

Monsoon impact on El Nino in the Holocene

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Abstract.

A coupled ocean-atmosphere general circulation model is used to investigate climatic shift of El Nino in the Holocene. The model simulates a reduced ENSO intensity in the early and mid- Holocene, in agreement with paleoclimate record. The ENSO reduction is proposed to be caused by an intensified Asian summer monsoon, which increases the trade and in turn upwelling in the eastern equatorial Pacific.

The potential monsoon effect on ENSO is further studied in a theoretical model – the delayed oscillator ENSO model. It is shown that an enhanced seasonal cycle of monsoon wind can reduce the amplitude of ENSO significantly through the nonlinear mechanism of frequency entrainment. This reduction of ENSO is most effective when the ENSO is in the mode of unstable self-exciting oscillation. Furthermore, the effect of the seasonal monsoon forcing is in contrast to that of the seasonal change of the coupled instability: the latter mainly determines the phase-locking of ENSO while the former predominantly influences the amplitude of ENSO. Implications are also discussed for interdecadal modulation of ENSO.