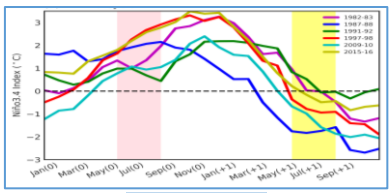
The Indo-western Pacific variability and its influence on Indian Monsoon: Post El Niño prospective

Jasti S. Chowdary[1]*, C. Gnanaseelan[1], Anant Parekh[1], G. Srinivas[2], Darshana Patekar[1], Amol Vibhute[1], Gopinadh Konda[1] and Nimmakanti Mahendra[3]

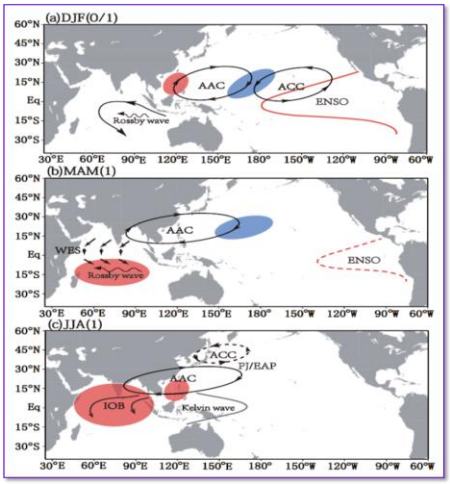
[1]Indian Institute of Tropical Meteorology, Ministry of Earth Sciences, Pune-411008, India
[2]CSIR – National Institute of Oceanography, Dona Paula, Goa 403 004, India
[3]Department of Earth and Atmospheric Sciences, National Institute of Technology, Rourkela – 769008, India.
*Email: jasti@tropmet.res.in

- **The El Niño and Southern Oscillation (ENSO) teleconnections offer crucial predictive insights for surface air temperature (SAT) and rainfall over India.**
- **Prominent climate anomalies over India during spring and summer of decaying El Niño events found have significant impact on the socio-economic conditions.**
- **The analysis revealed that the decaying phase of El Niño significantly impacts Monsoon depressions, ISM rainfall, extreme rainfall events in Northeast India, and spring to early summer heatwaves.**

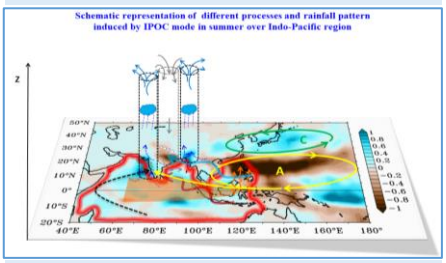


El Niño cycle

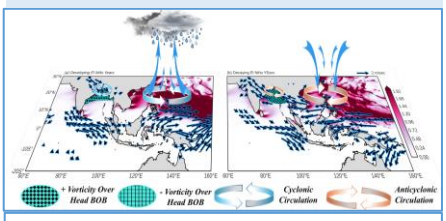
Schematic representation of the major SST anomalies and atmospheric teleconnection over the Indo-Pacific oceans associated with El Nino event *(Xie,..Chowdary et al. 2016).*



Schematic diagram of the mechanisms through which IPOC mode influences Indo-Pacific region *(Gnanaseelan and Chowdary 2019; Drashana et al. 2022).*

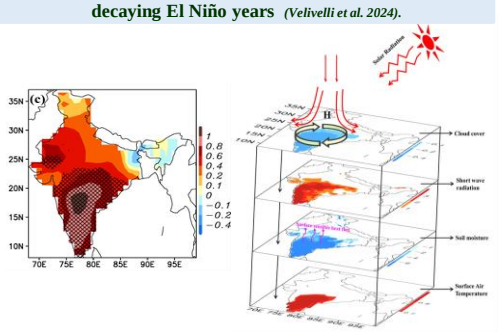


Schematic diagram that shows the major factors responsible for favourable and unfavourable conditions for the formation of MDs during summers of developing and decay El Niño years, respectively *(Chowdary et al. 2024).*

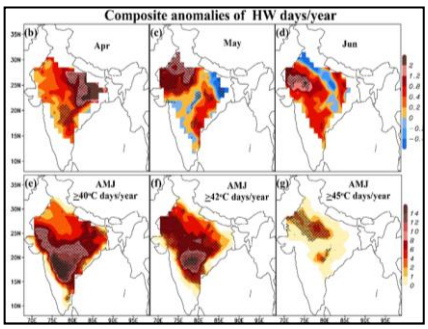


Our analysis revealed that the number of MDs has reduced remarkably by a factor of 2 during El Niño decay summers (more than half) as compared to climatology and in fact, no such decline is depicted in developing El Niño years.

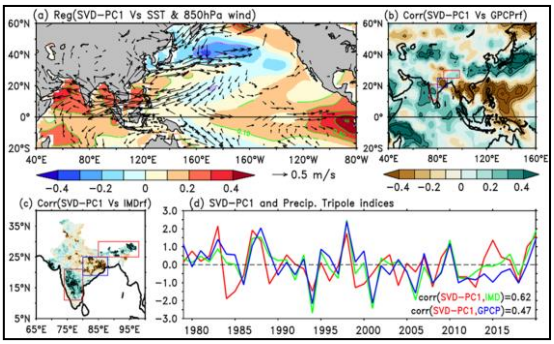
Composite of SAT anomalies in the spring (MAM) of decaying El Niño years *(Velivelli et al. 2024).*



Heat waves

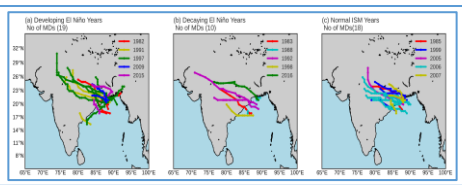


- **El Niño at its decaying phase, exerts a strong influence on the spring Surface Air Temperature (SAT) over India and this warming is mainly induced by an anomalous anticyclone, which extends from the Western North Pacific (WNP) to Indian region. Further, 6 out of the 10 warmest spring years in India found to occurred during El Niño decay years.**
- **Heat Wave days are more prevalent over India in spring and early summer, predominantly increased in south-central and northwest India during the decaying phase of El Niño years.**



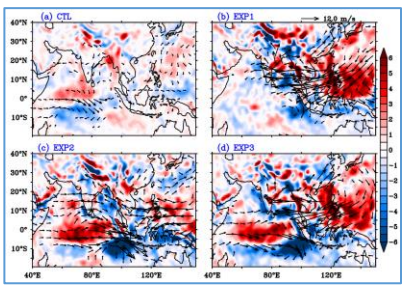
(a) Regression of JJA SVD-PC1 upon SST, 850hPa wind anom. (b) Correlation between SVD-PC1 and GPCP rainfall (c) Correlation between SVD-PC1 and IMD rainfall (d) Normalized time series of observed SVD-PC1 and PTI. (contours and vectors are significant at 90% confidence level) (Chowdary et al. 2019; Darshana et al. 2022).

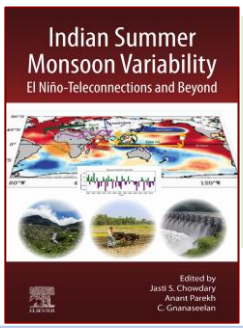
The Indo-Western Pacific Ocean Capacitor (IPOC) mode linked to El Niño decay induces anomalous tri-pole pattern in the precipitation anomalies over ISM region with strong positive precipitation anomalies over the Southern peninsular India and northeast India and negative precipitation anomalies over the monsoon trough region.



Monsoon depression tracks during June to September for (a) developing El Niño years, (b) decaying years, and (c) non-El Niño normal ISM years.

Individual and combined Impact of TIO warming and WNP anticyclone investigated using CFSv2 sensitivity experiments *(Srinivas et al. 2018; Chowdary et al. 2019).*





Various other ISM teleconnections, which includes the PJ, SRP, SHI, IOD, Atlantic Nino etc, are discussed in this book. Scan the QR code for more details on content.

References:
Chowdary et al. 2019, Climate Dynamics doi:10.1007/s00382-019-04850-w.
Darshana et al. 2022. Climate Dynamics , doi.org/10.1007/s00382-021-06133-9.
Gnanaseelan and Chowdary 2019, Mausam, 70, 4, 731-752
Srinivas et al. 2018, Journal of Climate https://doi.org/10.1175/JCLI-D-17-0408.1
Velivelli et al. 2024, Climate Dynamics, doi.org/10.1007/s00382-023-06990-6
Xie et al. 2016; Adv. Atmospheric Sci. doi.org/10.1007/s00376-015-5192-6

Acknowledgement: IITM, MoEs; WMO IWM-8