

# Remote and Local SST forcing on Indian Summer Monsoon Rainfall Variability

C. Gnanaseelan



Indian Institute of Tropical Meteorology, Pune

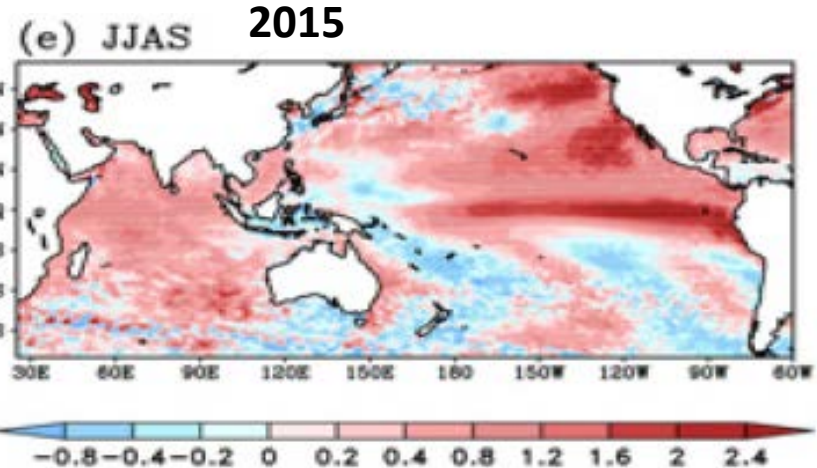
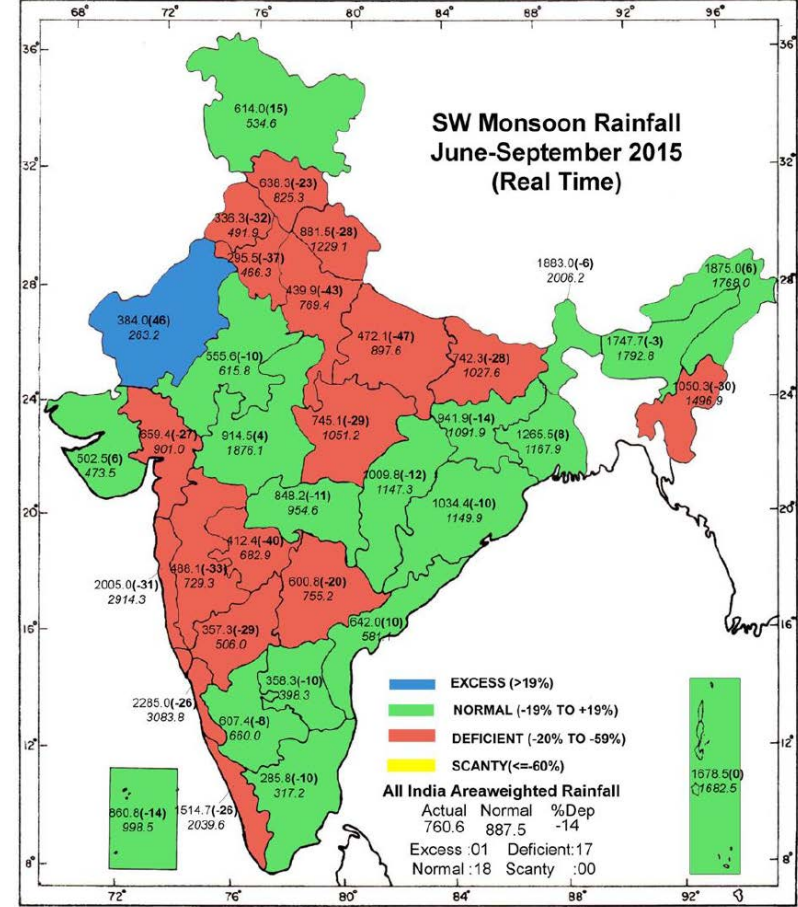
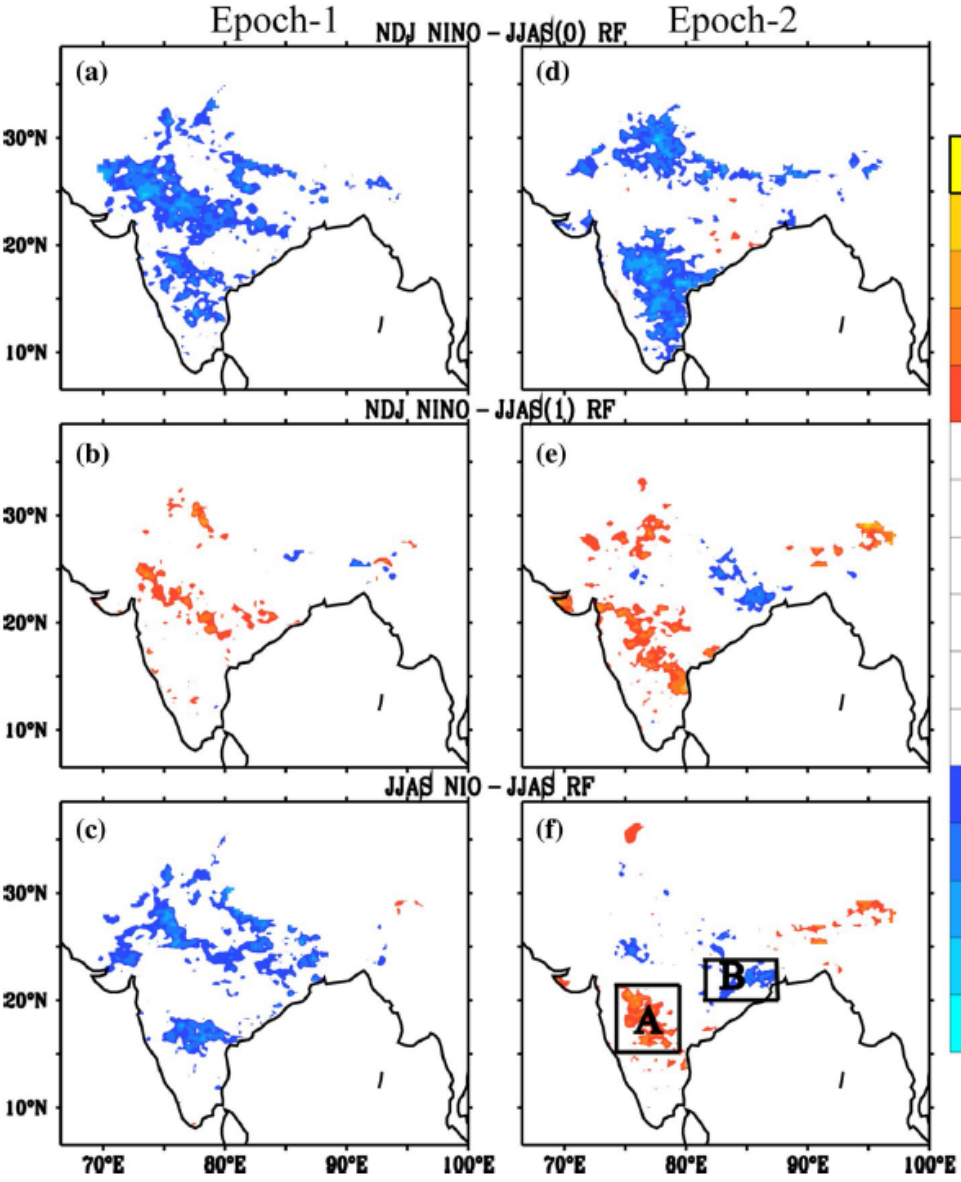
Collaborators: Soumi, Prasanth

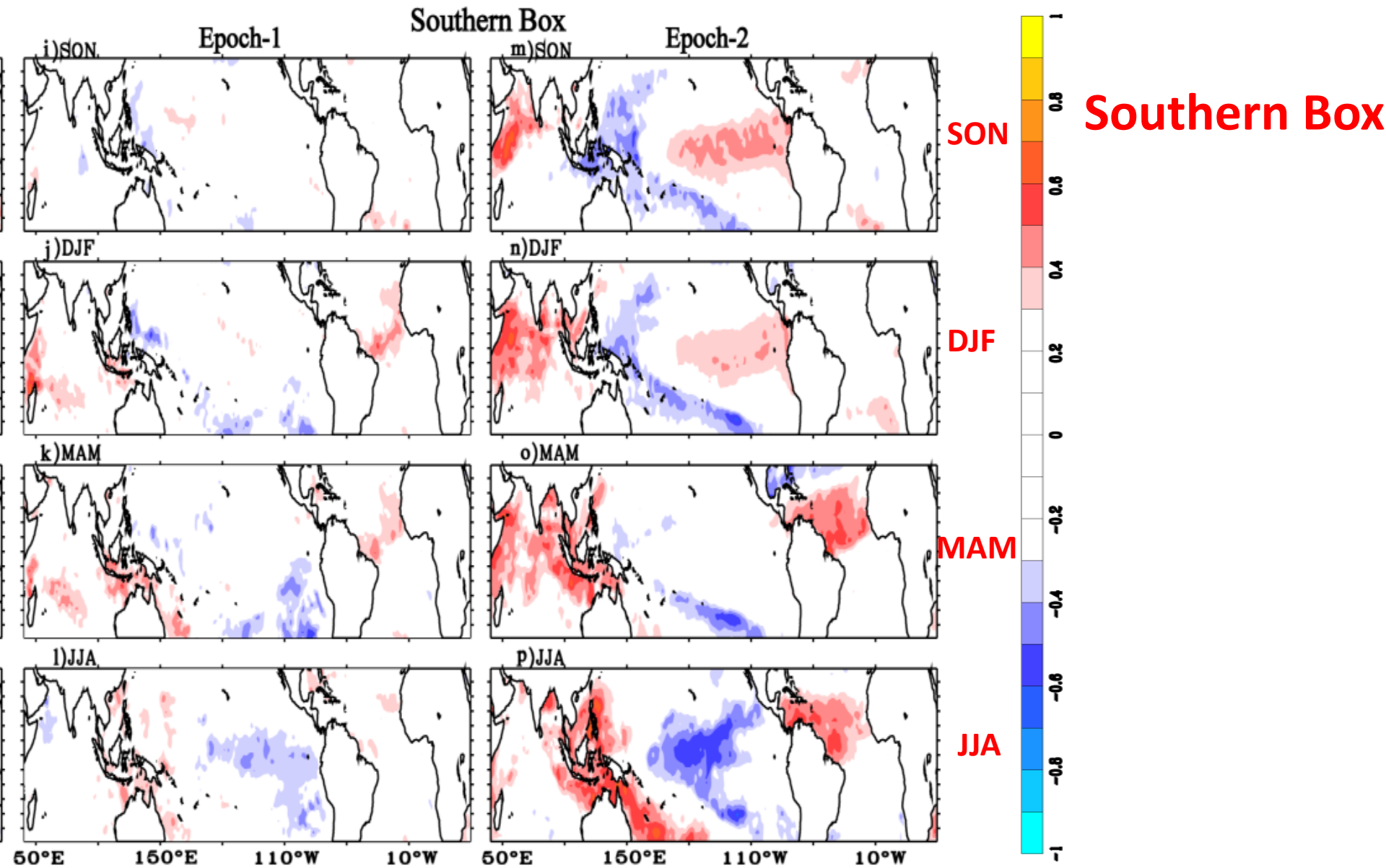
# OUTLINE

**SST and circulation patterns are examined in pre and post 1970s climate shift during both developing and decaying summers of El Nino**

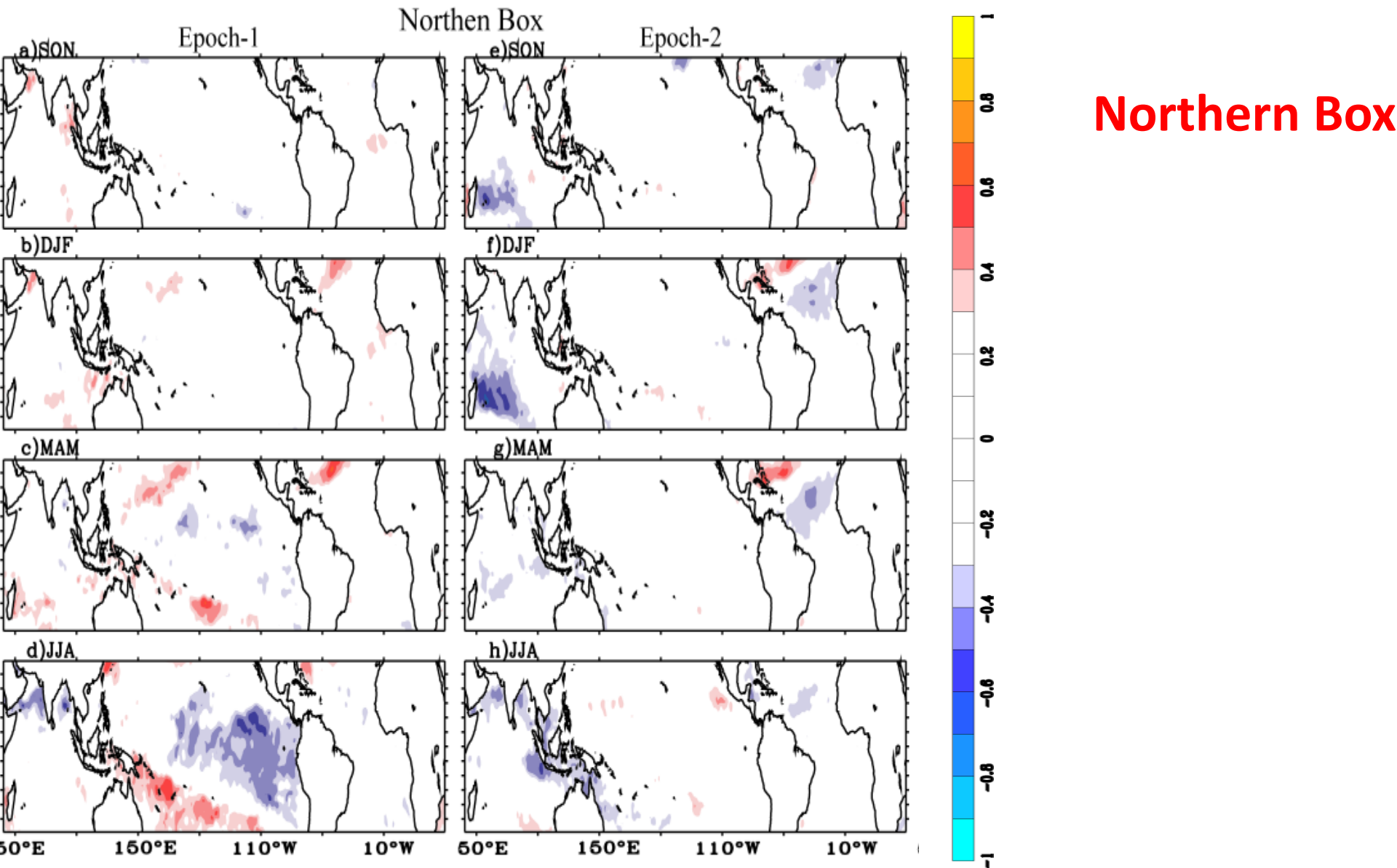
**Subseasonal rainfall and its relationship with large scale features associated with changing El Nino , TIO warming and northwest Pacific circulation are examined in the context of ISMR variability.**

# Lead lag correlation between JJAS rainfall and NDJ Nino3.4 and JJAS NIO SST anomalies

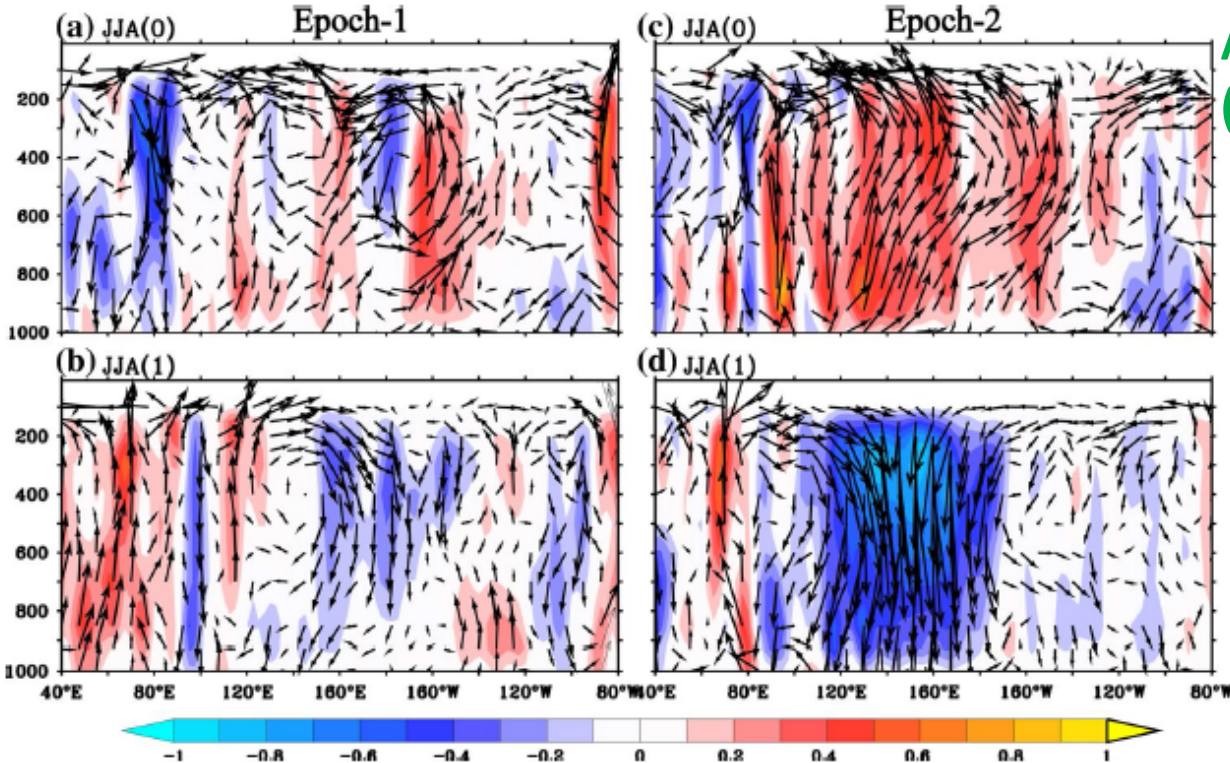




**Correlation between JJAS precipitation anomaly over Southern box with SON(-1), DJF(-1/0), MAM(0) and JJAS(0) SST anomaly for Epoch1 and Epoch2**



**Correlation between JJAS precipitation anomaly over Northern box with SON(-1), DJF(-1/0), MAM(0) and JJAS(0) SST anomaly over Indo-Pacific region for Epoch1 and Epoch2**



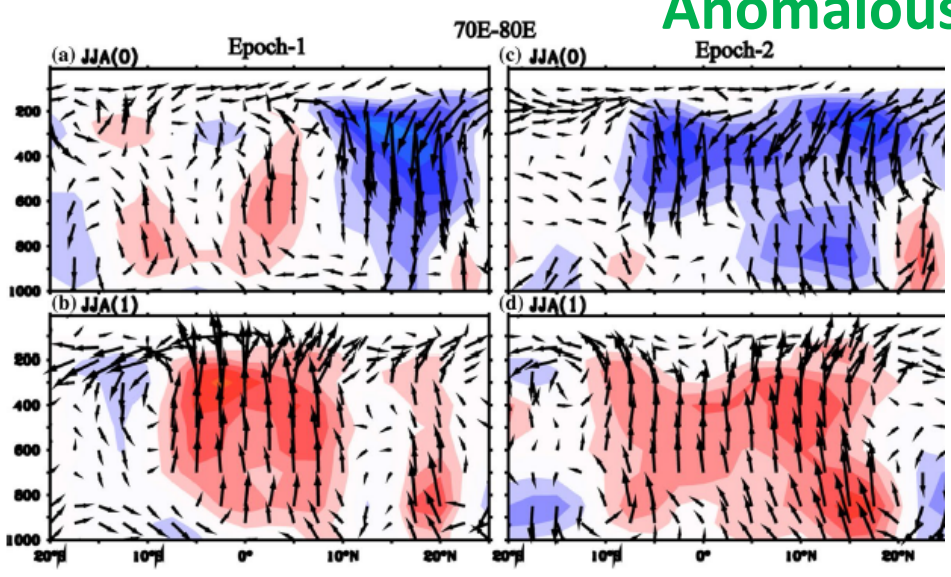
Anomalous Walker Circulation  
(15N-20N)

Developing El Nino

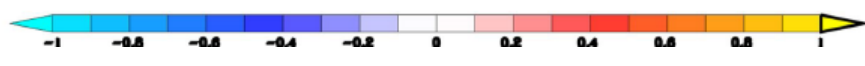
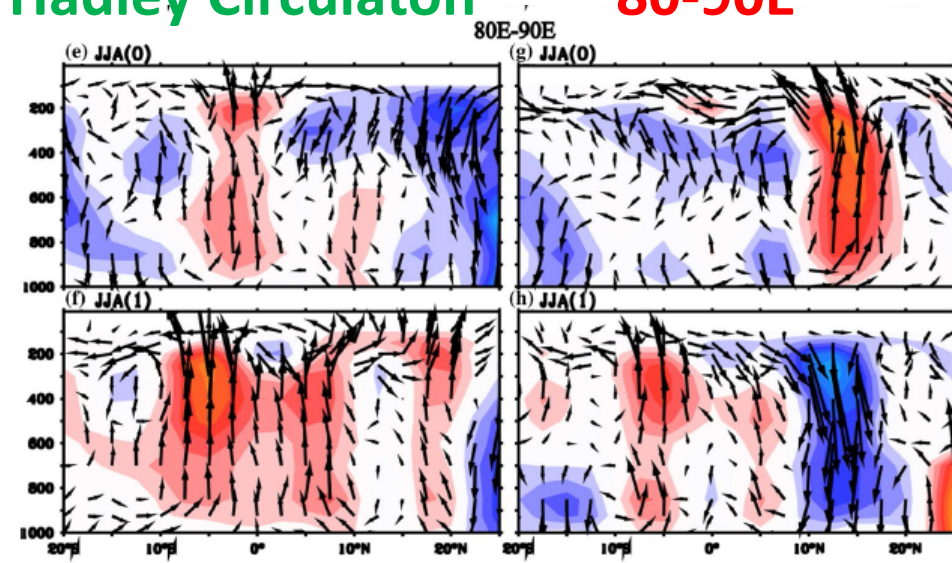
Decaying El Nino

Anomalous Hadley Circulation

80-90E

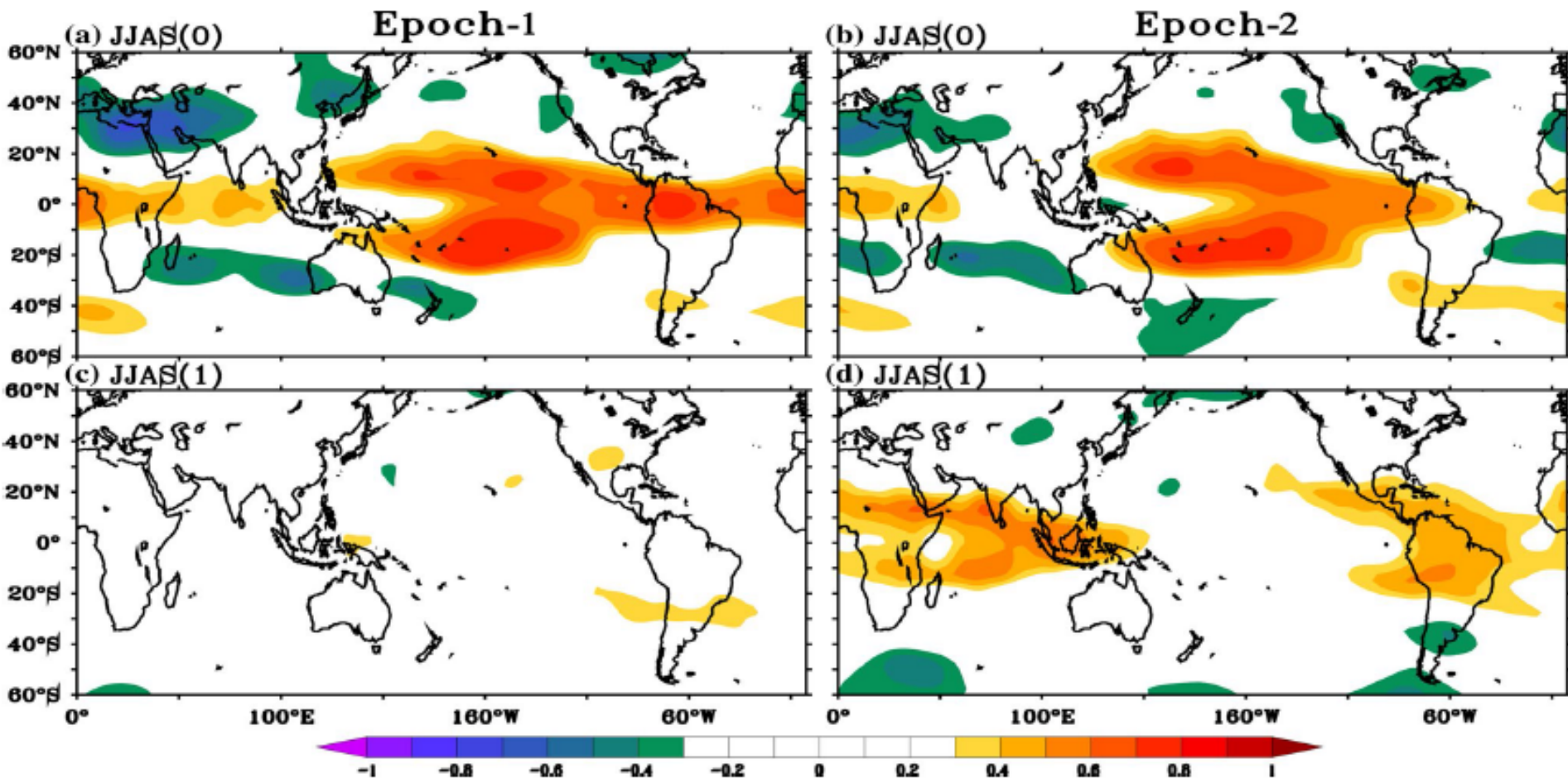


70-80E

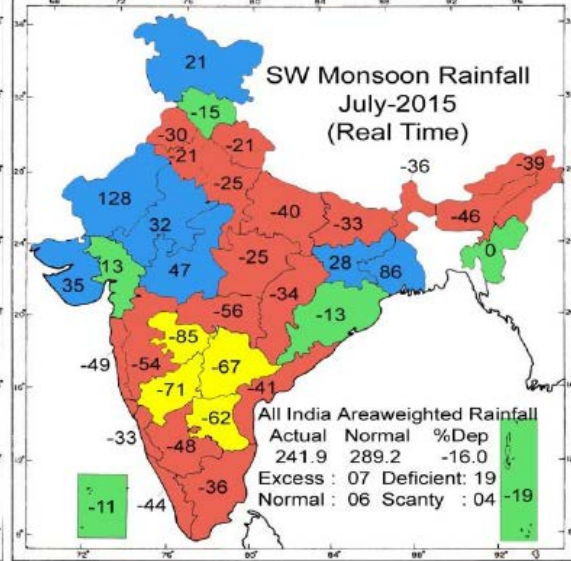
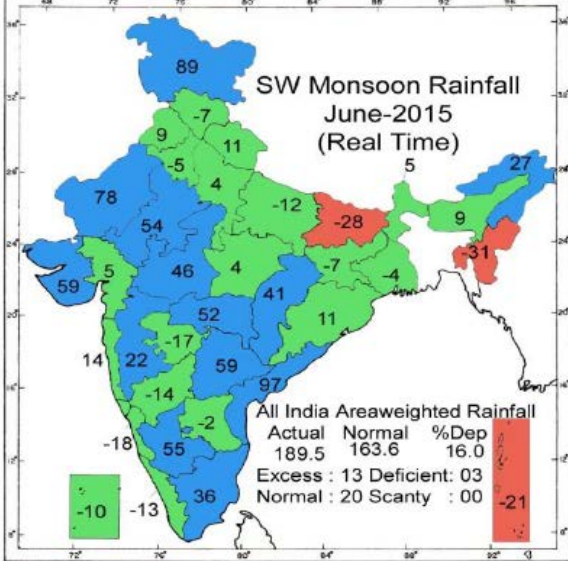


# Lead lag correlation of upper tropospheric temperature (average between 500 and 200 hPa) with NDJ Nino index

## Developing El Nino

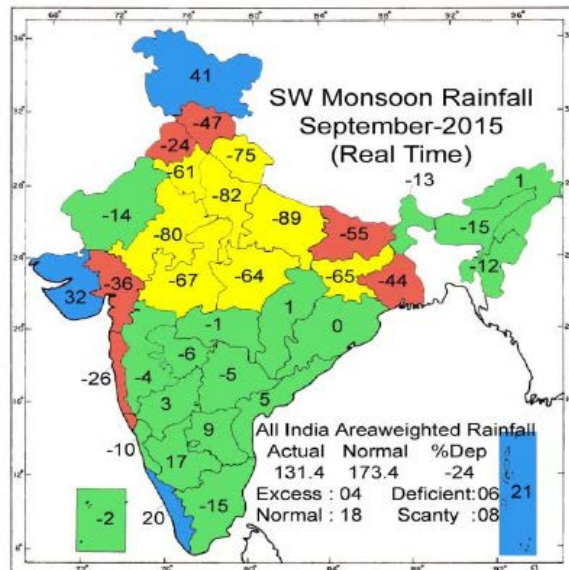
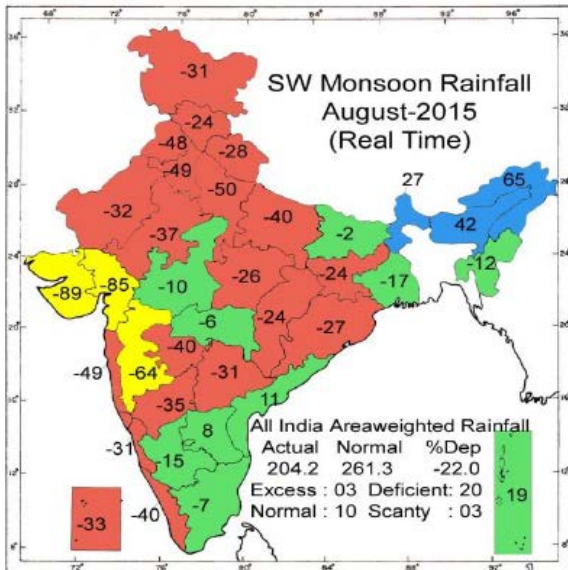


## Decaying El Nino



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INDIA METEOROLOGICAL DEPARTMENT

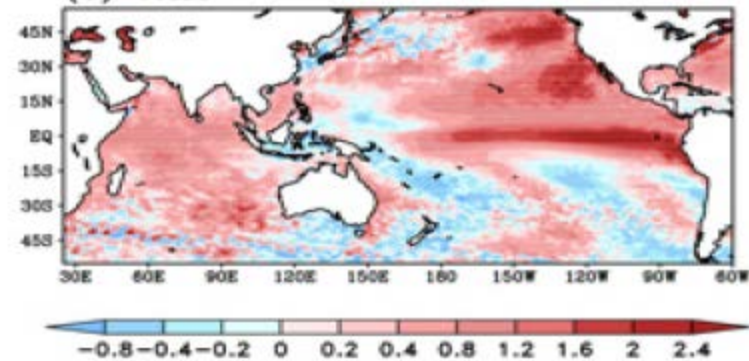
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INDIA METEOROLOGICAL DEPARTMENT



**EXCESS** (>19%)      **NORMAL** (-19% to +19%)

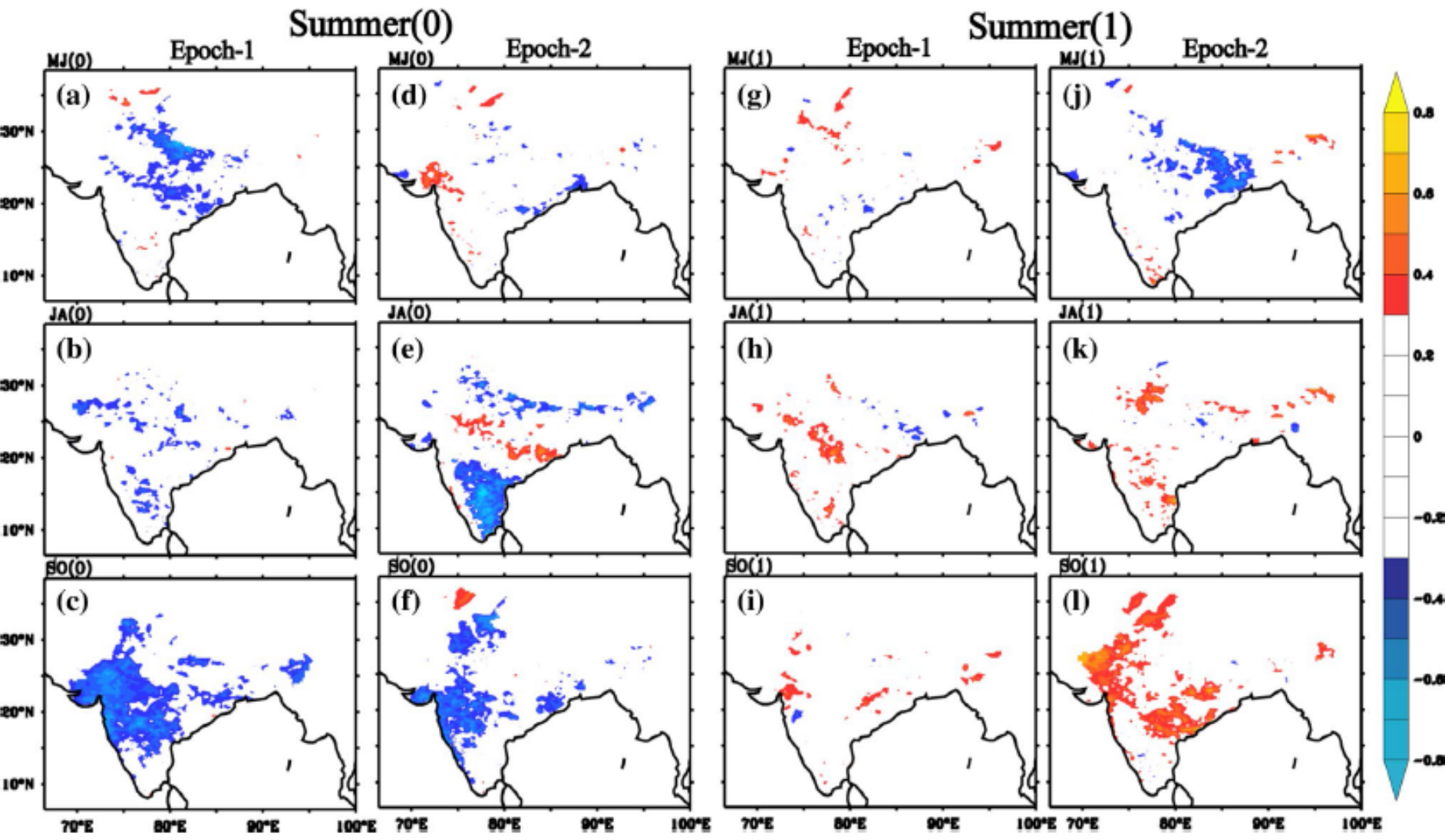
**DEFICIENT** (-20% to -59%)      **SCANTY** (<=-60%)

(e) JJAS 2015



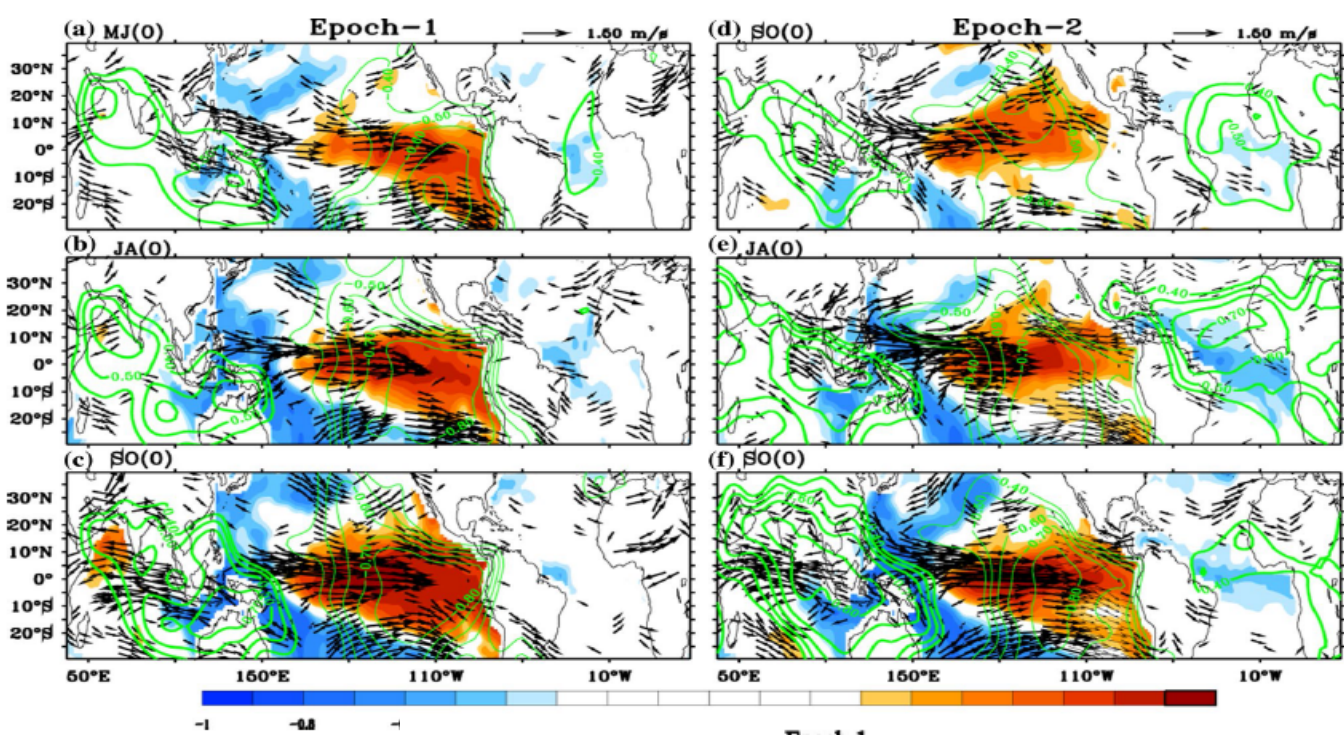


# Rainfall anomaly composites for different stages of monsoon



Developing El Nino

Decaying El Nino



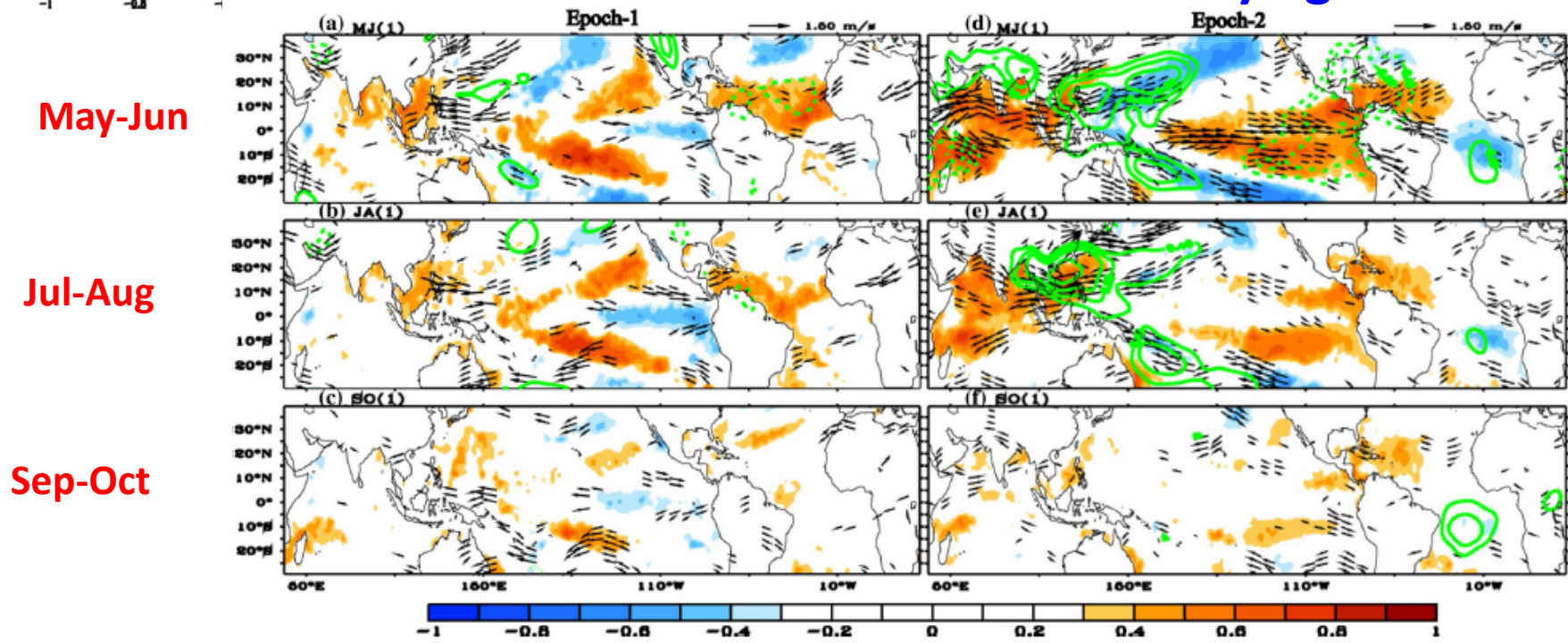
Developing El Niño

May-Jun

Jul-Aug

Sep-Oct

Decaying El Niño



May-Jun

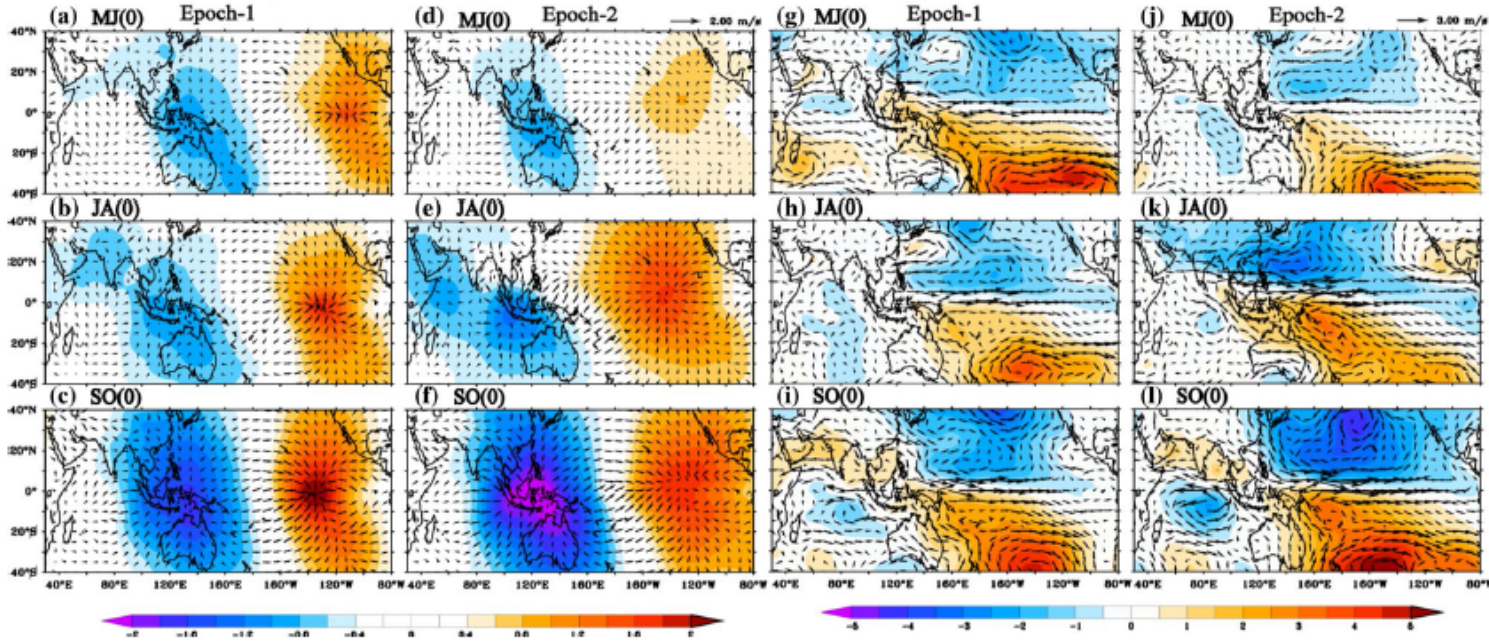
Jul-Aug

Sep-Oct

Developing El Nino

VP and Div Wind

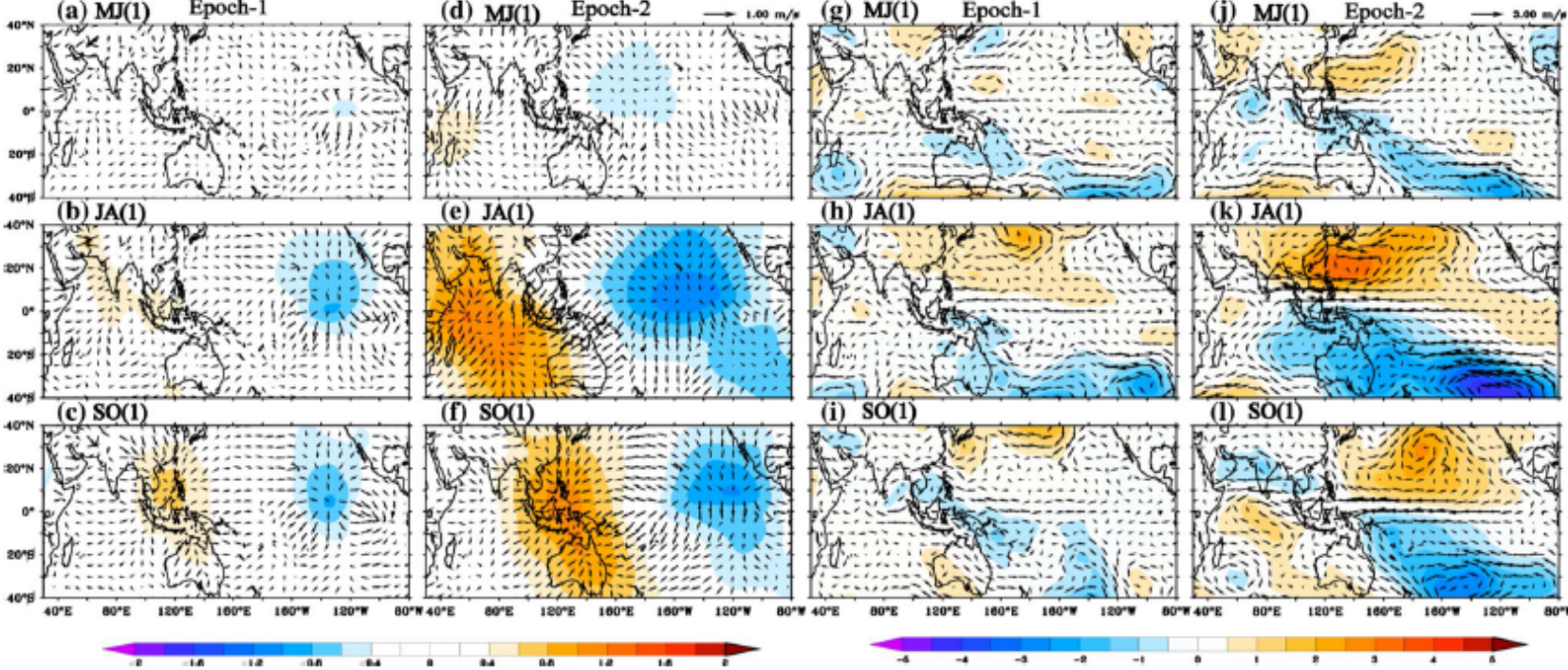
Strm fuction and Rot Wind

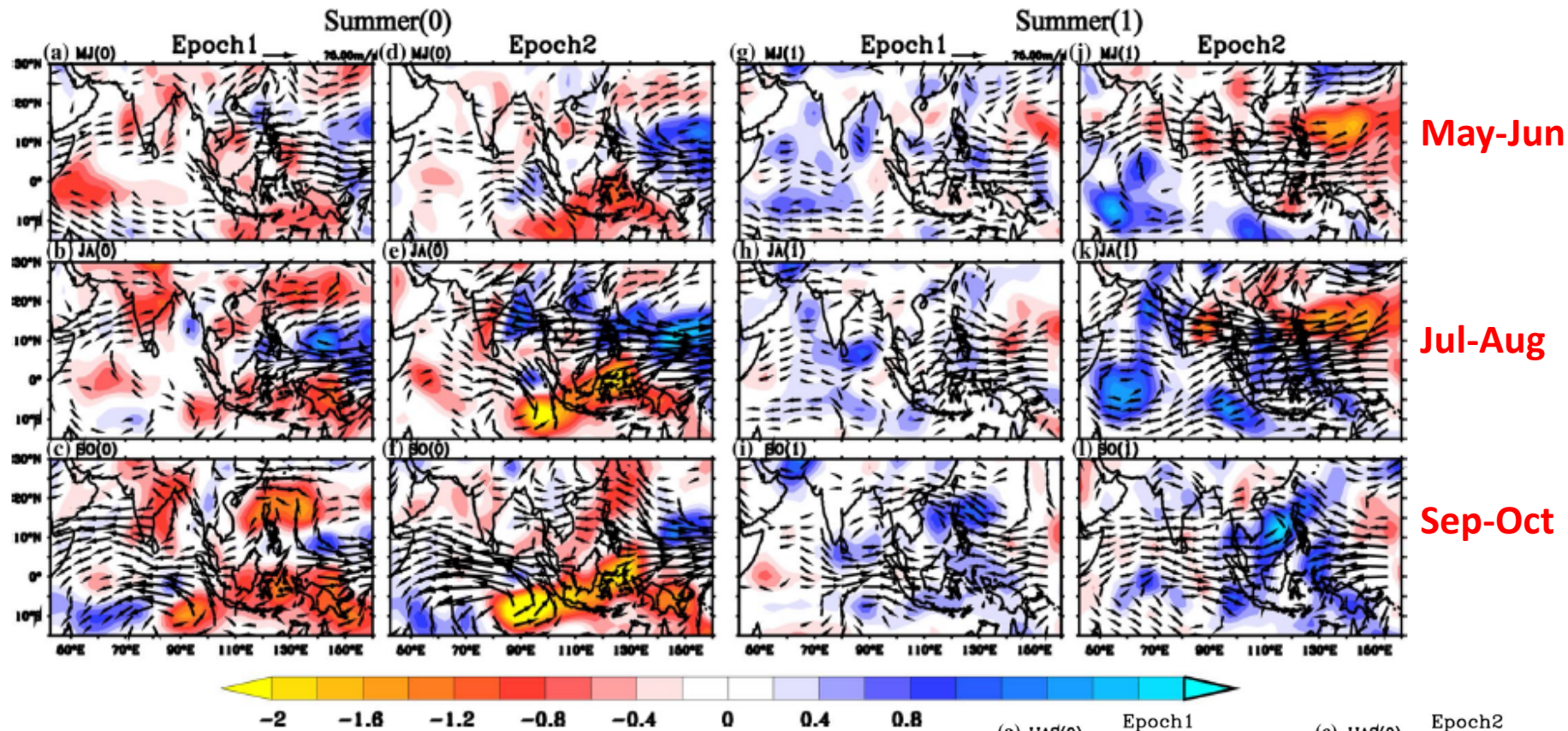


Decaying El Nino

VP and Div Wind

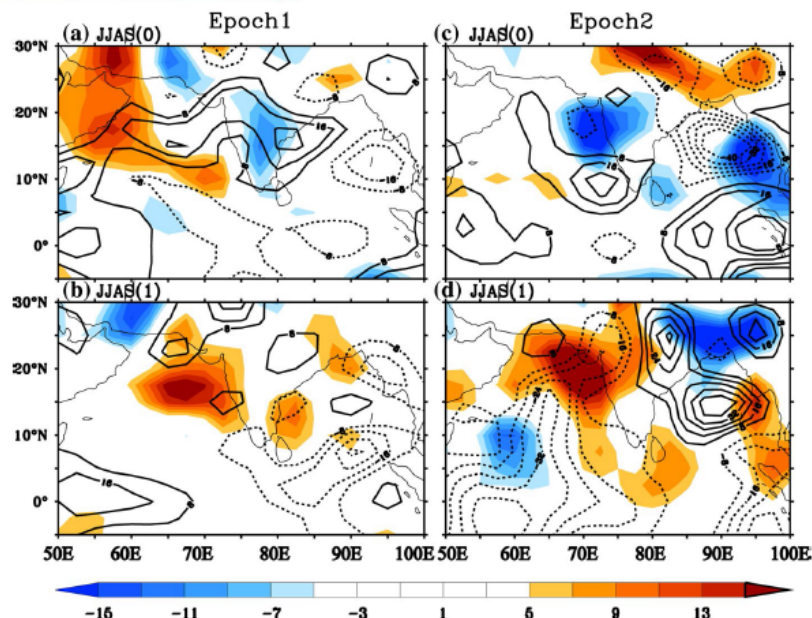
Strm fuction and Rot Wind

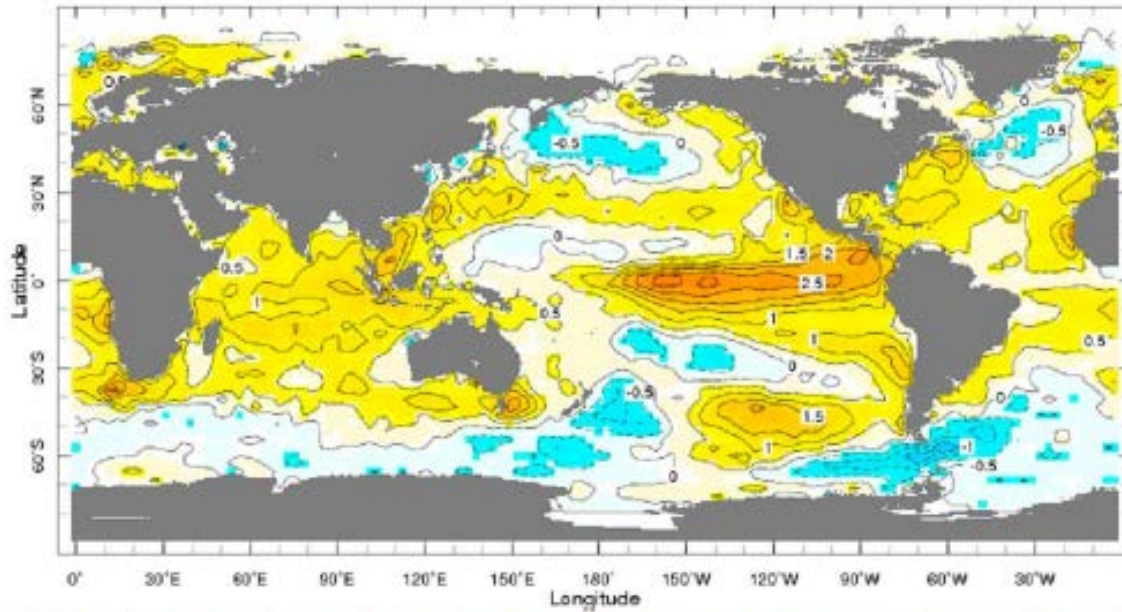




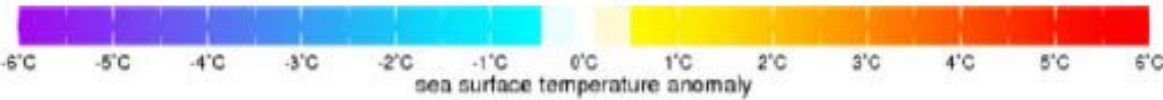
Diabatic heating composite (*shaded*) and vertically integrated moisture transport anomaly (*vectors*) during *developing and decaying summer* for epoch-1 and epoch-2

**moisture advection and moisture convergence**

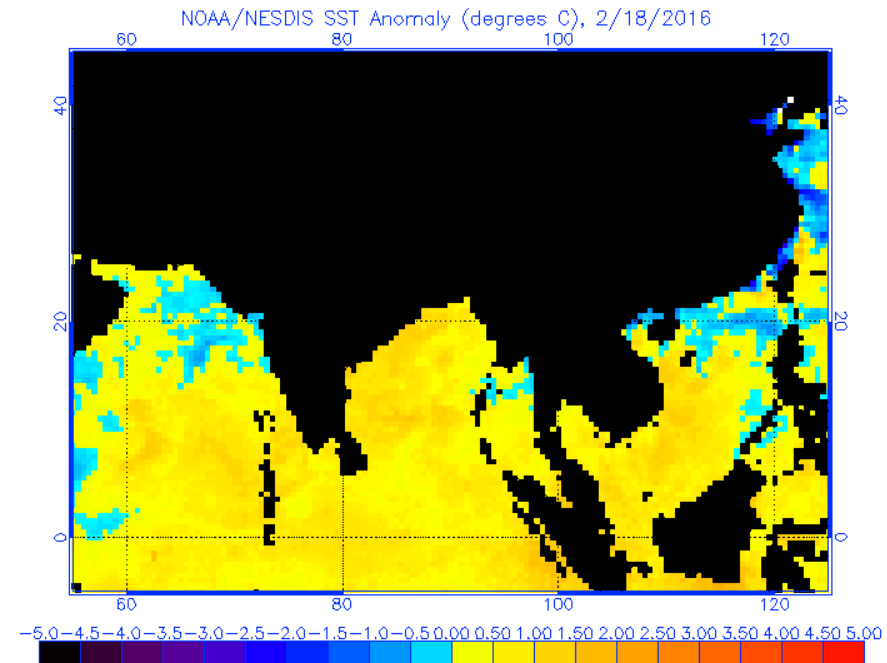




**SST anomaly forecast  
valid for Feb-Apr 2016**



**SST anomaly for 18 February, 2016**



# SUMMARY

**Both developing and decaying summer of El Niño exhibit significant changes in TIO SST and circulation patterns after the mid 1970's climate shift.**

**Major changes in the correlation between Indian rainfall and Nino SST anomalies and weakening ENSO monsoon are seen in July and August both in the developing and decaying phases.**

**Both Walker and Hadley circulation displayed strong epochal changes with strong east west contrast in epoch-2.**

**Weakening of north south temperature gradient is prominent in epoch-1 where as the weakening is confined to only western region in epoch-2.**

**Thank You**

