

## Linkages between the South and East Asian Monsoon water vapor transport during boreal summer

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This study provides a water vapor transport (WVT) perspective on the linkages between the South and East Asian summer monsoons (SASM and EASM) and indicates two robustly coupled modes of the vertical integrated WVT (VIWVT) over the two monsoons that accounts for above 90% of the total squared covariance fraction. The first coupled mode (SVD1 mode) depicts a meridional linkage between the meridional dipole VIWVT anomalies over both the SASM and EASM. While the second coupled mode (SVD2 mode) illustrates a zonal connection of an anomalous cyclonic/anticyclone VIWVT over the SASM and a zonal wave-like VIWVT over the EASM. The SVD1 mode is linked through the anomalous subtropical High over the western North Pacific (WNPSH) and primarily associated with the transition phase of El Niño/La Niña (ENSO) and simultaneous Indian Ocean Basin mode (IOBM) SST warming/cooling. The meridional connection of the VIWVT in the SVD1 mode experienced a clear intensification since the late-1970s that may be attributed to the strengthened impacts of the ENSO/IOBM on the EASM and SASM after the late-1970s. The SVD2 mode is connected by the Circumglobal teleconnection (CGT) pattern and related to the developing phase of ENSO and summer north Atlantic tripole (NAT) SST anomalies. The zonal VIWVT connection in SVD2 mode is strongly modulated by the SASM-CGT connections and reveals significant weakening since the late-1970s but re-intensifies after the early-1990s. This may be associated with the weakened ENSO-SASM relationship after the late-1970s and interdecadal decreasing of the all Indian summer rainfall since the early-1990s.

Keywords: Water vapor transport, South and East Asian summer monsoon, linkage, interdecadal change