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Impacts of polar ice sheets on the East Asian monsoon during the MIS-13 interglacial

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Among all the interglacials of the last one million years, Marine Isotope Stage (MIS) 13 has the highest δ^{18}O value over the past 800 ka in the deep-sea sediments. This would indicate that MIS-13 is the coolest interglacial if assuming δ^{18}O mainly represents global ice volume. The Antarctic ice core records show also that MIS-13 is the coolest interglacial over Antarctica with almost the lowest greenhouse gases concentrations (GHG). However, many proxy records from the northern hemisphere (NH) indicate that MIS-13 is at least as warm as or even warmer than the recent interglacials, with extremely strong summer monsoon and a possible melting of Greenland ice sheet. In this study, based on proxy reconstructions, different scenarios regarding the size of the Greenland and Antarctic ice sheets are made, and the response of the East Asian summer monsoon to these scenarios are tested by using the models HadCM3 and LOVECLIM as well as factor separation analysis and under the astronomical and GHG configurations of MIS-13. The results show that the influence of the disappearance of Greenland ice sheet on the surface temperature is quite localized, mainly over the northern high latitudinal regions, however, the influence of the bigger southern Hemisphere (SH) ice sheet on the surface temperature is very global, especially in the southern hemisphere. This ice sheet condition has an impact on the precipitation pattern over tropical-subtropical regions. It causes much more summer precipitation over all the East Asian monsoon region, in consistent with the paleosol record from southern China. The scenario of melted Greenland ice sheet and of larger SH ice sheets provides one of the explanations of the strong monsoon rainfall documented by the proxy data.