A Primary Study on Influence of Qinghai-Xizang Plateau Monsoon to East Asia Monsoon

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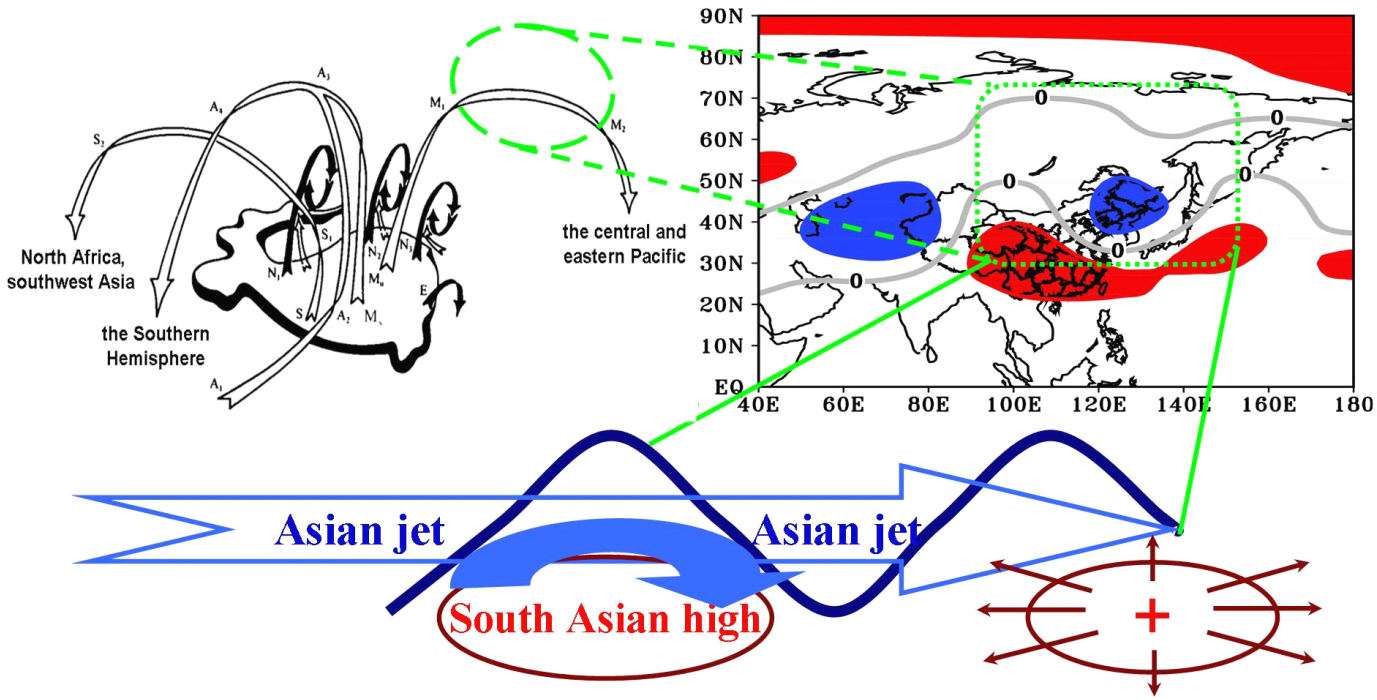
ABSTRACT: Large amplitude stationary Rossby wave trains with wavelength which emerges from North Africa to East Asia along the west jet in the mid-latitude areas. It has been identified in the mid-upper troposphere in summer based on the correlation analysis between Dynamic Plateau Monsoon Index (DPMI) and meridional velocity at 500-200hPa. The Qinghai-Xizang Plateau monsoon would influence the East Asia monsoon by general circulation indirectly. In strong plateau summer monsoon years, the West Pacific subtropical high (WPH) located westward and the Northeastern Weak trough (NET) moved eastward. With the anomalous northwesterly flow in the southwest side of the NET, the anomalous southwesterly flow in the northwest side of the WPH dominates over the Yangtze River Valley. It is propitious to maintain the rain-belt and bring more rainfall there. For the weak case, the opposite is true.

Key words: Qinghai-Xizang Plateau Monsoon, East Asia Monsoon, Asian jet, WPH, NET

1. Background and signification

1) The plateau monsoon has a major influence on the South Asian high.
2) The Asian jet is an enhanced portion of the subtropical jet on the northern fringe of the South Asian anticyclone that develops during the Asian summer monsoon period.
3) The plateau monsoon change would indirectly affect the distribution characters of East Asian monsoon and South Asian monsoon by affecting the general circulation.

2. A hypothesis on the propagation of Rossby waves



Based on the distribution characteristics of vertical mean circulation over the plateau and its adjacent regions during summer. Qian et al., (2001).

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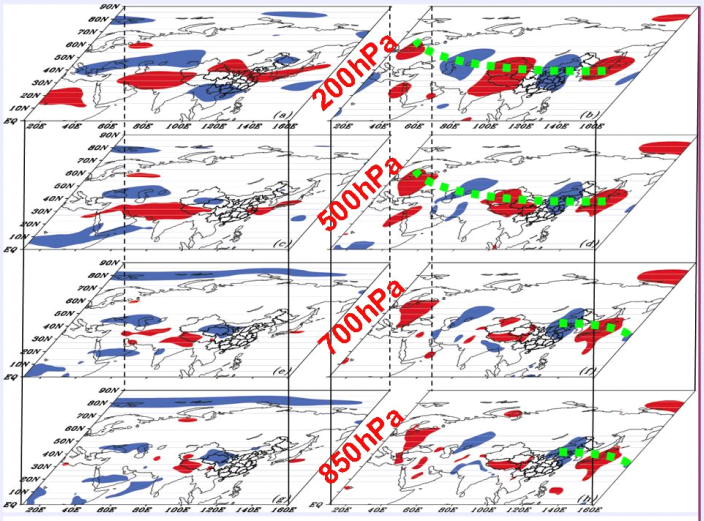
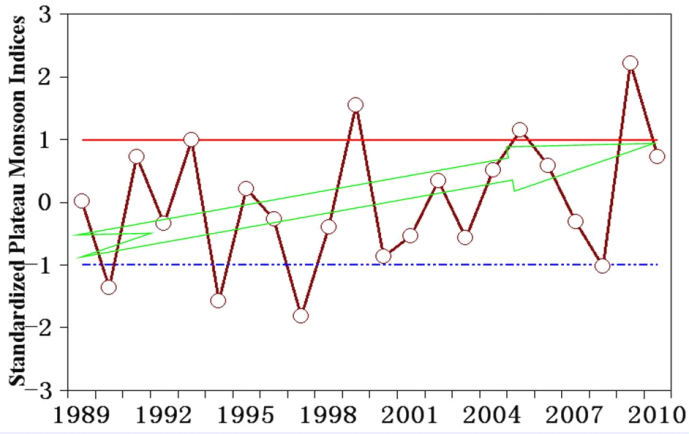
3. The teleconnection pattern



Correlation coefficients between summer DPMI and zonal velocity (left), and between summer DPMI and meridional velocity at every point (right).

4. Plateau monsoon index variation

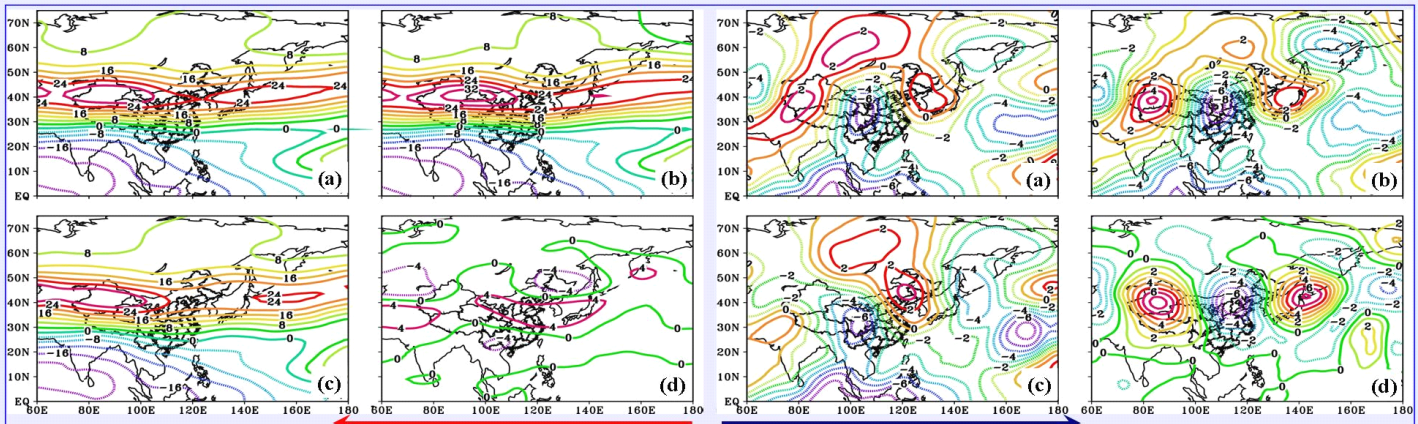


The strong plateau summer monsoon years—SPMI>1, 1993, 1999, 2005 and 2009; the weak plateau summer monsoon years—SPMI<-1, 1990, 1994, 1997 and 2008.

These years are used for the composite of strong and weak cases throughout the current study.

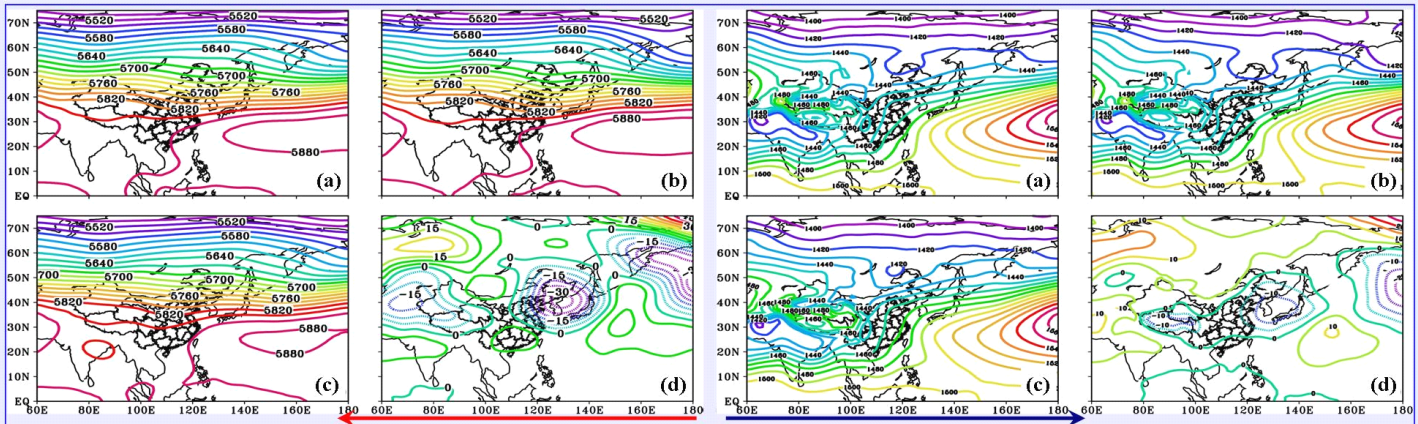
5 the propagation of Rossby waves and East Asia monsoon circulation change

The wavetrains pattern appears along the northern edge of the South Asian high, where the subtropical jet is intensified. This stands out in the difference between the strong and weak plateau summer soon years with some intensification toward the downstream.



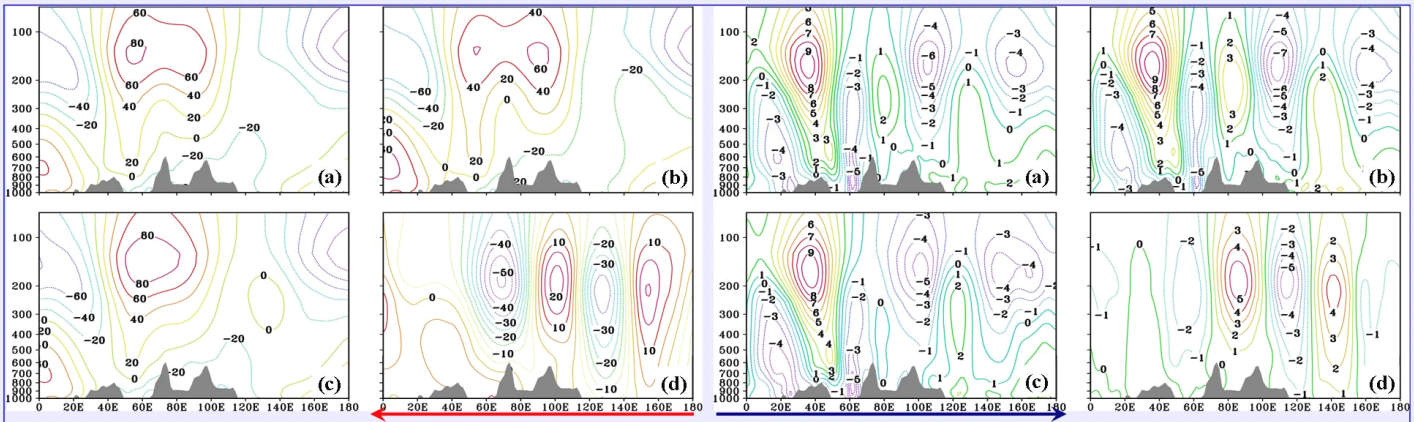
Distribution of the zonal (left) and meridional (right) wind at 200 hPa in the (a) climatology, (b) strong, (c) weak summer plateau monsoon years and (d) the difference between the strong and weak cases, (b)–(c): (unit: m/s).

In strong plateau summer monsoon years, the WPH located westward and the NET moved eastward. For the weak case, the WPH located eastward and the NET moved westward.

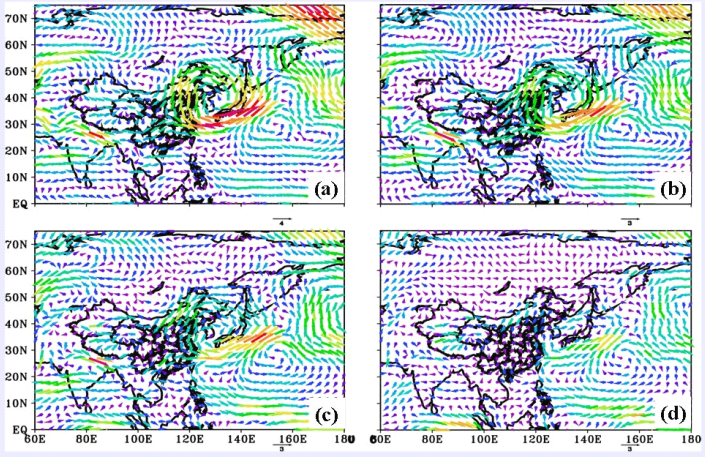


Distribution of the geopotential height at 500 hPa (left) and 850hPa (right) in the (a) climatology, (b) strong, (c) weak summer plateau monsoon years and (d) the difference between the strong and weak cases, (b)–(c): (unit: gpm).

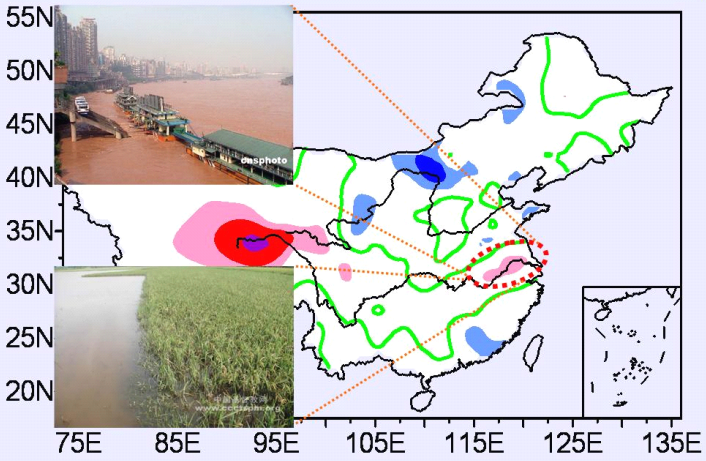
6. Influence on East Asia monsoon climate



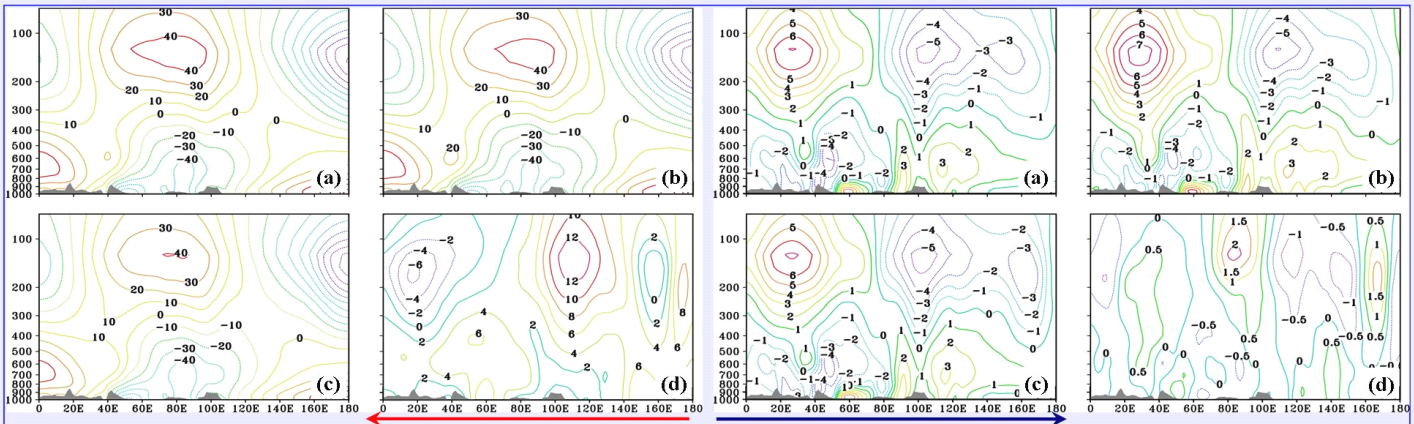
The latitude-height cross-section of the geopotential height (left) and meridional velocity (right) at average between 30-45° N in the (a) climatology, (b) strong, (c) weak summer plateau monsoon years and (d) the difference between the strong and weak summer plateau monsoon years, (b)–(c).



Difference flow fields of (a) 600, (b) 700, (c) 850 and (d) 1000 hPa between the strong and weak summer plateau monsoon years during summer: (units: m/s).



Correlation coefficients between the plateau summer monsoon and summer precipitation.



The latitude-height cross-section of the geopotential height (left) and meridional velocity (right) at average between 12-27° N in the (a) climatology, (b) strong, (c) weak summer plateau monsoon years and (d) the difference between the strong and weak summer plateau monsoon years, (b)–(c).

Ongoing works:

1) The East Asian monsoon → The plateau monsoon
2) The plateau monsoon ⇢ The South Asian monsoon
3) Surface heating fields over the plateau → The Asian monsoon

Reference: (1) Qian., Z.A., T.W. Wu and X.Y. Liang, *Chinese Journal of Atmospheric Sciences*, **2001**, 25(4): 444-454. (2) Xun., X.Y., Z.Y. Hu and Y.M.Ma, *Advances of Atmospheric sciences*, **2012**, doi: 10.1007/s003 76-012-1125-9. (3) Ambrizzi, T., B. J. Hoskins and H.H. Hsu, *J. Atmos. Sci*, **1995**, 52, 3661-3672. (4) Enomoto, T., *Journal of the Meteorological Society of Japan*, **2004**, 82(4): 1019-1034. (5) Hoskins., B.J. and T.Ambrizzi, *J. Atmos. Sci*, **1993**, 50, 1661-1671.(6) Parthasarathy, B., K.Rupakumar and V. Deshpande, *Int. J. Climatol*, **1991**, 11, 165-176. (7) Joseph, P.V. and J.Srinivasan, *Tellus A*, **1999**, *51*,854-864. (8) Lu, R.Y., J.H.OH and B.J.O. Kim, *Tellus A*, **2002**, 54(1): 44-55.