

PAGES2022

Session: 2. The last interglacial

Title: East Asian climate response to insolation, CO₂ and ice sheets during MIS-5 and indication for the future

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Abstract: Marine Isotope Stage (MIS) 5, between about 130 and 70 ka BP, 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 spatial and temporal variations of the East Asian climate, including the East Asian summer monsoon (EASM). Results show that precession plays a dominant role in the simulated summer precipitation, temperature and the EASM index. 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 affect the summer precipitation mainly through dynamic and thermodynamic processes, respectively. 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 the ice sheets. The simulated spatial-temporal variations of the EASM climate are compared with proxy records and the mechanisms involved are investigated. The simulated MIS-5 climate is also compared with the present and the future to investigate to which degree it can be considered as an analogue for the future in terms of East Asian climate.