



The Indian Easterly Jet During the Pre-Monsoon Season in India

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We identify for the first time an Indian Easterly Jet (IEJ) in the mid-troposphere during the pre-monsoon season, using ERA5 reanalysis data. The IEJ is weaker and smaller in zonal extent than the African Easterly Jet over West Africa, with a climatological location of 10°N, 60–90°E, 700 hPa, and strength 6–7 m s⁻¹ during March–May. The IEJ is a thermal wind associated with low-level meridional gradients in temperature (positive) and moisture (negative), resulting from equatorward moist convection in the ITCZ and poleward dry convection arising due to surface heating of northern India and surrounding inland desert regions. The IEJ is associated with a negative meridional potential vorticity gradient, therefore satisfying the Charney-Stern necessary condition for instability. However, no wave activity is detected in various metrics, suggesting that the potential for combined barotropic-baroclinic instability is not often realized. This is likely related to the small zonal extent of the jet, with insufficient time for wave growth, or the lack of upstream orography. The IEJ is found to be linked with the meteorology of pre-monsoon India. IEJ strong years feature increased near-surface temperatures and drier conditions over India, while the opposite is found in IEJ weak years. Initial investigations did not indicate strong relationships between the IEJ state and the El Niño-Southern Oscillation or the Madden Julian Oscillation, although more detailed investigations are needed to clarify this. This study provides an introduction to the IEJ's role in pre-monsoon dynamics, and a platform for further research. This includes identifying any links with pre-monsoon meteorological hazards (heatwaves and thunderstorms) and potential impacts on the subsequent monsoon, and understanding large-scale conditions that drive changes in the IEJ.