



The spatial-temporal patterns of East Asian climate in response to insolation, CO₂ and ice sheets during MIS-5

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Marine Isotope Stage (MIS) 5, between about 130 and 70 ka BP, is a relatively long warm period characterized by climate oscillations consisting of three interstadials and two stadials. In this study, two sets of snapshot simulations by a step of 2 ka covering the whole MIS-5 period are performed with the model HadCM3 to investigate the relative impacts of insolation, CO₂ and Northern Hemisphere ice sheets on the internal variations within MIS-5 and spatial variations of the East Asian climate, including the East Asian summer monsoon (EASM) intensity. The first set of experiments are forced by varying insolation and GHGs (OrbGHG) and the second ones are forced by varying insolation, GHGs and ice sheets (OrbGHGIce). Results show that a similar trend with precession can be found in the simulated summer precipitation, temperature and EASM index in both OrbGHG and OrbGHGIce, indicating the dominant role of precession on the EASM. Within the range of CO₂ variability during MIS-5, the change of CO₂ causes similar degree of warming effect, but much lower degree of humidifying effect compared to insolation. Insolation and CO₂ change the precipitation through different dynamic and thermodynamic processes. Our results also show that the influence of ice sheets on temperature and precipitation is less important than the effect of insolation and it varies from regions and in time. The effect of ice sheets depends on background insolation and also the location, height and area of ice sheets. The simulated spatial-temporal variations of the EASM climate are compared with proxy records and the mechanisms involved are investigated.

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