP4-CMIP6 ensemble for the mid-Holocene has a global mean temperature change of -0.3 K, which is -0.2 K cooler that the PMIP3-CMIP5 simulations predominantly as a result of the prescription of realistic greenhouse gas concentrations in PMIP4-CMIP6. Neither this difference nor the improvement in model complexity and resolution seems to improve the realism of the simulations. Biases in the magnitude and the sign of regional responses identified in PMIP3-CMIP5, such as the amplification of the northern African monsoon, precipitation changes over Europe and simulated aridity in mid-Eurasia, are still present in the PMIP4-CMIP6 simulations. Despite these issues, PMIP4-CMIP6 and the mid-Holocene provide an opportunity both for quantitative evaluation and derivation of emergent constraints on climate sensitivity and feedback strength.

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