Interannual Variability of the Asian Subtropical Westerly Jet in Boreal Summer and Associated with Circulation and SST Anomalies

Yin Du[1, 2], Tim Li[1,2], Zhiqing Xie[3] and Zhiwei Zhu[1, 2]

[1] *Climate Dynamics Research Center and Earth System Modeling Center, International Laboratory on Climate and Environment Change, Nanjing University of Information Science and Technology, Nanjing, China*
[2] *International Pacific Research Center and Department of Atmospheric Sciences, School of Ocean and Earth Science and Technology, University of Hawaii at Manoa, Honolulu, Hawaii*
[3] *Jiangsu Climate Center, Nanjing, China*

The interannual variability of the Asian Subtropical Westerly Jet (ASWJ) in boreal summer is investigated through the diagnosis of 54-yr (1960-2013) NCEP/NCAR reanalysis data. The main characteristics of two leading Empirical Orthogonal Function (EOF) patterns of 200hPa zonal wind anomalies are the meridional displacement and southwest-northeast tilting of ASWJ. The first leading mode has significant periods of 4.9 years, whereas the second mode has significant periods of 3.6 and 7.7 years, respectively. The two modes exhibit an equivalent barotropic structure, and are associated with a distinctive north-south and east-west dipole rainfall pattern in China, respectively.

The positive phase of the first leading mode appears during El Nino developing phase, whereas the positive phase of the second mode occurs during La Nina decaying phase. A mechanism is put forth based on observational analysis and AGCM sensitivity experiments. The positive phase of the first mode is primarily driven by the combined effect of a cold SST anomaly (SSTA) in mid-latitude North Pacific and a warm SSTA in tropical Indian Ocean and Pacific. In response to the SSTA forcing, a zonally oriented north-south tropospheric temperature dipole is induced. While the tropospheric warming in the tropics arises from El Nino like heating, the tropospheric cooling in the mid-latitudes arises possibly from the local SSTA forcing. For the positive phase of the second mode, the upper-tropospheric anticyclonic vorticity anomaly in the east pole arises from local SSTA forcing in North Pacific, whereas the cyclonic anomaly in the west pole results from southeastward Rossby wave energy emanation from North Atlantic to East Asia.

Key words: Asian Subtropical Westerly Jet, Meridional temperature gradient, Sea surface temperature anomaly, AGCM experiments