

Asian summer monsoon evolution since the late Miocene

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How Asian Summer Monsoon (ASM) evolved since the late Miocene and its controlling mechanisms remain controversial. Here, we report multiple biomarker records reconstructed from the northern coast of the South China Sea, which consistently indicate three phases of late Miocene-Pliocene ASM evolution: weak ASM strength at ~6.5-5.6 Ma, substantially enhanced strength at 5.6-4.3 Ma, and reduced strength but with a slightly strengthening trend after ~4.3 Ma. These three features have been reported collectively from previous terrestrial and marine records. The close correspondence of the ASM strength to tropical temperature before ~4.3 Ma suggests a dominant tropical temperature control, whereas the increasing ASM strength after that, opposite to temperature changes, implies that the developed Walker Circulation started to influence ASM strength over the Late Pliocene. The long-term increasing trend in the ASM strength over Pleistocene interglacial periods, supported by a recent terrestrial temperature reconstruction from the Chinese Loess Plateau, also corresponds to the enhanced Walker Circulation. Hence, the ASM evolution since the late Miocene appear to be controlled by both tropical temperature and Walker Circulation.

Keywords: Asian summer monsoon, Late Miocene, tropical temperature, Walker Circulation