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Holocene temperature evolution in the Northern Hemisphere high latitudes – model-data comparisons

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Holocene climate development in the Northern Hemisphere high latitudes is primarily determined by orbital-scale insolation variations and melting ice sheets. Previous inter-model comparisons have shown that model simulation results vary spatially. Here, we compare multiple model results with compiled proxy reconstructions in Fennoscandia, Greenland, north Canada, Alaska and Siberia. Our model-data comparisons reveal that data and models generally agree in Fennoscandia, Greenland and Canada, with the early-Holocene warming by 8–7 ka BP and subsequent gradual decrease to 0 ka. In Fennoscandia, simulations and pollen data suggest a 2°C warming by 8 ka BP, but this is less expressed in chironomid data. In Canada, a 4°C early-Holocene warming is suggested by both the simulations and pollen results. Adjustments in paleo-topography due to dynamic ice sheets and post-glacial rebound exert uncertainty in Fennoscandian and north Canadian model-data comparisons. In Greenland, the magnitude of early-Holocene warming ranges from 6°C in simulations to 8°C in δ18O-based temperatures. Simulated and reconstructed temperatures are mismatched in Alaska. Pollen data suggest 4°C early-Holocene summer warming, while the simulations indicate 2°C Holocene cooling, and chironomid data show a stable trend. In high-latitude Siberia, simulations and proxy data signals are noisy owing to a large spread in the simulations and between pollen and chironomid results. On the whole, the Holocene climate evolution in Fennoscandia, Greenland and north Canada is well established and understood, but important questions regarding the Holocene temperature trend and mechanisms remain for Alaska and Siberia.