

Different Regional Sensitivity of Summer Precipitation in East Asia to Astronomical Forcing, CO₂ and Ice Volume

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The relative influence of insolation, CO₂, and ice sheets on the East Asian summer monsoon (EASM) is not well understood especially at regional scale. We use a Gaussian emulator based on simulations with HadCM3 to quantitatively assess how astronomical forcing, CO₂, and northern hemisphere ice sheets affect the variation of the summer precipitation over the last 800 thousand years. Our results show that in the north of 25° N of the EASM domain, the variation of the summer precipitation is dominated by precession, and ice volume only modulates the effect of insolation through influencing the land-sea pressure contrast. This leads to strong 23-ka cycles in the summer precipitation. In the southern part (south of 25° N), the impact of ice volume becomes more important, leading to strong 100-ka cycles. Ice volume controls the precipitation in the southern part via its dominant control on the location of the Intertropical Convergence Zone and the Hadley cell. The effect of ice volume on summer precipitation depends on background astronomical configurations and vice versa. The relationship between summer precipitation and glaciation level varies among latitudes and for different astronomical configurations. Obliquity and CO₂ have little effect on the summer precipitation as compared to precession and ice sheets.

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