



Contributions of Insolation and Warm Pool SST to the strong East Asia Summer Monsoon during the interglacial MIS-13

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During Marine Isotopic Stage (MIS) 13, an interglacial about 500,000 years ago, the East Asian summer monsoon (EASM) was suggested by the loess records from northern China to be exceptionally strong (the strongest over the last one million years). This is quite surprising because MIS-13 was globally a cool interglacial with relatively low CO₂ concentration. In order to understand the physical mechanisms responsible for such an intense summer monsoon during a relatively cool interglacial, the impacts of several factors have been investigated by previous modeling studies. Here the impacts of the warm pool sea surface temperature (SST) on the MIS-13 EASM are quantified for the first time. The individual contributions of insolation and of the warm pool SST as well as their synergism are quantified through experiments with the Hadley Centre atmosphere model HadAM3 and with factor separation technique. The SST over the warm pool region has been increased based on geological observations. Our results show that the strong summer insolation during MIS-13 strengthens significantly the summer monsoon precipitation in both northern and southern China and in particular in northern China. The pure impact of an increase in the warm pool SST reduces the summer precipitation in both northern and southern China. However, the synergism between insolation increase and warm pool SST increase contributes to a large increase of summer precipitation over southern China but to a decrease in northern China. Finally, the increased warm pool SST and their synergism together reinforce the impact of insolation in southern China but reduce the impact of insolation in northern China. Therefore, we conclude that the increased SST over the warm pool region is favorable for precipitation increase only in southern China, and that the exceptionally strong EASM recorded in the loess in northern China is unlikely due to the warm pool SST increase as suggested by some proxy study. The physical processes will be analyzed and presented.

Keywords: MIS-13 interglacial, Warm Pool SST, Insolation, East Asia Summer Monsoon