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Enhanced seasonality of surface air temperature over China during the mid-Holocene

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Using all available simulations performed by climate models participating in PMIP4 (Paleoclimate Modelling Intercomparison Project – Phase 4), we quantify the seasonality change of surface air temperature over China during the mid-Holocene (6000 years ago) and the associated physical mechanisms. Relative to the preindustrial period, all 16 models consistently show an enhanced temperature seasonality (i.e., summer minus winter temperature) across China during that interglacial period, with a nationally averaged enhancement of 2.44°C or 9% for the multimodel mean. The temperature seasonality change is closely related with the seasonal contrast variation of surface energy fluxes mainly due to the mid-Holocene orbital forcing. Specifically, the summer–winter increase in surface net shortwave radiation dominates the intensified temperature seasonality at the large scale of China during the mid-Holocene; the surface net longwave radiation has a minor positive contribution in most of the Tibetan Plateau and eastern China; and both the surface latent and sensible heat fluxes show partial offset effects in most of the country. There are uncertainties in the reconstructed temperature seasonality over China during the mid-Holocene based on the proxy data that can reflect seasonal signals.