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Role of ocean on changes of the Asian monsoon during 6000 years before present: Simulations using MIROC (CCSR/NIES/FRCGC AOGCM) and AGCM

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Studies of the climate change in 6000 years before present using AGCMs suggested enhancement and northward shift of the summer African and Indian monsoons (Joussaume et al. 1999). The simulated monsoon enhancements are consistent with what suggested by paleoclimate proxies qualitatively but not quantitatively (Harrison et al. 1998). Synergistic precipitation enhancements of the African monsoon by the ocean coupling were robust change (Hewitt and Mitchell 1998, Braconnot et al. 2000, Zhao et al. 2005). On the other hand, the role of ocean on the Asian monsoon was not consistent among models. Hewitt and Mitchell (1998) and Braconnot et al. (2000) suggested the further enhancement of the Asian monsoon with ocean coupling. In contrary, Voss and Mikolajewicz (2001) and Liu et al. (2003) suggested the ocean coupling suppressed the enhancement of the Asian monsoon.

Addition to studying the unclear role of ocean on the Asian monsoon, we clarify the role of ocean thermodynamics and dynamics by different ocean coupling schemes, [C]: MIROC, the Atmosphere-Ocean coupled GCM, [M]: an AGCM extracted from MIROC coupled with a mixed layer ocean model, and [A]: the AGCM with prescribed SST. The resolution of the atmospheric component of MIROC is spectral T42 with 20 vertical levels and the resolution of the oceanic component is about 1.4 degree x (0.5 - 1.4) degree with 44 vertical levels.

Precipitation, temperature, and sea level pressure changes suggest that the simulated Asian monsoon enhancement is the most vigorous in [A], and suppressed in [M] and [C]. The difference between [M] and [C] is not very significant. This suggests that the ocean thermodynamics plays an important role on the suppression of the enhanced

Asian monsoon with 6 ka forcing, while the African monsoon is synergistically enhanced with [M] and [C], which is consistent with the previous works.