

Introduction or Motivation

Intertropical Convergence Zone (ITCZ) accounts for about 32% of global precipitation and shapes climate and society in tropic. It is a permanent low-pressure feature that marks the meteorological equator where the trade winds laden with heat and moisture from surface evaporation and sensible heating, converge to form a zone of increased mean convection, cloudiness and precipitation.

The spatiotemporal variation in the characteristics of ITCZ can be related to the variability of the monsoon. As Indian monsoon is a manifestation of the seasonal migration of the ITCZ, the understanding of regional characteristics of ITCZ can give more insight into the variability of Indian Monsoon Rainfall in a changing climate.

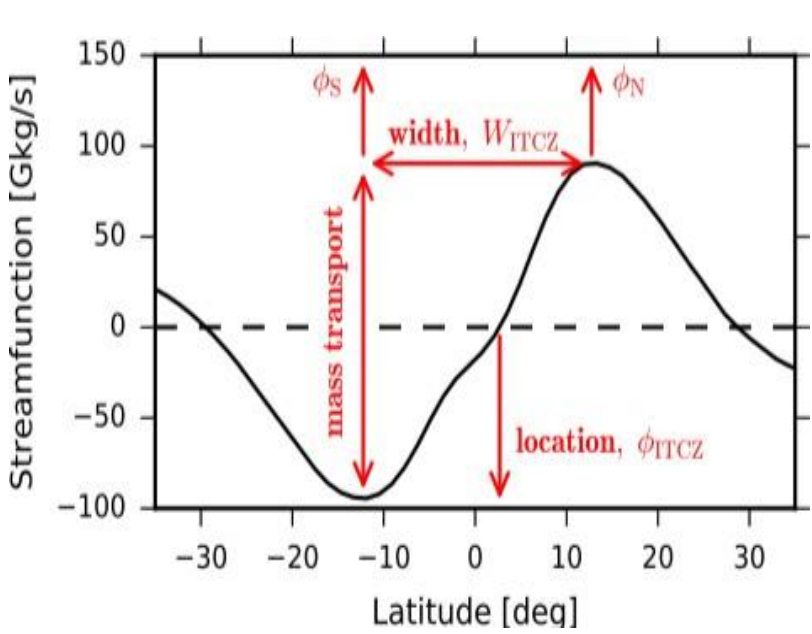
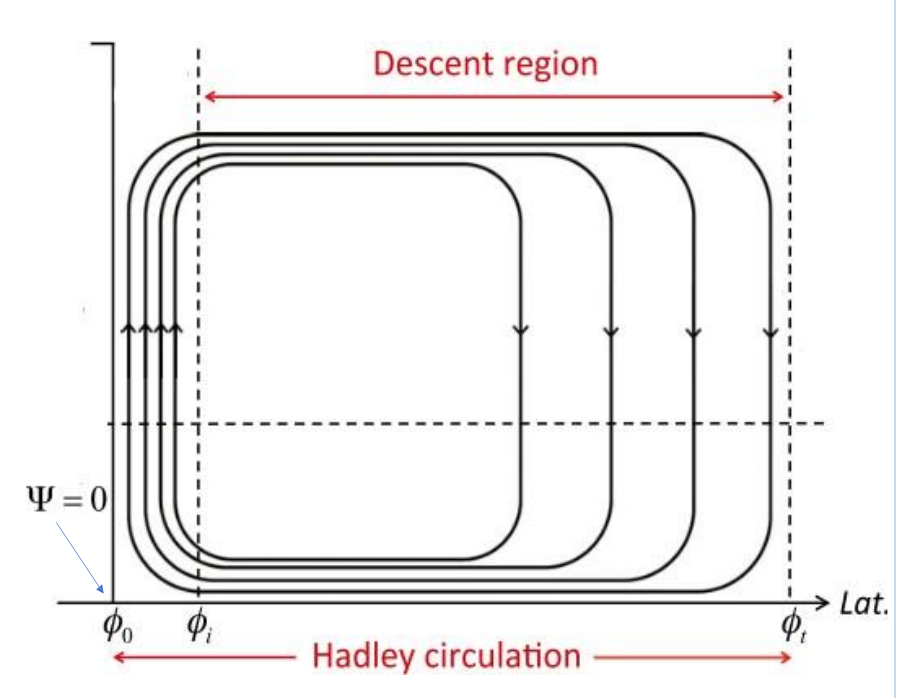
Objectives

This study discusses about the variability of ITCZ characteristics during boreal monsoon season over the south Asian monsoon domain. The results indicate large variability in ITCZ in response to SST forcings especially during El-Nino and La Niña years in a changing climate.

Methodology & Study Area

Zonal mean position of ITCZ is computed using Eulerian-mean meridional stream function for June–September for the Indian monsoon region [70–90°E]. ITCZ location is the latitude closest to the equator where the stream function (vertically averaged with mass weighting between 1000 and 100 hPa) is zero

$$\Psi(\Phi, p) = 2\pi a g^{-1} \int_0^p [\bar{v}_a] \cos \phi$$



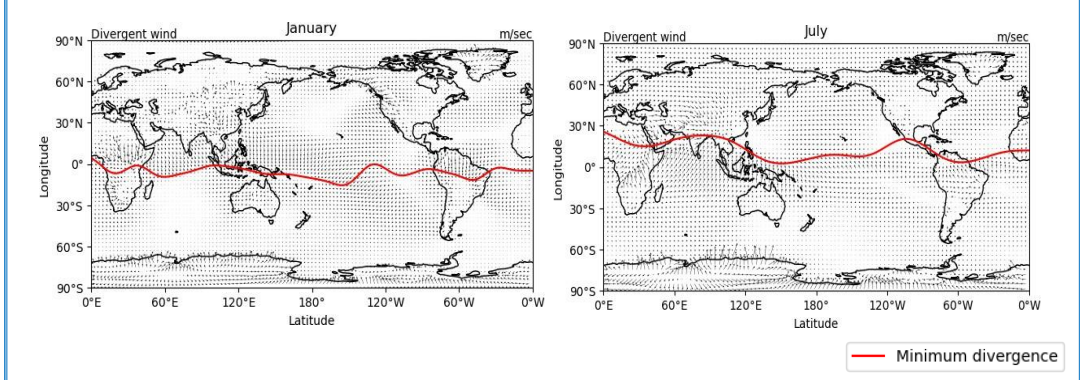
Specific humidity, Total column water vapor and divergent wind at 925 hPa is also used.

IMDAA Data - high resolution (12km) regional reanalysis over India - precipitation, wind at different pressure levels, etc. Data is available from 1979-2020.

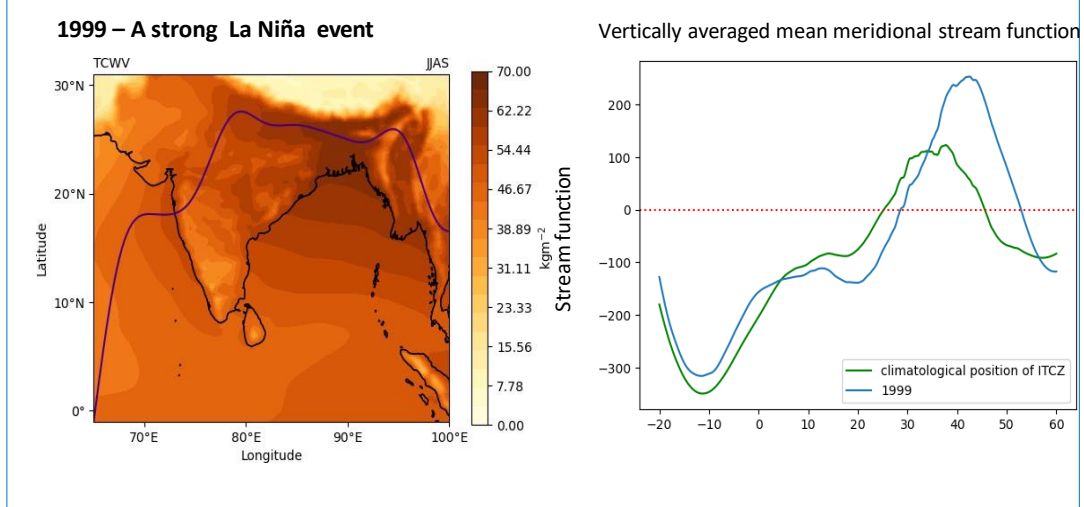
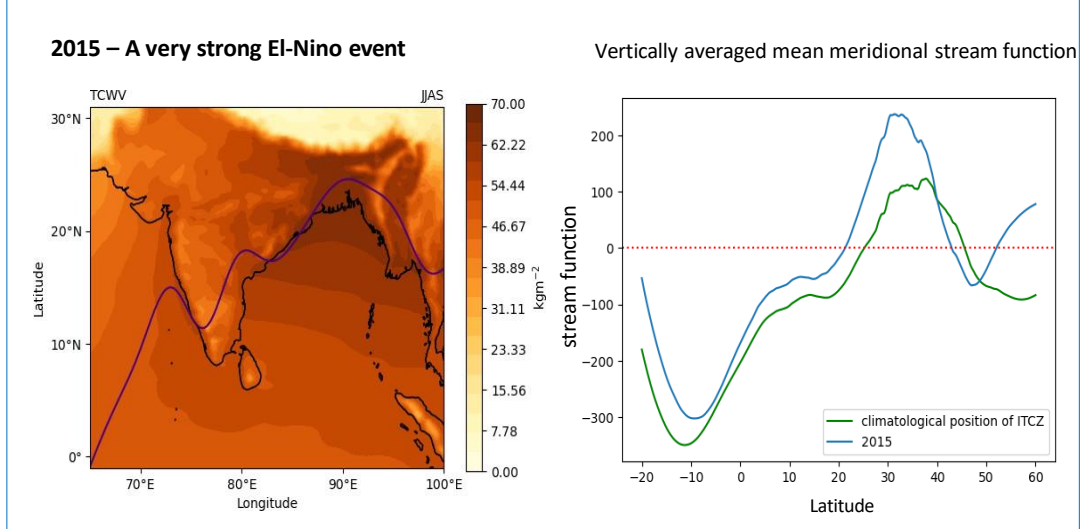
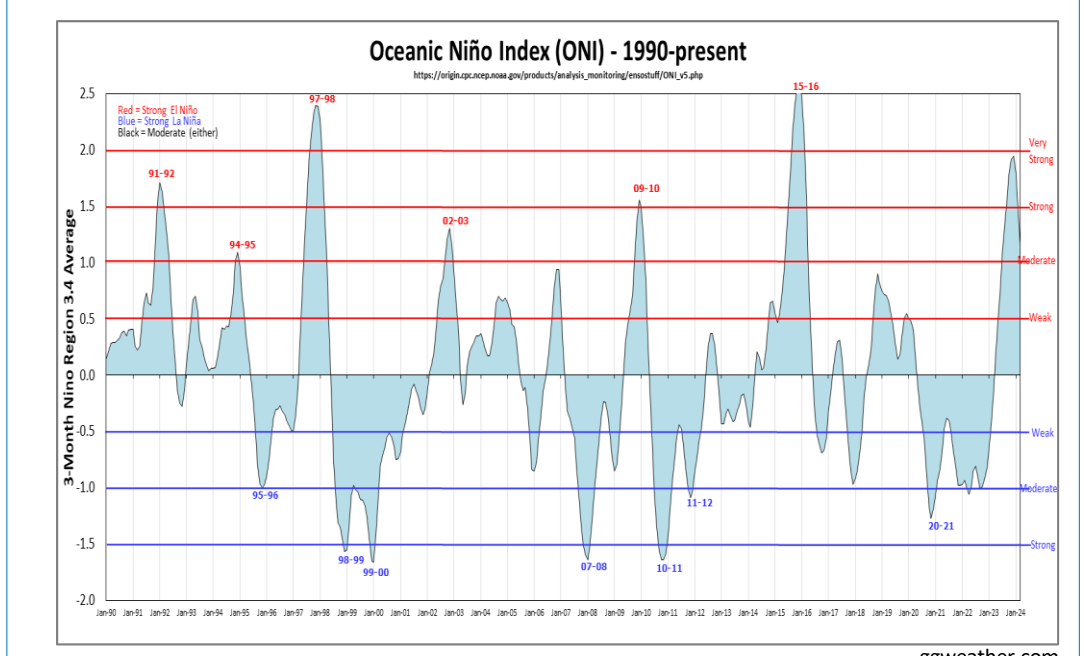
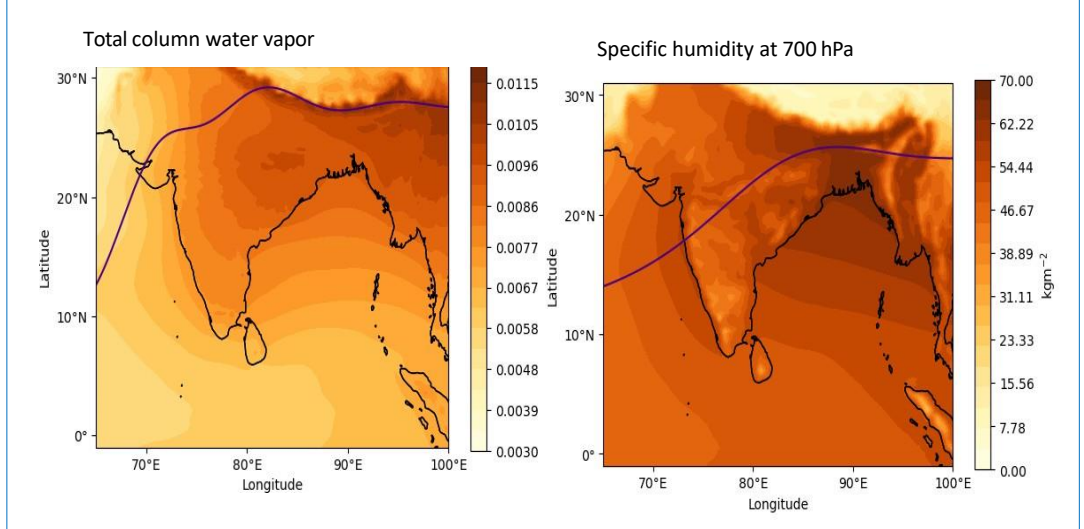
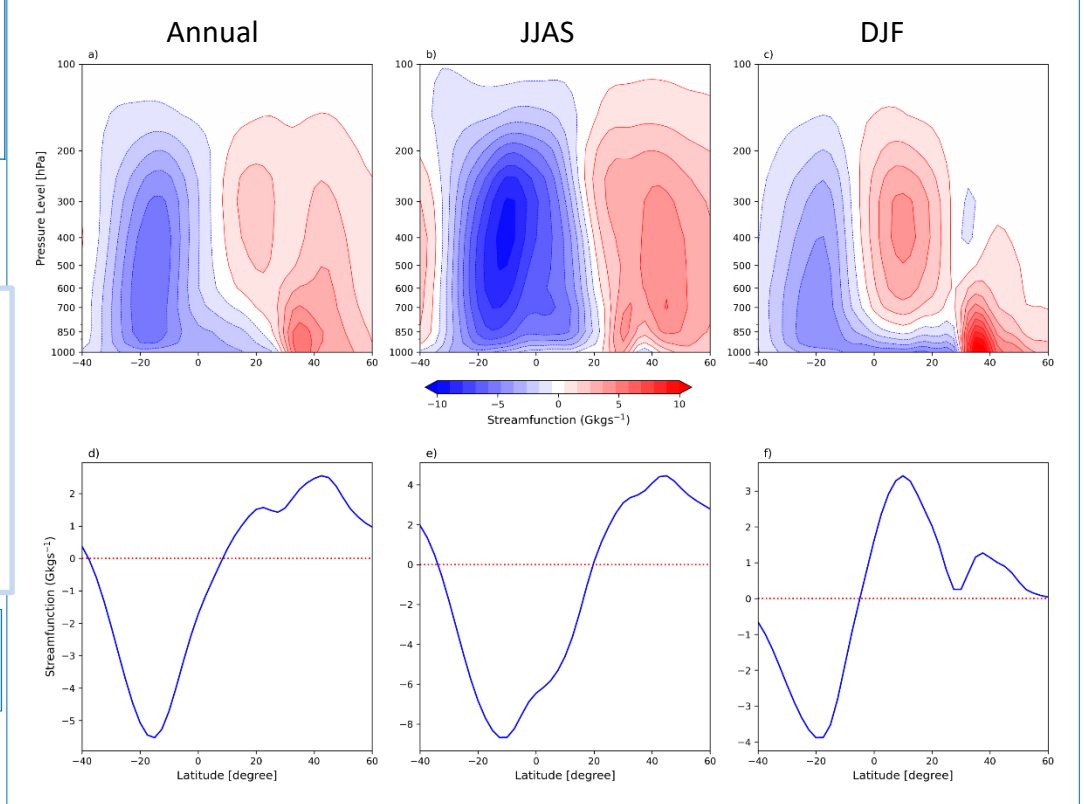
ERA5 (Hersbach et al., 2020) at $0.25^\circ \times 0.25^\circ$ - wind at different pressure levels, total column water vapor, specific humidity at 700 hPa. Data is available from 1948.

Results

Global climatology of ITCZ during boreal summer and winter season

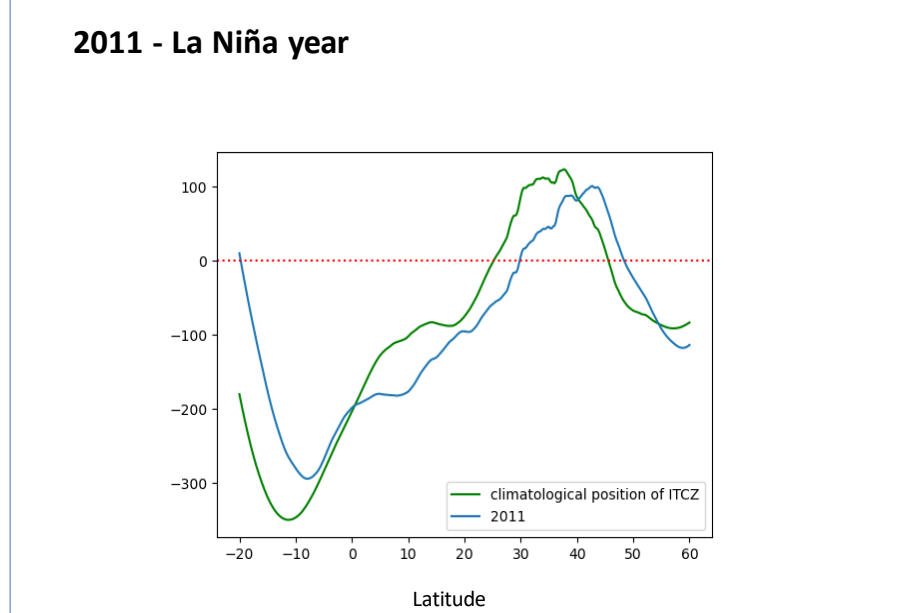
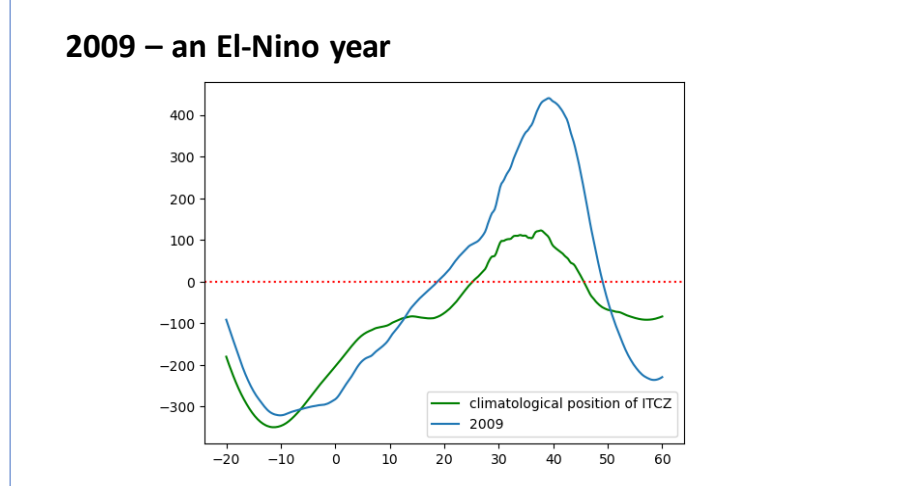


Regional climatology of ITCZ



Results

Other case



Conclusion

- The years 2015 and 2009 are pure El-Nino years without Indian ocean forcing. Similarly the years 1999 and 2011 are pure La-Niña years without Indian ocean forcing.
- The El-Nino years showed a southward shift in ITCZ during JJAS season from its climatological mean
- This shift is evident in both the parameters used whether it is based on dynamics or thermodynamics of parameter
- The La-Niña years showed a northward shift during JJAS season in ITCZ from its climatological mean
- The observed shifts in ITCZ can be attributed to anomalous Pacific ocean warming and cooling during El-Nino and La-Niña years, respectively.

Acknowledgement & References

Ashok et al., 2004 Individual and combined influences of ENSO and IOD on ISMR

Byrne & Schneider., 2016 Narrowing of the ITCZ in a warming climate

Chan, S. C., & Evans, J. L. (n.d.). Comparison of the Structure of the ITCZ in the West Pacific during the Boreal Summers of 1989-93 Using AMIP Simulations and ECMWF Reanalysis.

Doblas-Reyes, F.J., A.A. Sörensson, M. Almazroui, A. Dosio, W.J. Gutowski, R. Haarsma, R. Hamdi, B. Hewitson, W.-T. Kwon, B.L. Lamptey, D. Maraun, T.S. Stephenson, I. Takayabu, L. Terray, A. Turner, and Z. Zuo, 2021: Linking Global to Regional Climate Change.

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