# INFLUENCE OF PDO AND ENSO ON INDIAN SUMMER MONSOON RAINFALL AND ITS CHANGING RELATIONSHIP BEFORE AND AFTER CLIMATE SHIFT

Anupama K Xavier[1,2,3], Hamza Varikoden[3*] and C. A. Babu[2]

[1]Royal Meteorological Institute of Belgium, Avenue Circulaire, 3, 1180 Brussels, Belgium

[2]Department of Atmospheric Sciences, Cochin University of Sciences and Technology, Kochi–682016, India

[3]Indian Institute of Tropical Meteorology, Pashan, Pune–411008, India

# Introduction and Methodology

- The Indian Summer Monsoon Rainfall (ISMR) Significant feature of India's climate system, accounting for 70-90% of the annual rainfall over major parts of India

- It is highly sensitive to the changes in tropical Pacific sea surface temperature (SST) hence phenomenons like ENSO and PDO

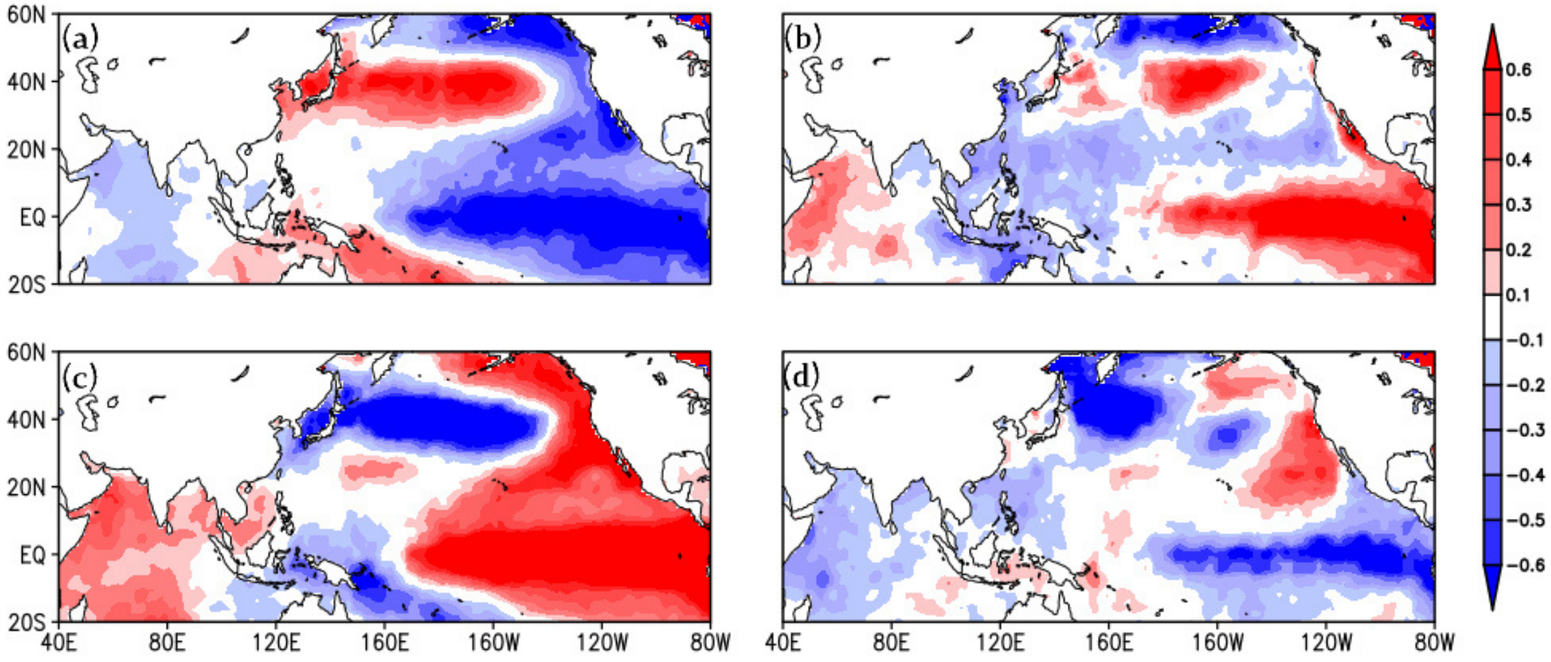
- In 1976 - 1977, climate shift was observed in the Pacific Ocean which will also influence this relation

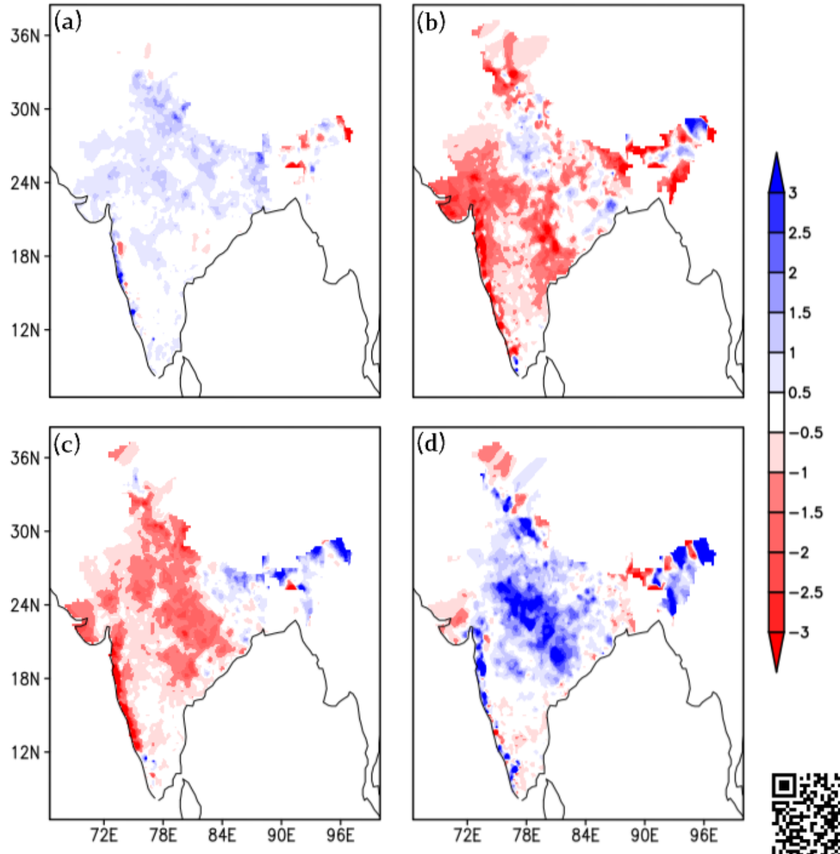
- Inorder to study the combined effect of PDO and ENSO on ISMR, the study period is divided in to 4 based on the standard deviation

- Later the study period again divided in to Pre-shift and Post shift periods by considering climate shift happened in 1976

# Results and Discussions

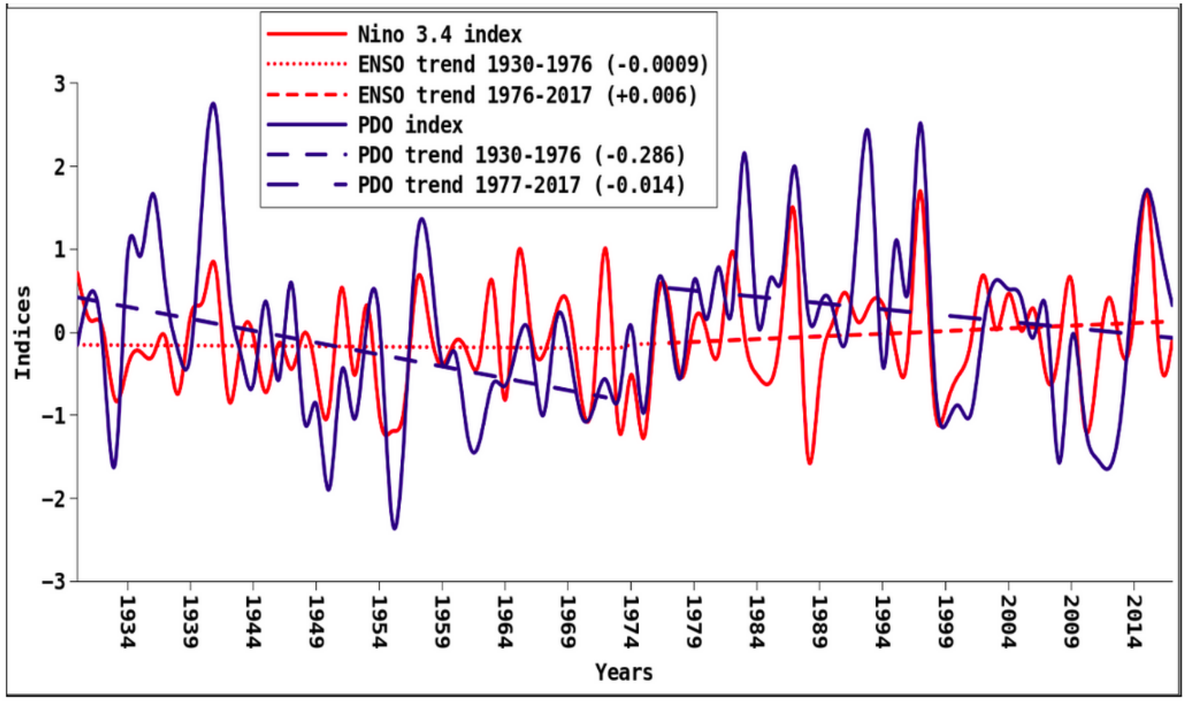
## 1. Combined effect of PDO and ENSO on SST and ISMR anomalies



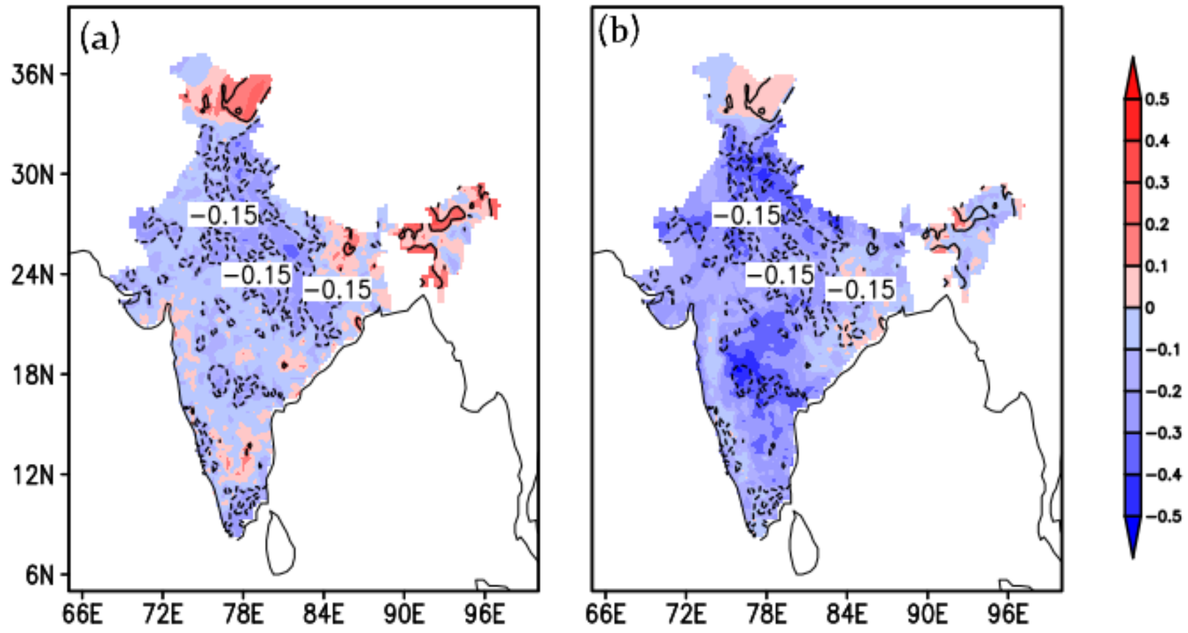




Spatial distribution of SST (°C) and rainfall (mm/day) anomalies during PDO and ENSO periods. a. Negative PDO and La Niña, b. Negative PDO and El Niño, c. Positive PDO and El Niño, d. Positive PDO and La Niña.

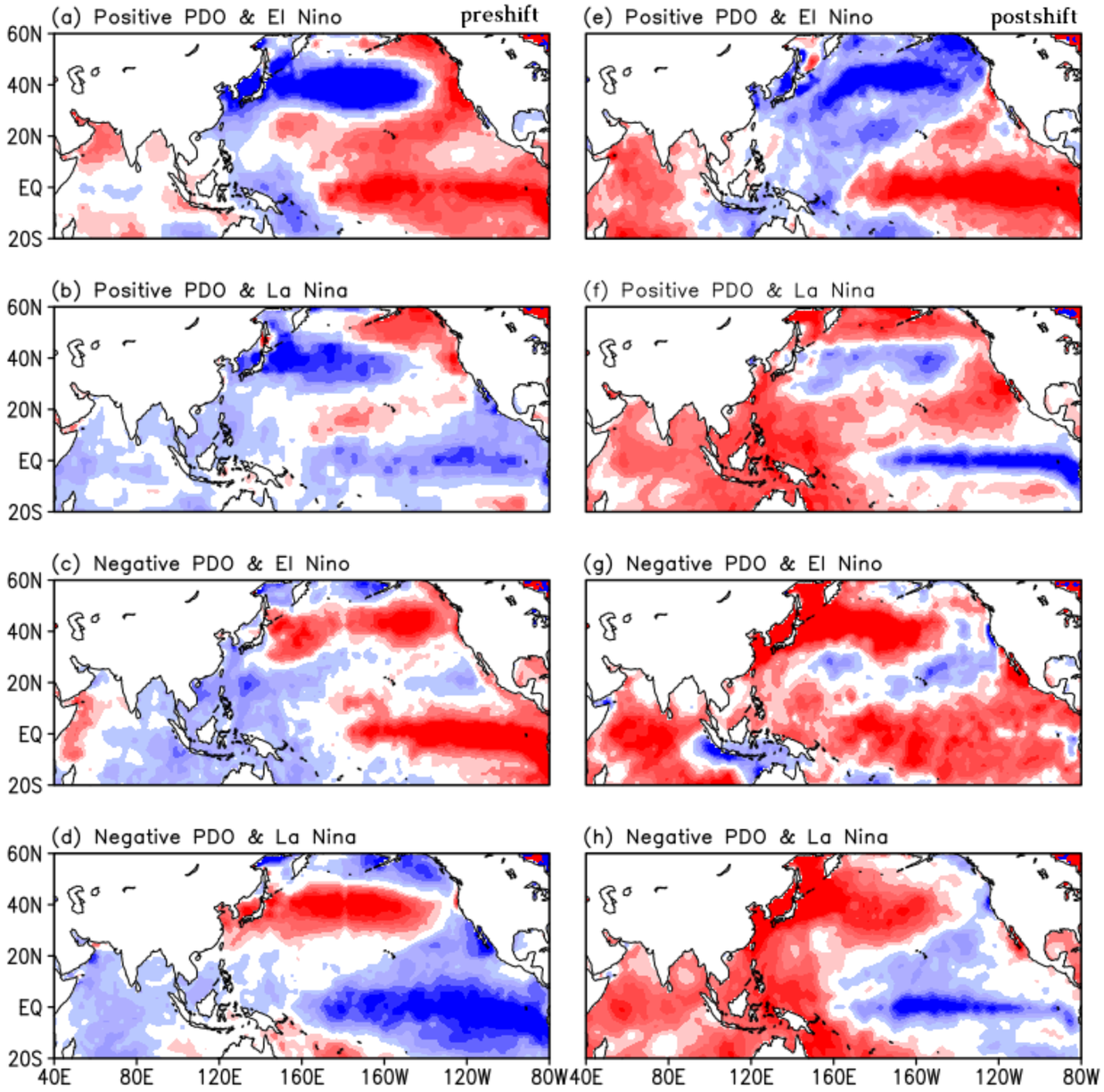
# 2. Climate shift and change in the behaviour of teleconnections

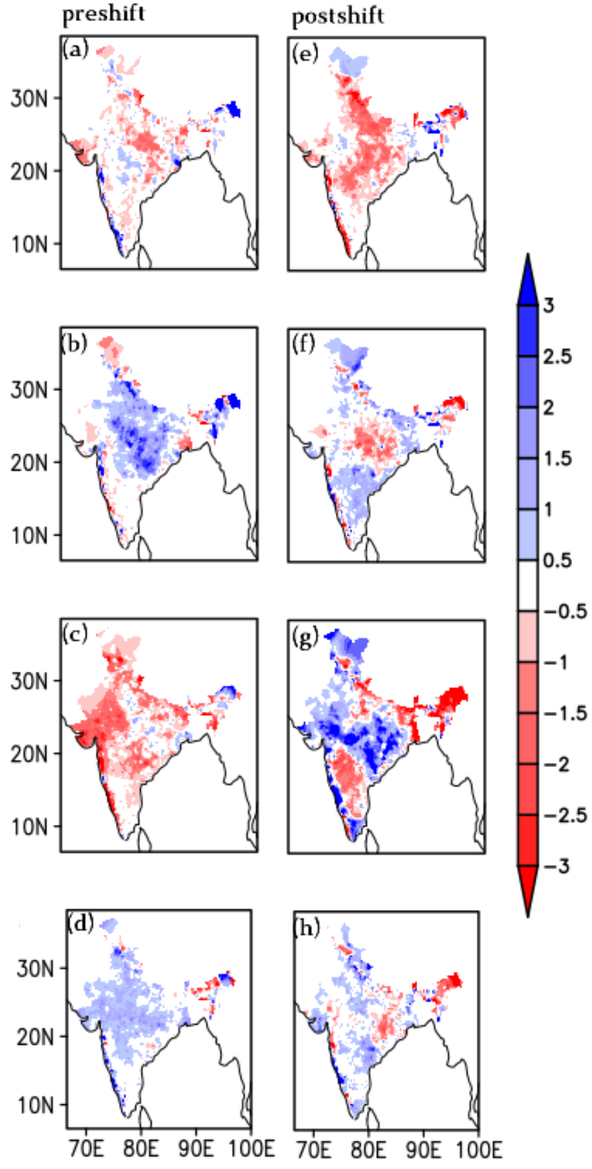



Interannual variability of PDO and Niño 3.4 indices



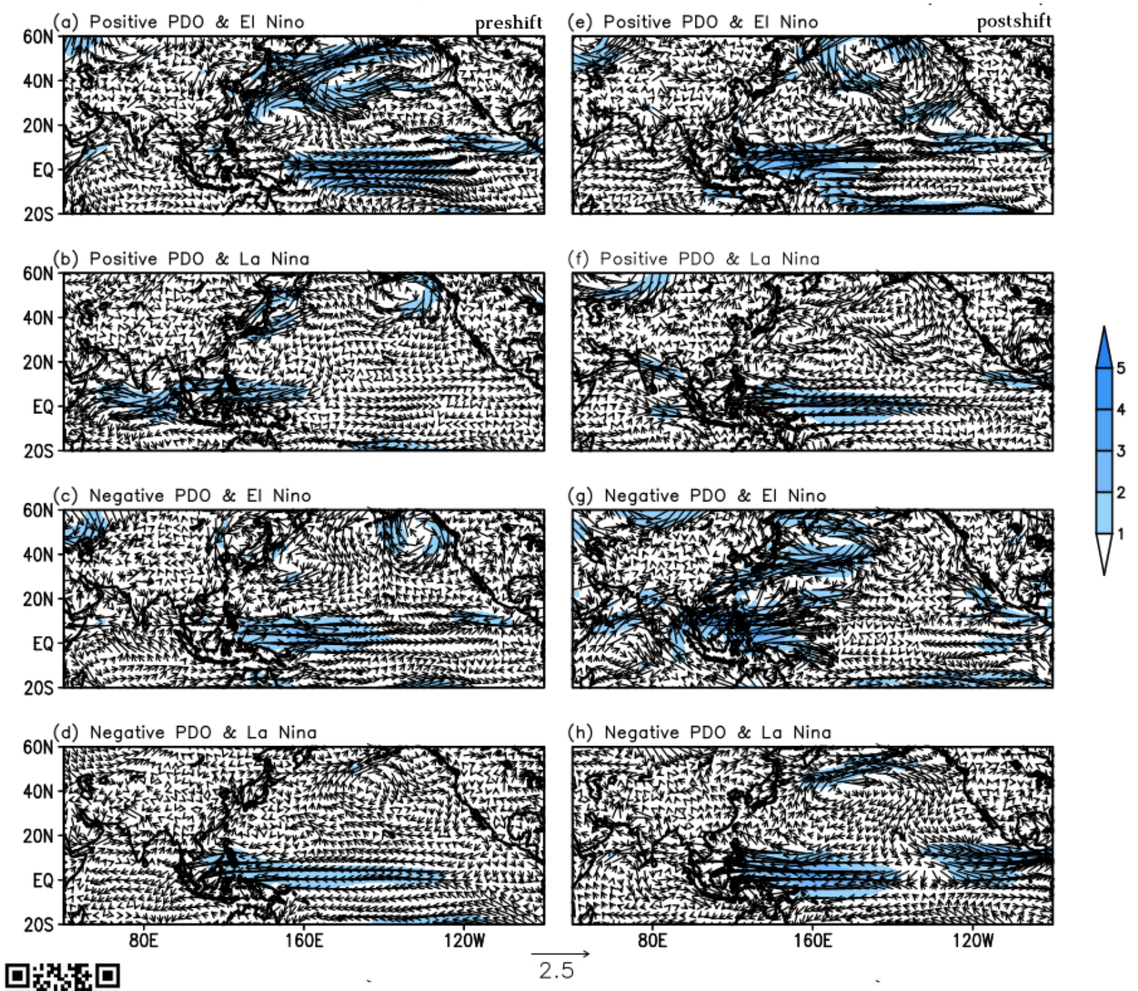

Spatial correlation of ISMR with a. PDO and b. Niño 3.4 indices



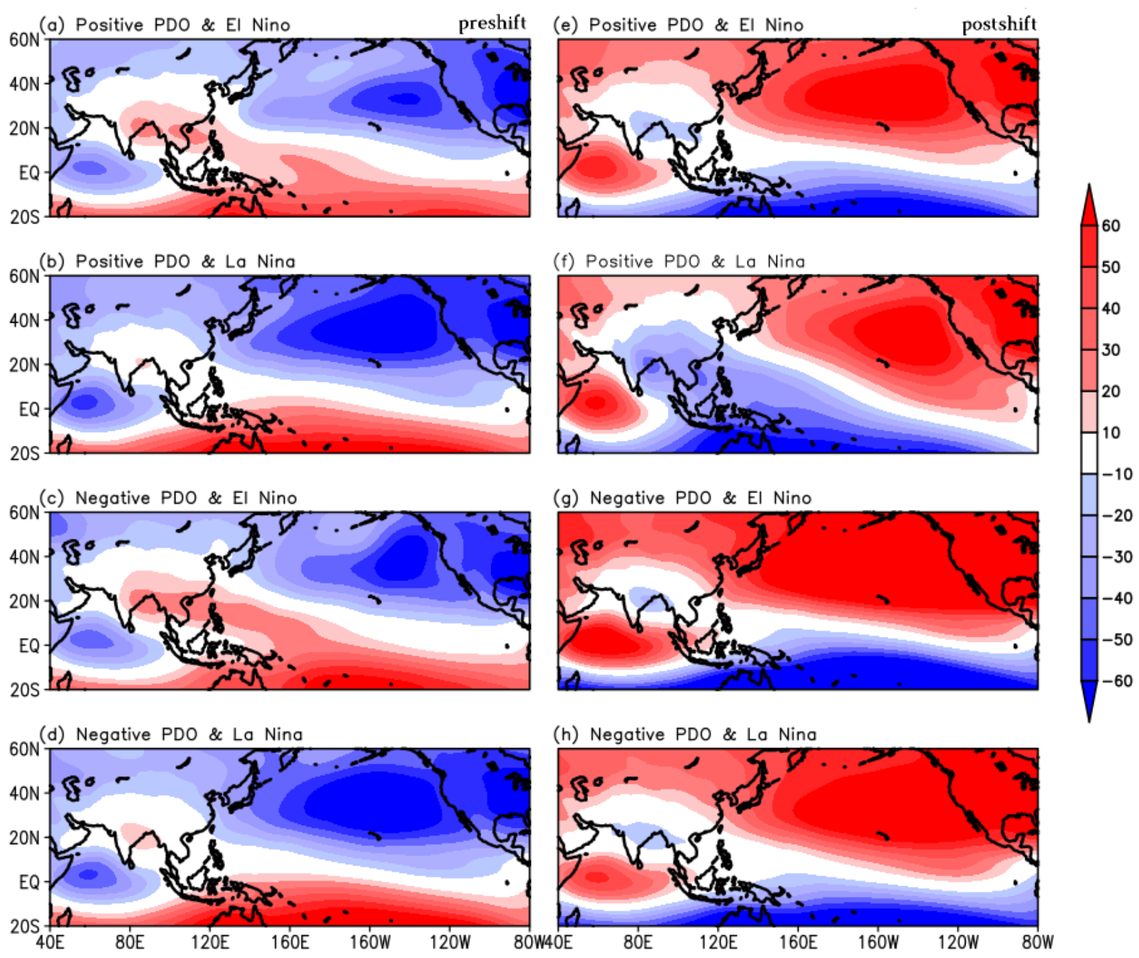




Spatial distribution of SST (°C) and rainfall (mm/day) anomalies during PDO and ENSO periods in pre-shift and post shift JJAS seasons.

# 3. Enhancement of changes using dynamical parameters

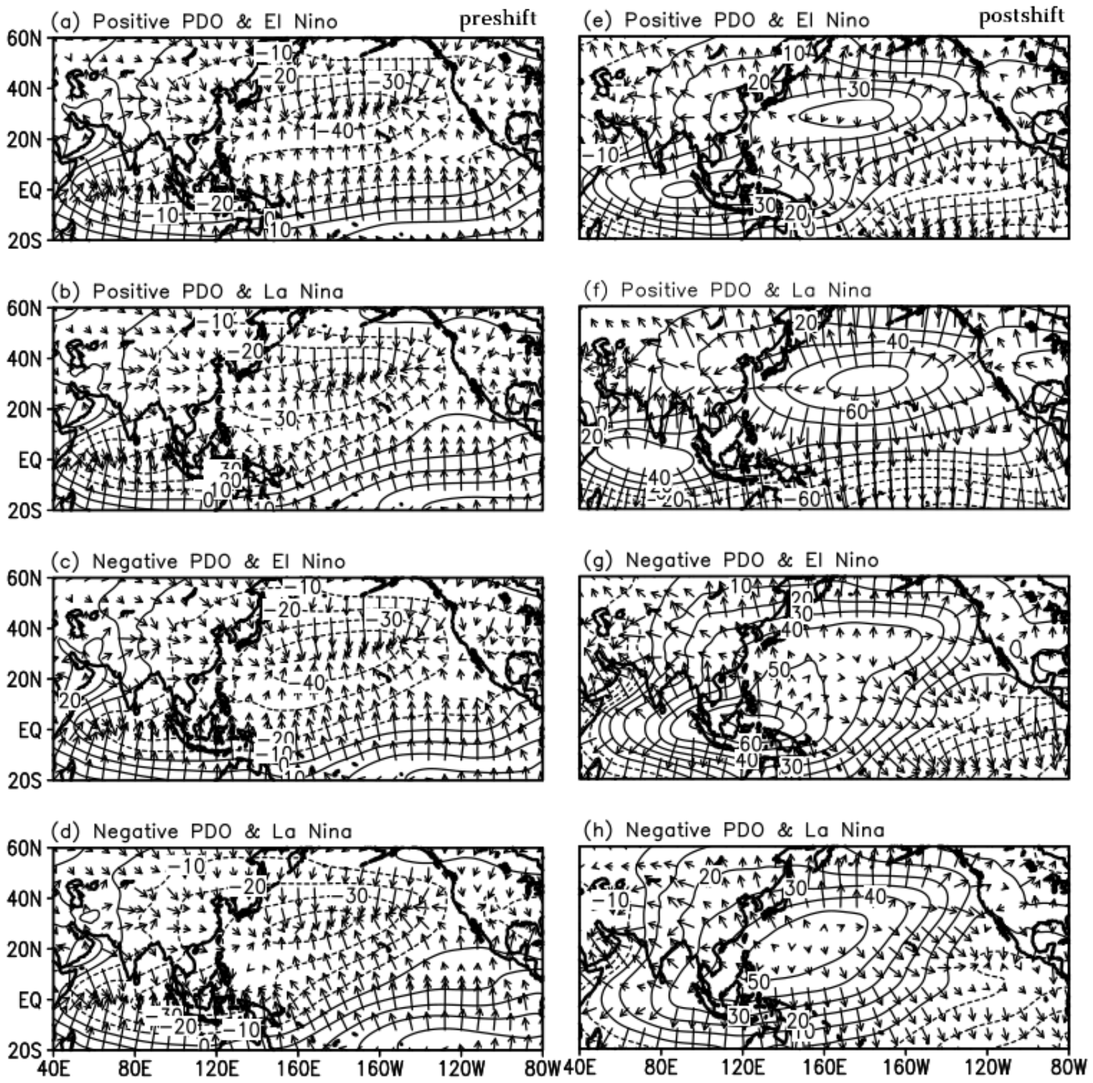



Wind anomalies (850 hPa)




Stream Function anomalies (850 hPa)

# Conclusions




Velocity Potential anomalies (850 hPa)

- ISMR and PDO and ISMR and ENSO is having a negative correlation
- ISMR–PDO correlation is slightly less than that between ISMR and Niño 3.4 index
- when ENSO and PDO are in (out of) phase they enhance (counteract) the conventional monsoon-ENSO relation.
- Climate shift has influenced ISMR - PDO - ENSO relation
- Preshift shows the characteristics of ENSO where as after shift is showing characteristics of PDO
- Changes in ISMR - PDO - ENSO relation is identified in the analysis of dynamical parameters