Orbital-scale Pacific-East Asia teleconnection and anti-phased variations of summer precipitation

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Abstract

Various monsoon proxies obtained in the East Asian region, which covers the past several orbital cycles, show different phase responses. A distinct out-of-phase relationship of summer precipitation is found between southern and northern parts of East Asia. We use a 280ka-long transient run to explore the potential driving mechanism for the anti-phased change in precipitation. In the modeling results, an orbital-scale Pacific-East Asia teleconnection is clearly shown, just like that over the interannual timescale; this explains the observed regional precipitation differences. At NINO3.4 SST maxima, the East Asian summer monsoon strengthens, inducing more precipitation in the north and less precipitation in the south. The SST impact is primarily via the subtropical high pressure anomaly over northwestern Pacific. Thus, the internal ocean feedback can significantly modulate the response timing of Asian paleo-monsoon to the orbital forcing.

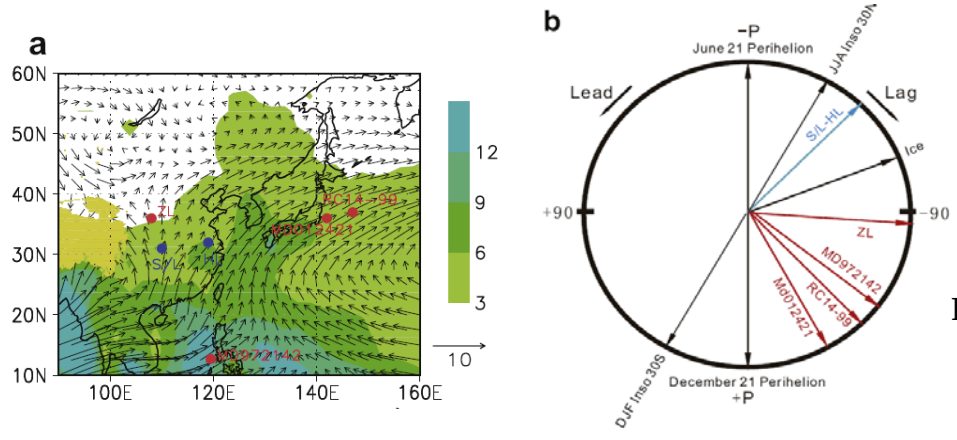

Fig 1： Anti-phased orbital-scale variations of summer precipitation over East Asia.

Precipitation-related proxies:

ZL: Zhaojiachuan/lingtai (Sun et al., 2006); S/L-HL: Sanbao/Linzhu-Hulu (Cheng et al., 2009); RC-14-99 (Morley and Heusser, 1997); MD012421 (Igarashi and Oba, 2006)

Circulation-related proxies:

MD972142 (Chen et al., 2003)

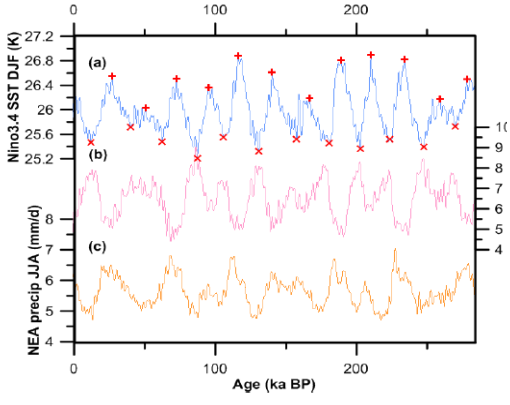

Fig 2:Simulated variations of summer precipitation over southern and northern East Asia and Nino3.4 SST.

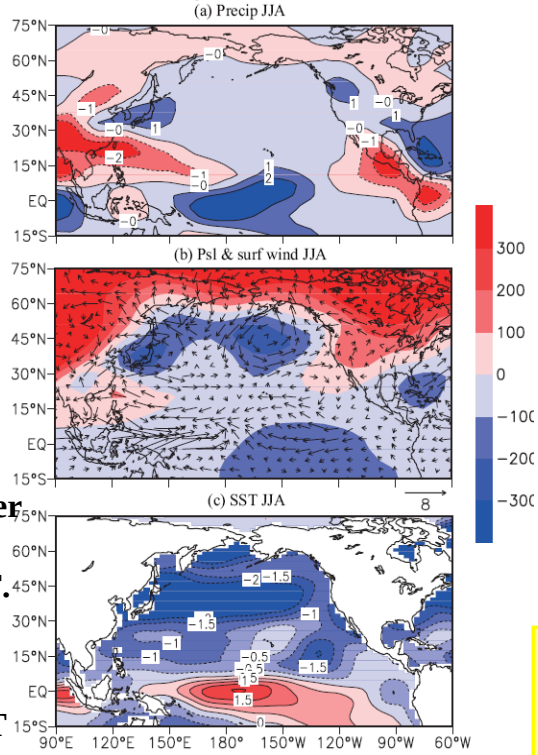

Fig 3: Composite differences in the JJA precipitation (a), sea level pressure & surface wind (b) and SST (c).

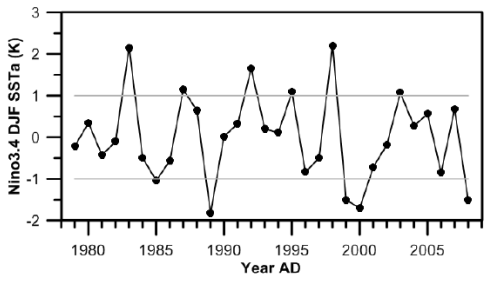

Fig 4: Modern Nino3.4 SST Anomalies.

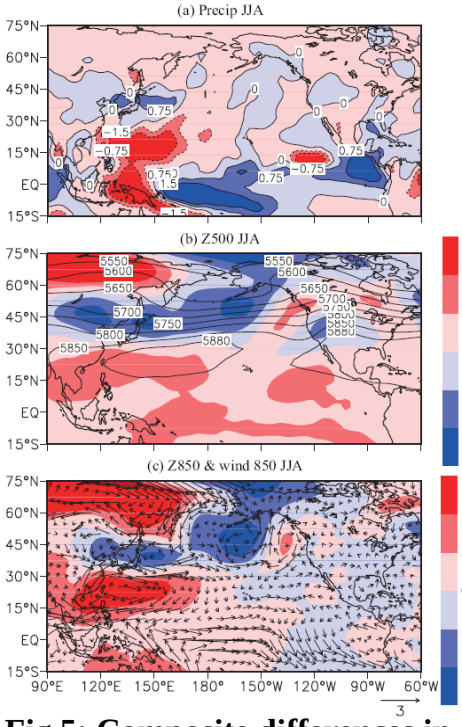

Fig 5: Composite differences in the JJA rainfall, Z500 and Z850& wind vectors between Nino and Nina years.

Shi et al., Anti-phased response of northern and southern East Asian summer precipitation to ENSO modulation of orbital forcing. QSR, 2012.