Response of convective systems to changes in orbital forcing of the last interglacial

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We ran a number of simulations using a global nonhydrostatic atmospheric model coupled with a slab ocean model for the orbital parameters of the last interglacial. The model used in this work is Nonhydrostatic ICosahedoral Atmospheric Model (NICAM): a framework to resolve cumulus convection when used with a proper resolution. Because of the limit of computational resources, we use NICAM with a horizontal resolution of 56km. The simulations were run with and without cumulus scheme to compare the performance. The integrations were continued for 5 years. The boreal summer climate of the last interglacial shows an enhancement of the monsoon activity. The spatial pattern of the mean-state precipitation is quite similar between the simulations with and without cumulus scheme, while the cumulus scheme tends to moderate the peak precipitation. Since the strength of NICAM is in its representation of variability associated with convective systems, we gave particular focuses on the behaviors of the equatorial waves and tropical cyclones represented by the model. We found that the Madden-Julian oscillation (MJO) is better represented in the present simulation when using the cumulus scheme. We also found that the signal of the MJO is stronger in the last interglacial, which was found both in the coherence-squared and lag-correlation regardless of the use of the cumulus scheme. Although the model does not represent the boreal summer intraseasonal oscillation (BSISO) very well, the lag-correlation shows its greater signal in the last interglacial. In particular, the lag correlation in the simulation of the last interglacial run with the cumulus scheme shows a very clear pattern of the BSISO, comparable to that of the present-day observation. The change in the global genesis frequency of the tropical cyclones was different depending on the use of the cumulus scheme. It decreases without the cumulus scheme, while it increases with the cumulus scheme.

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