

Linkage between upper-level jets over East Asia and East Asian winter monsoon variability

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This study investigates the linkage between East Asian winter monsoon (EAWM) variability and upper-level jets, with particular focus on East Asian polar front jet (PJ) and its concurrent variation with subtropical jet located to the south of Tibetan Plateau (TSJ). The winter upper-level zonal wind variations over East Asian landmass (70 °-120 °E) are dominated by two distinct principle modes, i.e., meridional displacement of PJ and out-of-phase variation in the intensity of TSJ and PJ. Both modes are closely linked to EAWM variability. Meridional shift of PJ corresponds to EAWM northern mode, while the concurrent variation of PJ and TSJ matches EAWM southern mode. When PJ migrates southward, Siberian High (SH) displaces northwestward, East Asian trough axis exhibits northeast-southwest tilt and westward shift, leading to cold winter in northern East Asia. Meanwhile the configuration of intensified TSJ and weakened PJ is linked to the amplified SH, Aleutian Low (AL), and strengthened East Asian trough, as well as a wave like anomaly pattern extending from western Barents Sea downstream to East Asia at 500hPa. Possible reasons for the linkage are also examined from the perspective of external forcings and atmospheric internal dynamics. Equatorward shift of PJ, coupling with enhanced (weakened) zonal wind in its south (north), is driven by La Niña phase in the tropics and sea ice anomalies over the Arctic. On the other hand, the configuration of intensified TSJ and weakened PJ is associated with weak stationary planetary wave activity together with synoptic-scale transient eddy activity anomalies.

Key words: Upper level jets, East Asian winter monsoon, External forcings, internal dynamics