Title:	Meridional displacement of the Asian jet and its impact on Indian summer monsoon rainfall in observations and CFSv2 hindcast
Authors:	Attada, Raju (/jspui/browse?type=author&value=Attada%2C+Raju)
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Abstract:	In this study the impact of meridional displacement of the Asian jet on the Indian summer monsoon (ISM) rainfall in observations and Climate Forecast System version 2 (CFSv2) hindcast is examined, for the period of 1985 to 2019. The observations show that during boreal summer (June to September), the leading mode of variability in the upper-tropospheric zonal wind anomalies along the Asian jet exhibits a north–south seesaw pattern on the interannual time scale. The strength of the meridional displacement/loading of the summer Asian jet is robust over the East Asian region in the observations, whereas in the case of CFSv2 the signals are strong both over the West and East Asian regions. The southward displacement of the Asian jet (SWDAJ) provoke reduced precipitation over the central and northern India regions in observation. This reduced rainfall over northern India is well captured by the model with slight overestimation of its strength. Physical mechanisms that link the SWDAJ and monsoon rainfall are unravelled in this study. It is found that SWDAJ weakens the upper level Tropical Easterly Jet over the Indian subcontinent and reinforces the lower level anticyclone thereby reducing the rainfall as evidenced in both observations and model. Southward gradients in the tropospheric temperature and low level moisture divergence also support the reduced rainfall over India. Observed precipitation enhancement in the Meiyu–Baiu rain band and the associated low level convergence are the characteristics of SWDAJ over East Asia, linked with divergence over India, which is completely absent in the model. Detailed analysis of individual summer months in the observations and model reveals that during early summer (June and July), the dominant meridional displacement of the Asian jet is located over the West and East Asian regions. These dominant anomalies are migrated eastward to the East Asian region by September in the observations, whereas persisted over both West Asia and East Asia regions in the model. In addition to this, meridional displacement of the Asian jet in the model is strongly influenced by the El Niño-Southern Oscillation (ENSO) predominantly in late monsoon season. This study suggests that the teleconnections of the Asian jet variability and ISM rainfall are over dependent on ENSO in the model, which might limit its prediction skill, not only over India but also for the entire Asian region.
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