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Modeling variations of summer upper-tropospheric temperature and associated climate over the Asian-Pacific region during the mid-Holocene

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The summer upper-tropospheric temperature change and its association with atmospheric circulations and precipitation over the Asian-Pacific region during the mid-Holocene have been addressed by using outputs from a coupled ocean-atmosphere general circulation model (OAGCM) performed as part of the second phase of the Paleoclimate Modeling Intercomparison Project (PMIP2). The simulated result shows the summer oscillation pattern similar to the present Asian-Pacific oscillation (APO) existed in the mid-Holocene. When there was a warming (cooling) upper troposphere over East Asia, a cooling (warming) upper troposphere occurred over the mid-latitudes of the North Pacific. Compared to the modern climate, however, the simulated mid-Holocene temperature in the upper troposphere was higher over East Asia and lower over the mid-latitudes of the North Pacific, indicating a stronger summer APO in the mid-Holocene. Corresponding to such a condition, the North Pacific was modeled to be dominated by a high-level cyclonic circulation difference and a low-level anticyclonic circulation difference in the mid-Holocene relative to the present, which favored the subsidence of airflows and thus resulted in less precipitation in this region. Meanwhile, East Asia was simulated to be occupied by an anticyclonic circulation difference in the upper troposphere and a cyclonic circulation difference in the lower troposphere. Accordingly, the ascending motion and the low-level southerly wind strengthened in East Asia, leading to an increase of local precipitation in the mid-Holocene. Therefore, the modeled mid-Holocene climate suggests that the summer rainfall change over the Asian-Pacific region may be a result of the strengthened APO in the upper troposphere.

This study has already been published

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