Role of Pacific and North Atlantic Circulation in Modulating Indian Summer Monsoon Variability

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The interannual variability of Indian summer monsoon rainfall (ISMR) have been examined in association with the variability of 2-meter surface temperature (2mST), and lower- and upper- tropospheric pressure and wind patterns over the globe using ERA-40 reanalysis dataset. The analysis of 44-years (1958-2001) data reveals a recurrent negative phase of ENSO (La Niña) pattern. The increase in 2mST over tropical southwest Pacific and intensification of subtropical westerly jet stream over Indian Ocean due to the consequence of thermal wind balance. The intensification of jet forms anticyclonic anomaly which intensifies Mascarene High as the atmospheric response is equivalent barotropic over there. The Mascarene High intensifies the cross equatorial flow and hence Indian summer monsoon (ISM) circulation. While, during non-ENSO years data reveals a recurrent positive relationship of ISMR with 2mST anomaly over northwest of North Atlantic and intensification and shift of North Atlantic westerly jet stream to higher latitudes. The jet stream intensifies the meridional vorticity dipole, formed due to Azores High and the entrance of Asian subtropical westerly jet stream over North Atlantic and west Mediterranean Sea. A wave activity flux for stationary Rossby waves diverges out of the vorticity dipole toward downstream along the Asian jet stream over the Eurasian region. The jet stream acts as a wave guide and the successive trough and ridges of the Rossby waves travel along the jet and influence upper-tropospheric Tibetan High and hence ISM circulation.

KEY WORDS Rossby wave; Azores High; ENSO; Circumglobal Teleconnection; Indian Summer Monsoon; Indian Ocean Dipole Mode