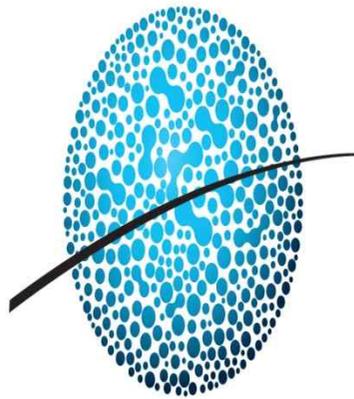


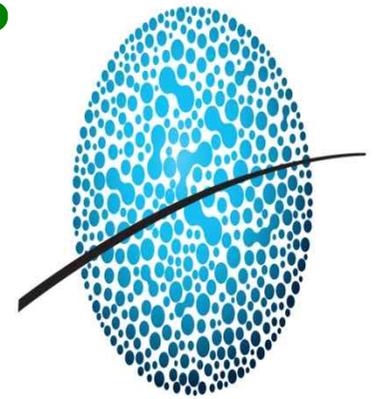


# Impact of Monsoon rains on the total food Grain production over India



**APCC**  
APEC CLIMATE CENTER

Venkatraman Prasanna,  
Climate Change Research team,  
APEC Climate Center,  
Busan, Republic Of Korea.



**APCC**  
APEC CLIMATE CENTER

APEC Climate Symposium (APCS) 2012, St Petersburg, Russia



# Outline of the talk

- ❖ **Overview of Agriculture in India**
- ❖ **Rainfall features over the Indian Region**
- ❖ **Rainfall Signal in the Indian Food grain yield**
- ❖ **Impact of daily rain spells and anomalies on Indian Food grain yield**
- ❖ **Why daily rain anomalies are so important?**
- ❖ **Impact of prolonged break episodes**
- ❖ **Monsoon rainfall variability as a food grain production indicator**
- ❖ **Summary**



# Dependence on agriculture in the Rural Livelihoods of India



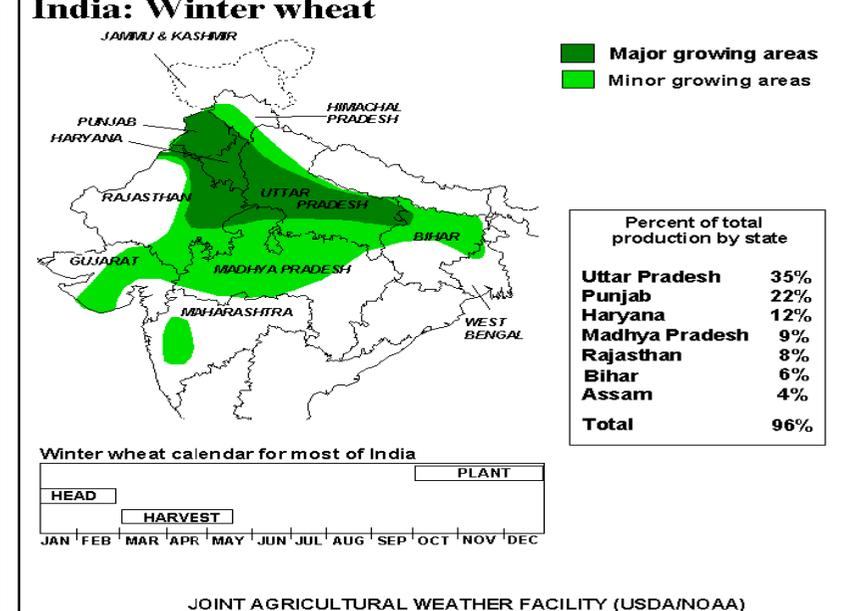
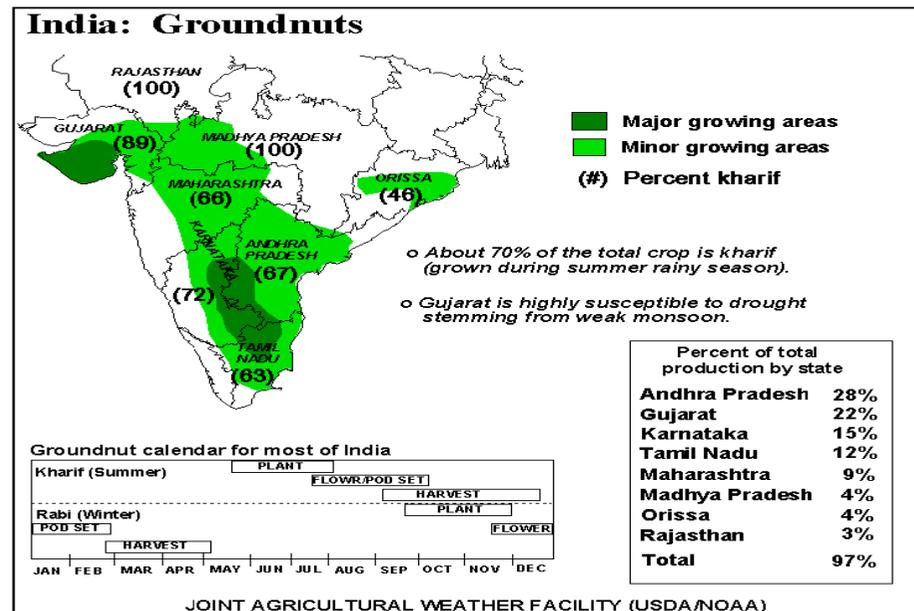
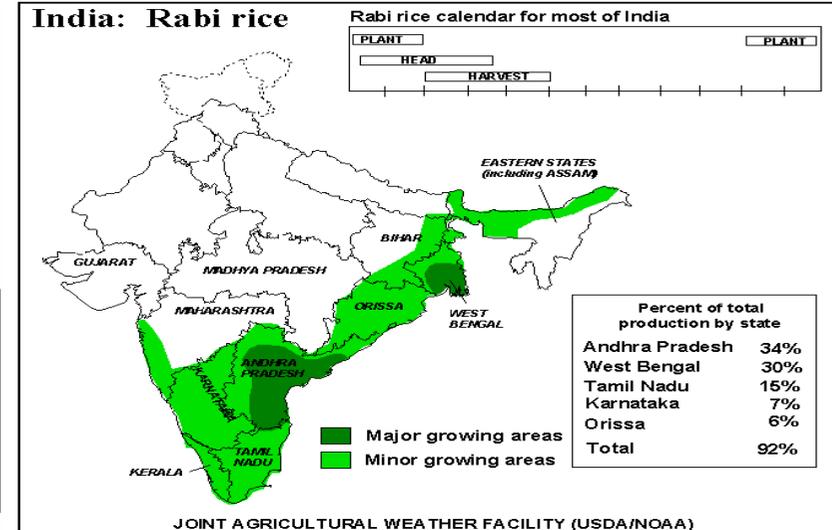
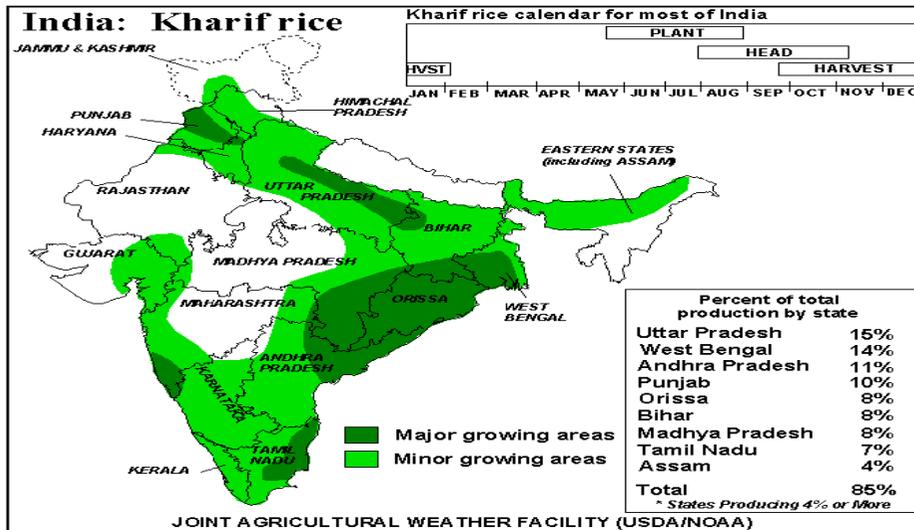
- ❖ **Agriculture provides livelihood to about 65% of the labor force in India**

# Overview of Agriculture in India

- ❖ Roughly 65% of the population is rural and are dependent on agricultural related activities
- ❖ India's growth in per capita food production during 1979-92 was about 1.6% per annum – the highest in the world during this period
- ❖ Agriculture contributes nearly 29% to the GDP
- ❖ About 43% of India's geographical area is used for agriculture



# Crop Areas



Source : Major Crop Areas USDA Maps

<http://www.usda.gov/oce/weather/pubs/Other/MWCACP/sasia.htm>

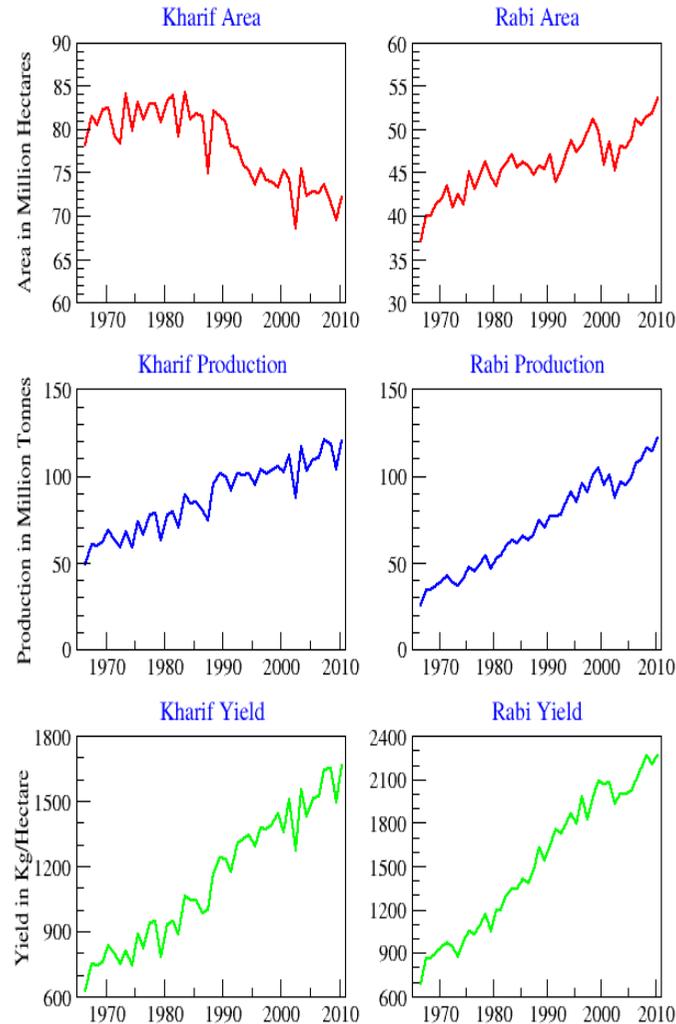
# DATA

## Production/Area/ Yield

- Total foodgrains
- Kharif/Rabi food grain production

## Source

- Center for Monitoring Indian Economy
- Dept. of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India



**Normal Area and Production and yield of Total food grains**

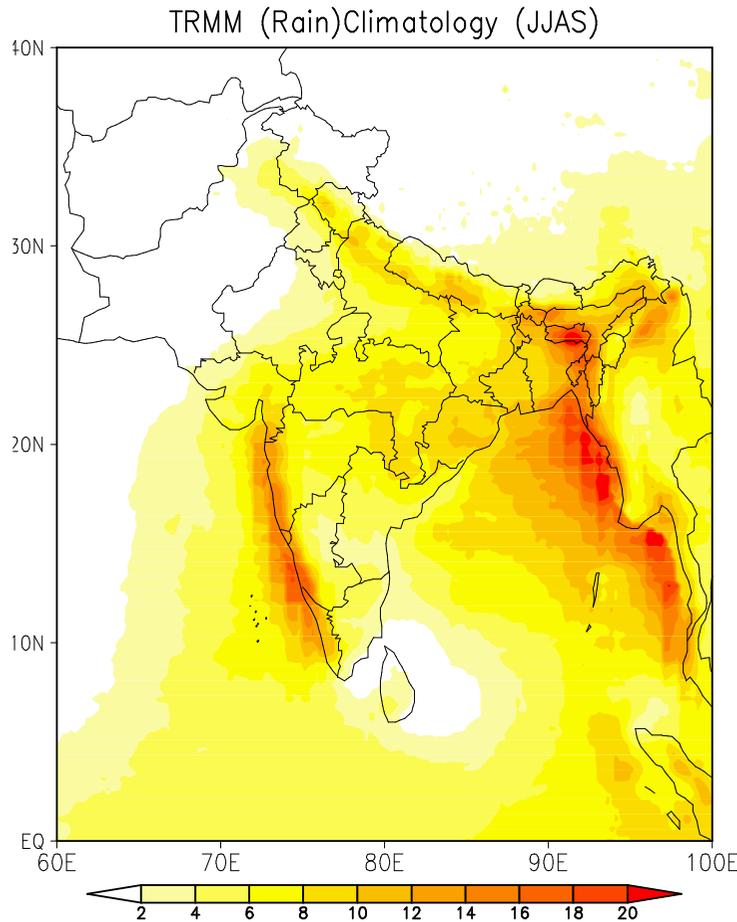


# Rainfall features over the Indian Region

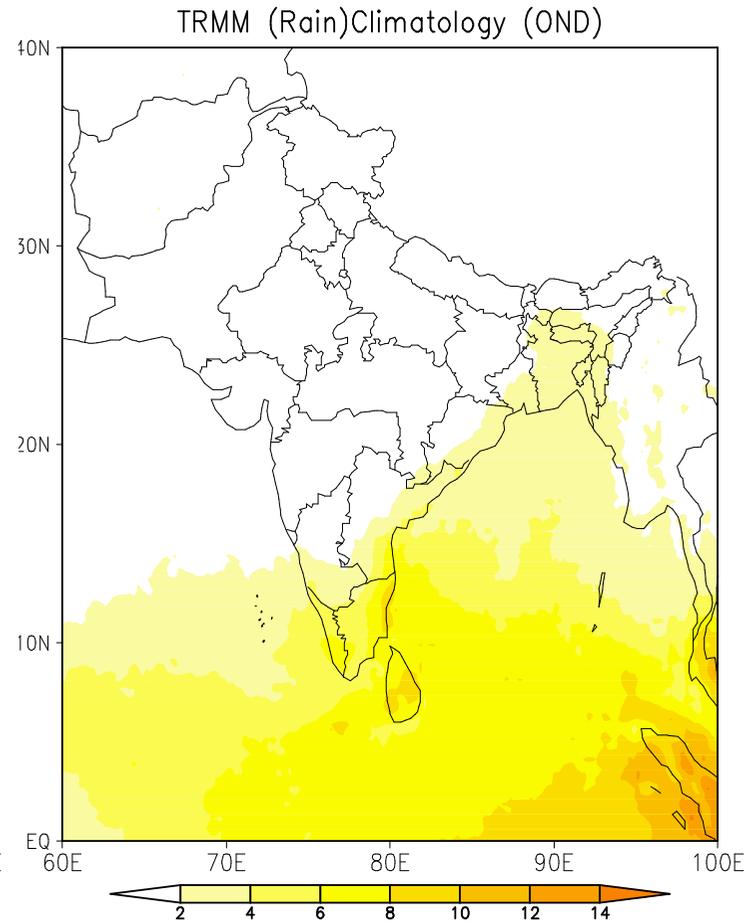


# Mean Rainfall Patterns

## South West Monsoon (mm/day)



## North East Monsoon (mm/day)

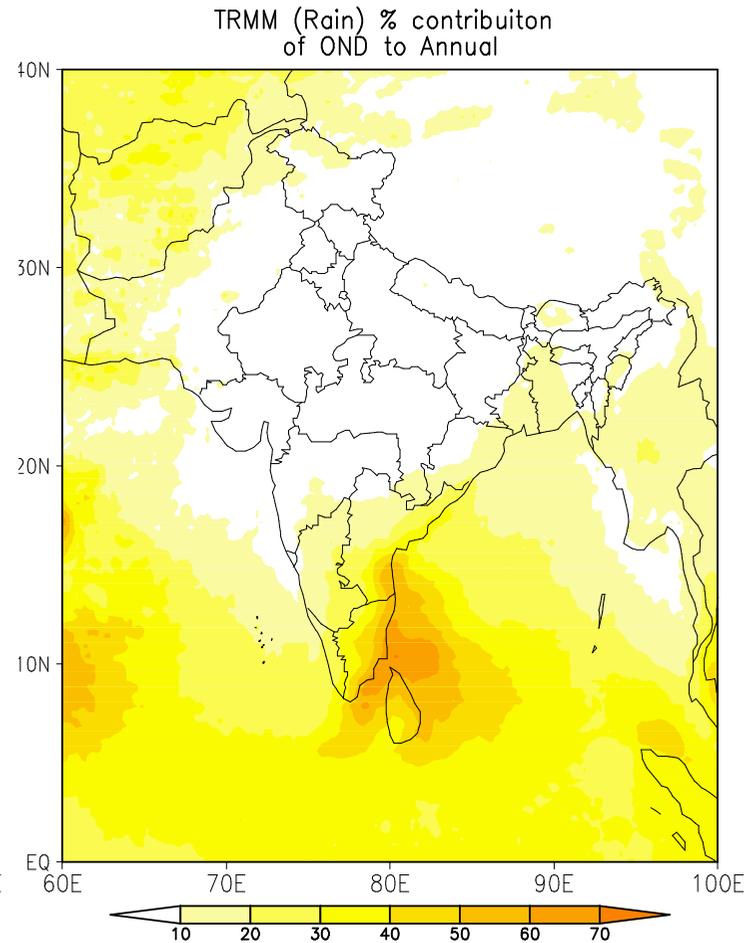
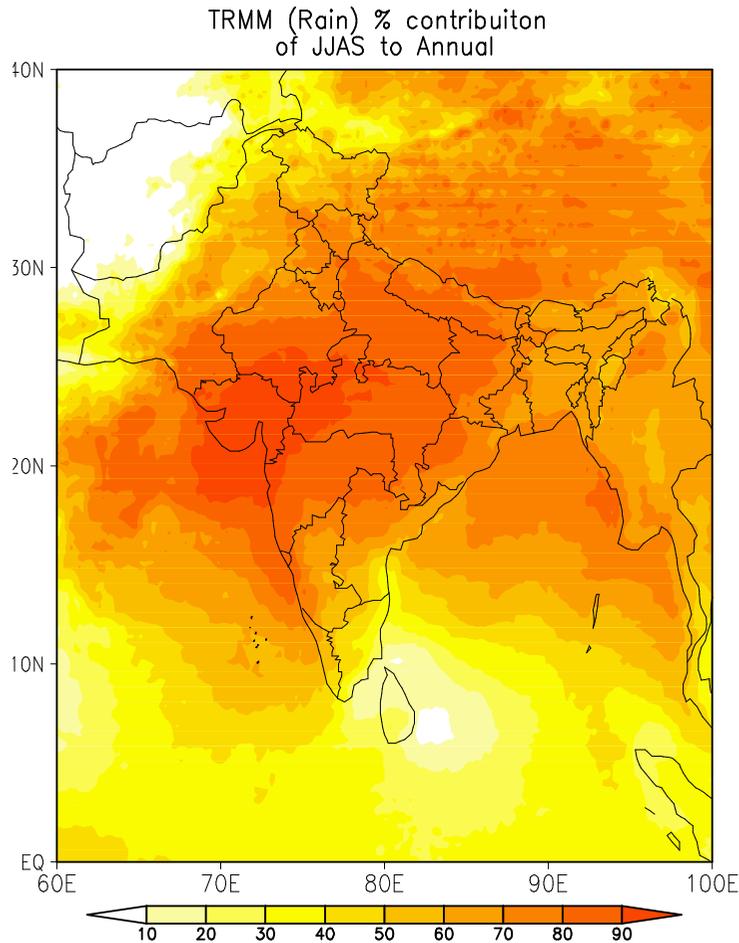


Data Source : TRMM 1998-2007

# Indian Monsoons

**Contribution of South West Monsoon to Annual Rf. (in %)**

**Contribution of North East Monsoon to Annual Rf. (in %)**



Data Source : TRMM 1998-2007

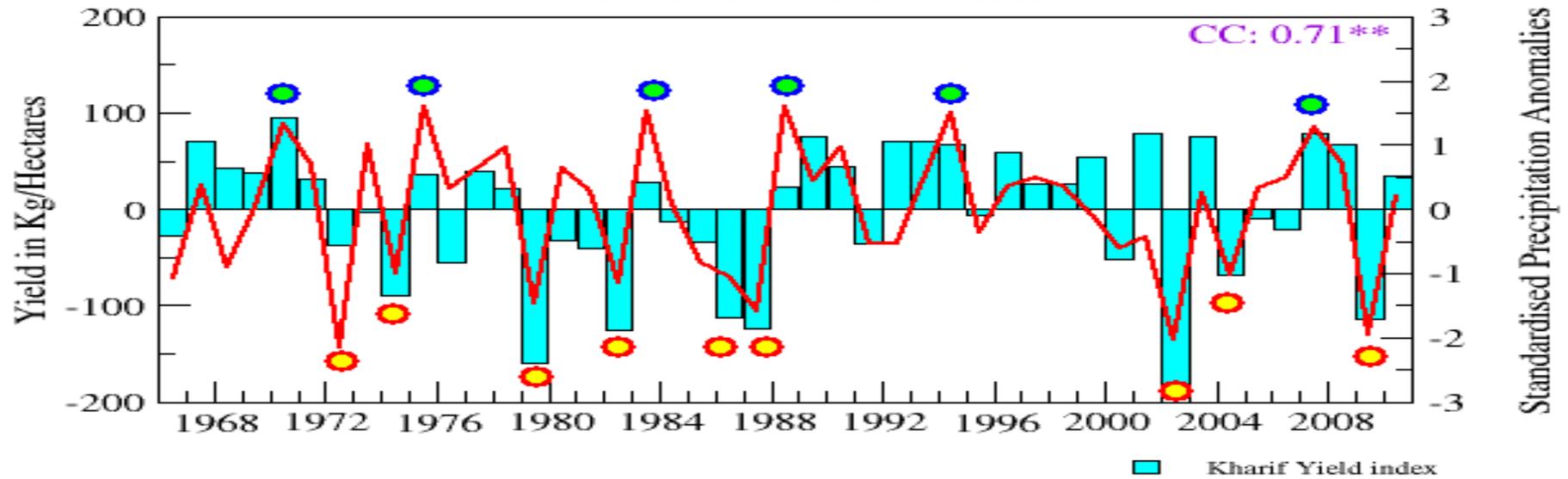


# Rainfall Signal in the Indian Food grain Yield

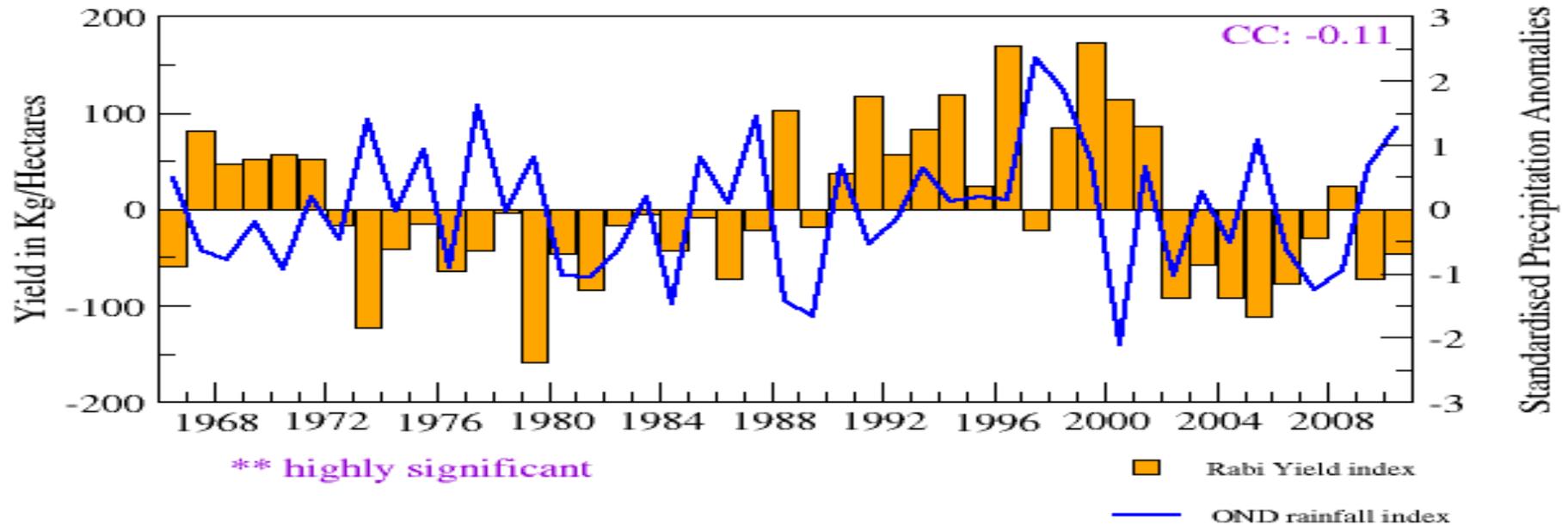


# All India Rainfall Vs All India Crop Yield Index

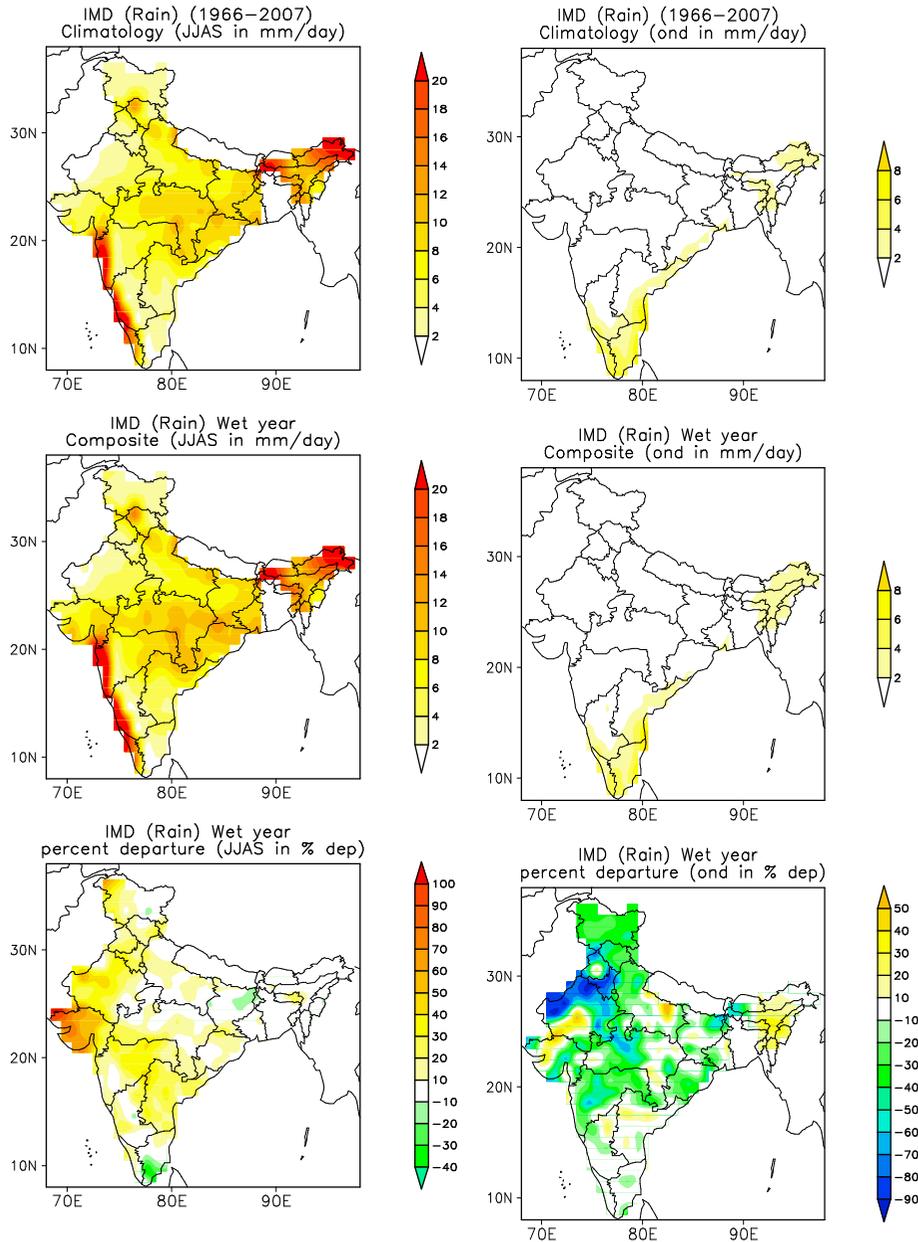
## Kharif Yield vs JJAS Rainfall



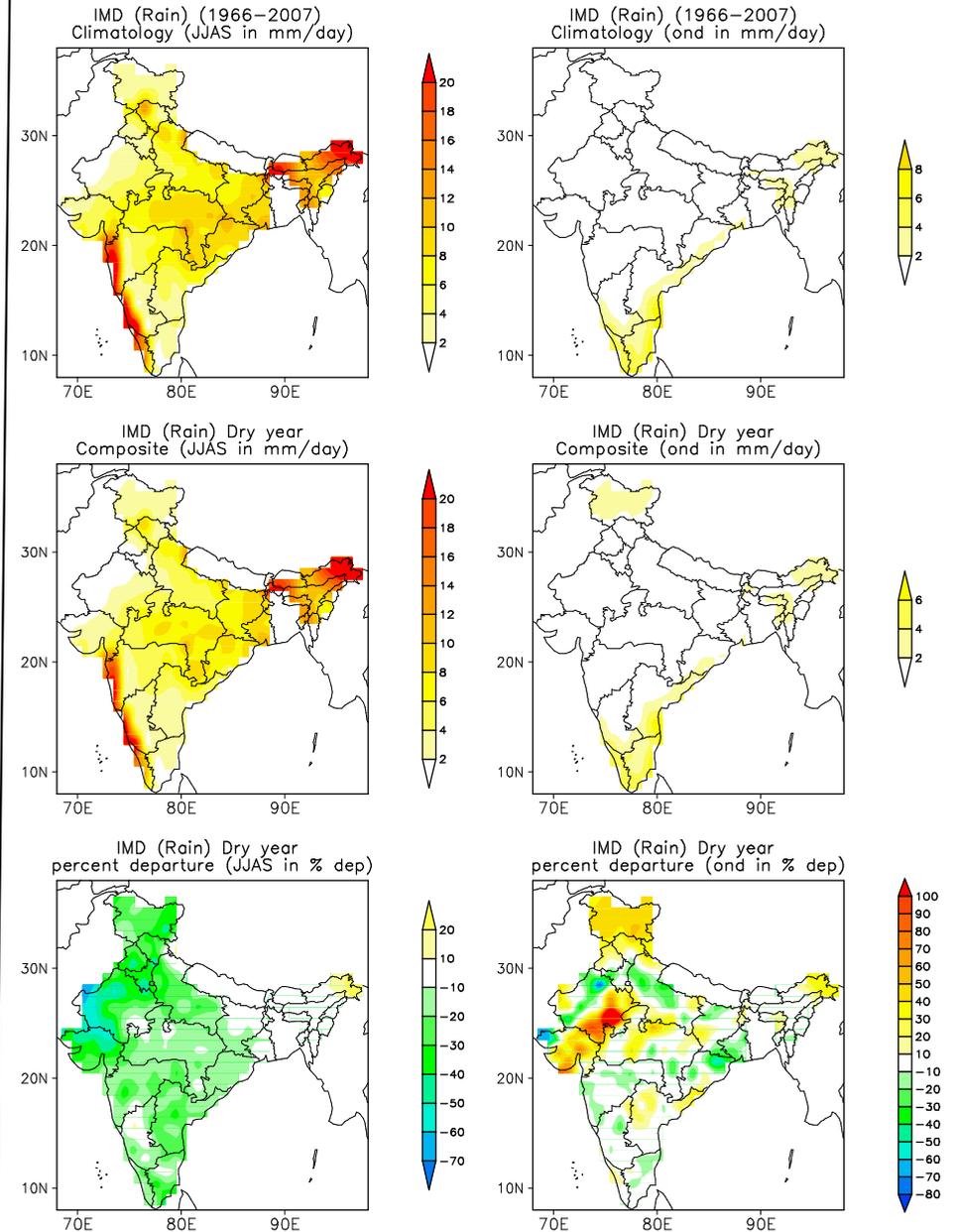
## Rabi Yield vs OND Rainfall



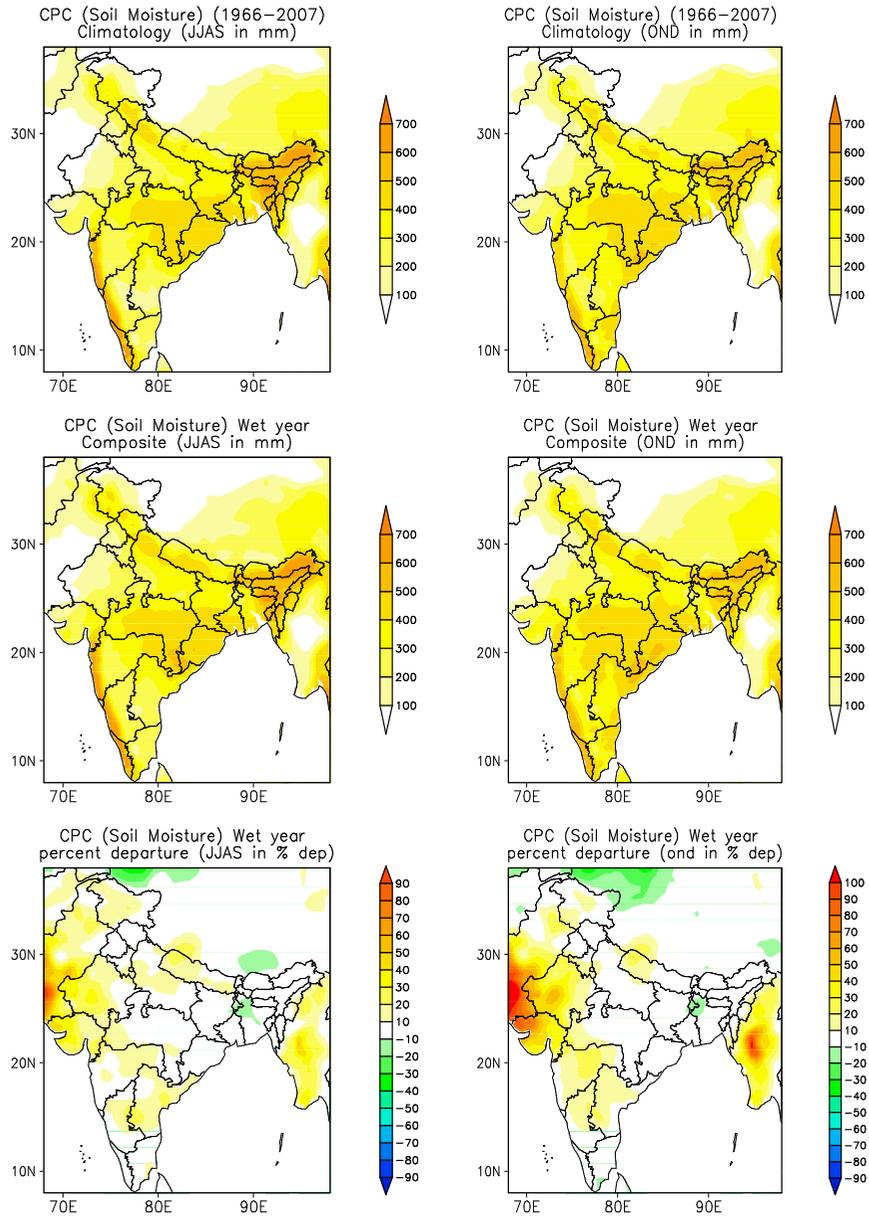
# Wet Year Rainfall Composites



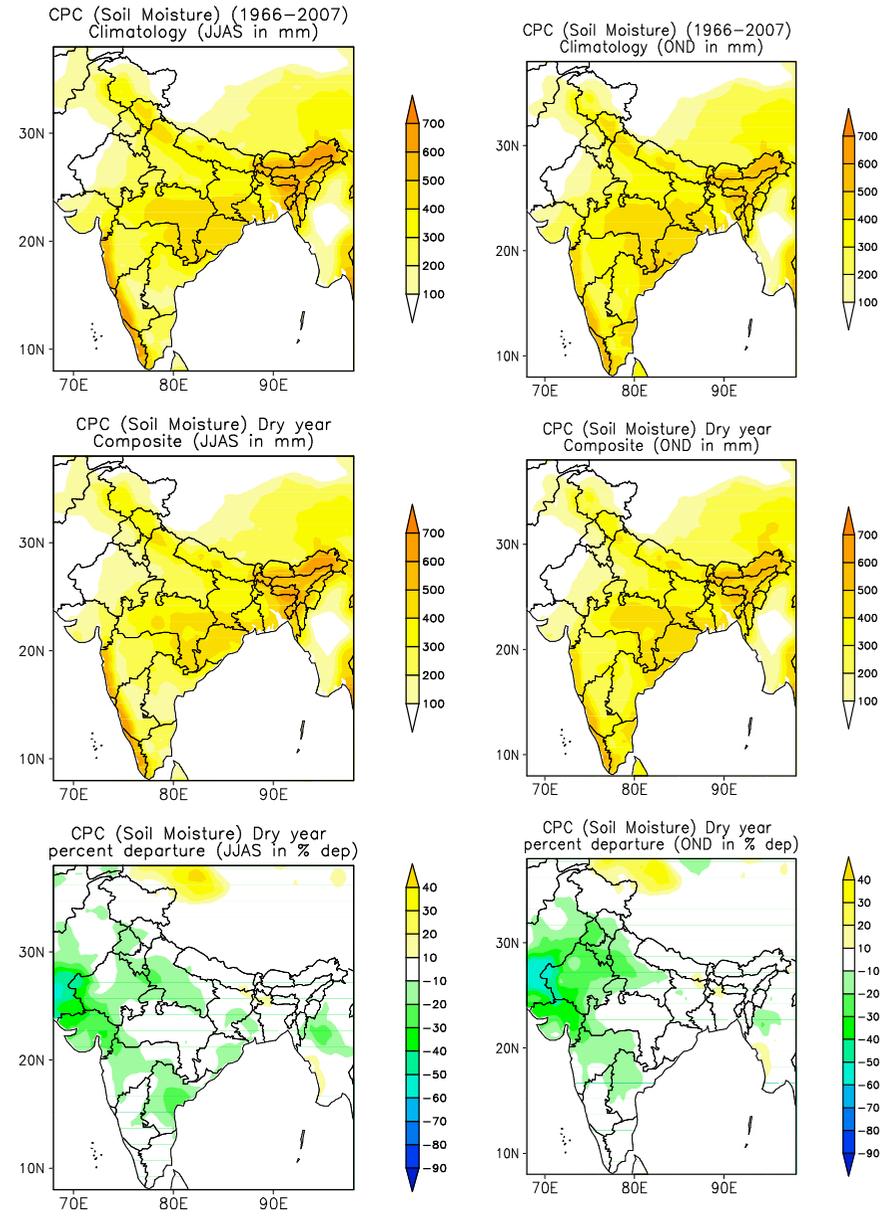
# Dry Year Rainfall Composites



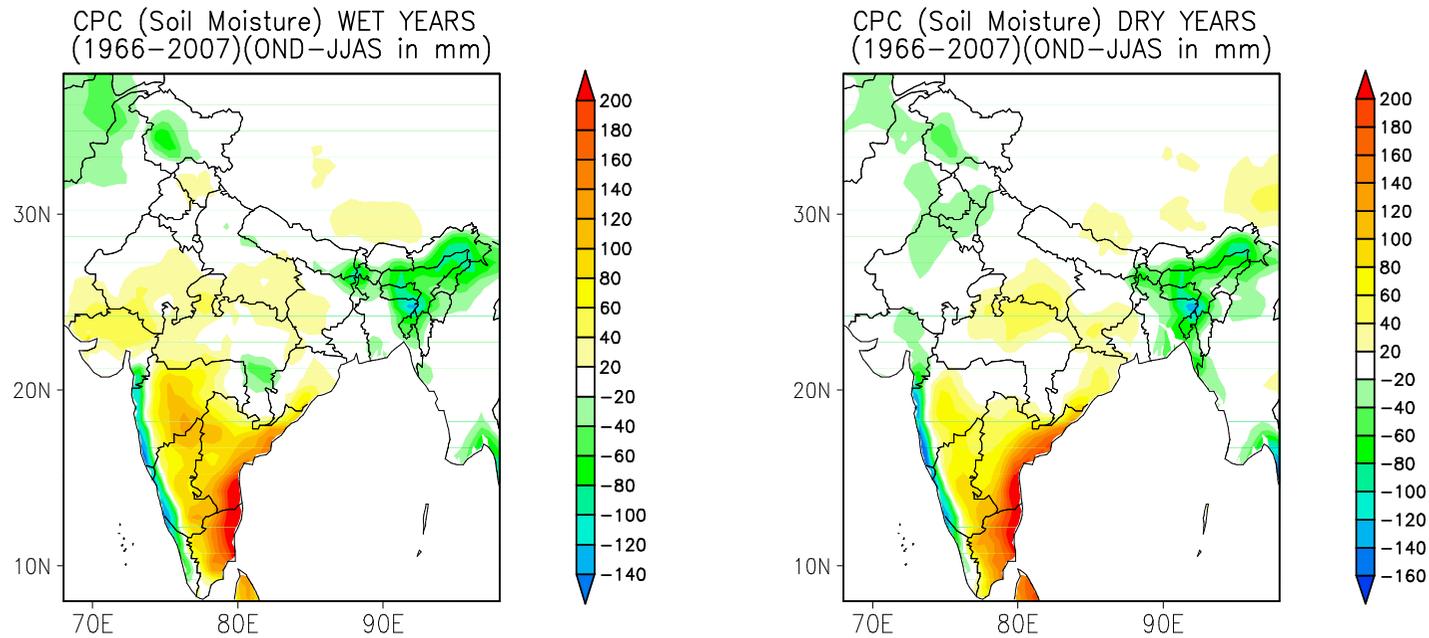
# Wet Year Soil Moisture Composites



# Dry Year Soil Moisture Composites



# Difference in Soil Moisture Composites between post monsoon and summer monsoon



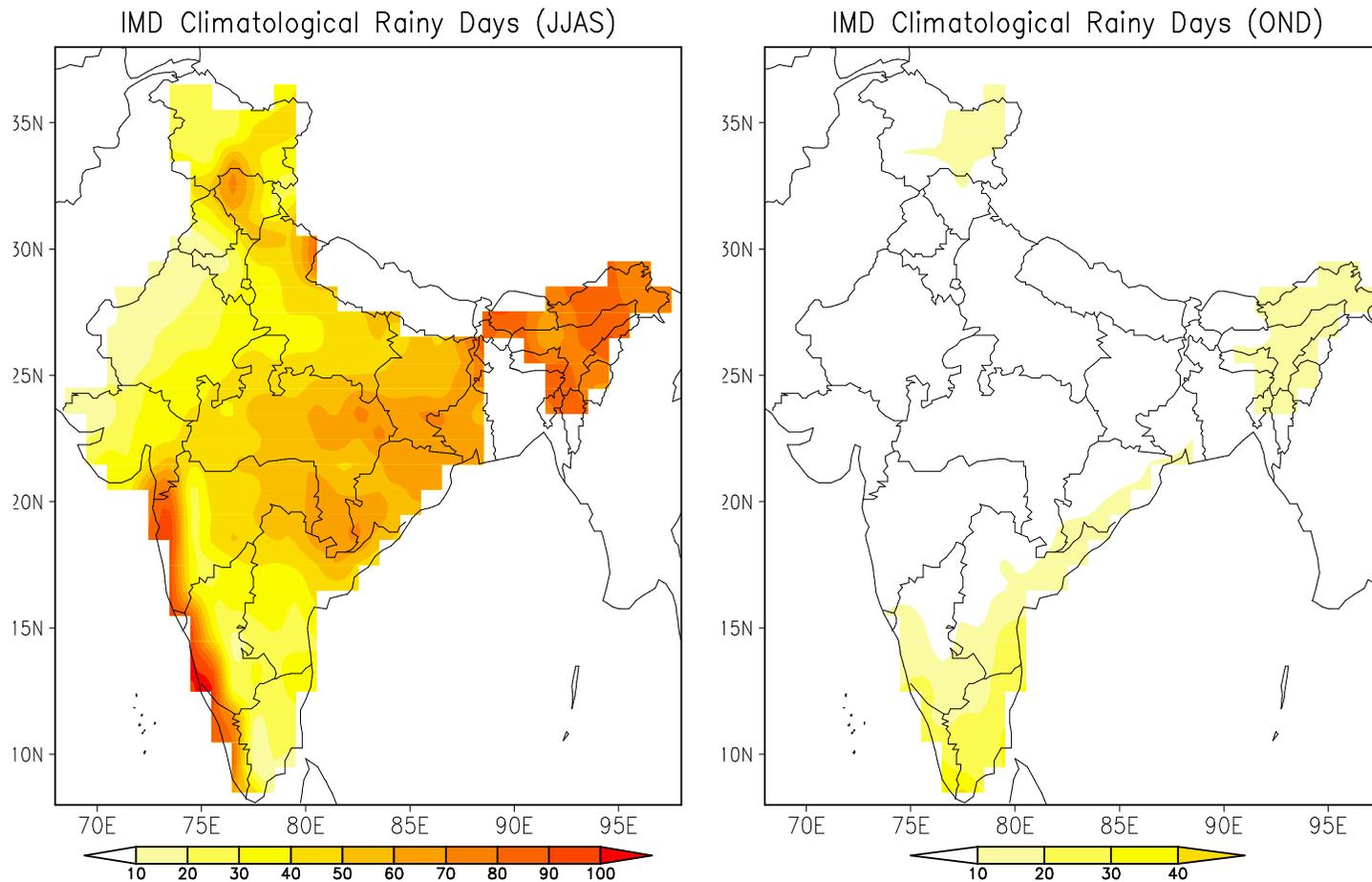


# Impact of daily rain spells and anomalies on Indian Food grain Yield



# No of Rainy Days (or no. of Rain Spell)

## Climatology

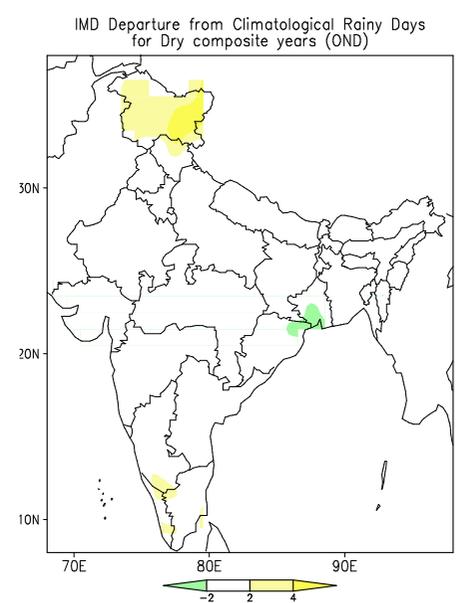
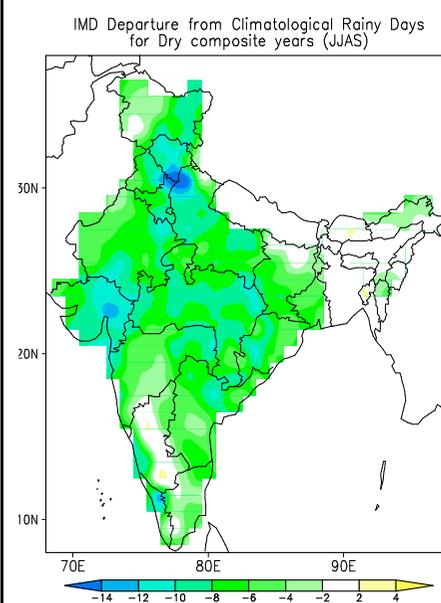
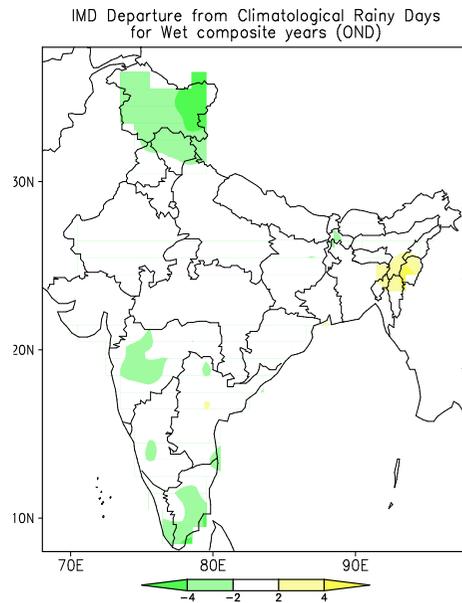
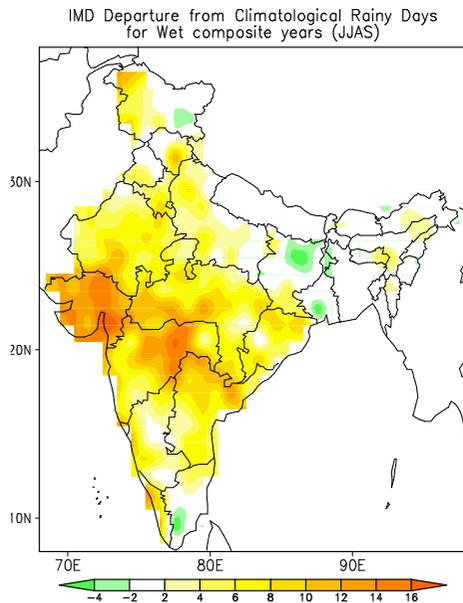
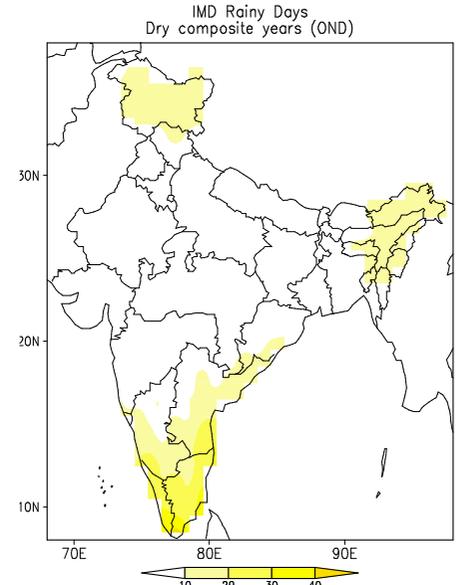
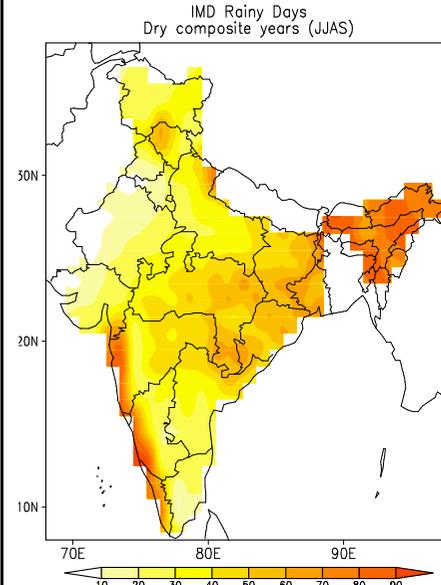
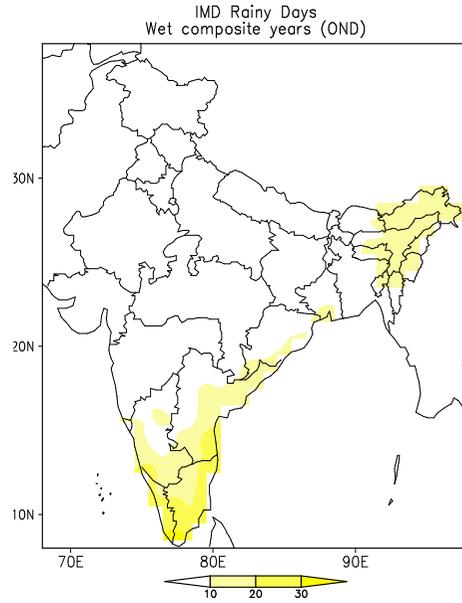
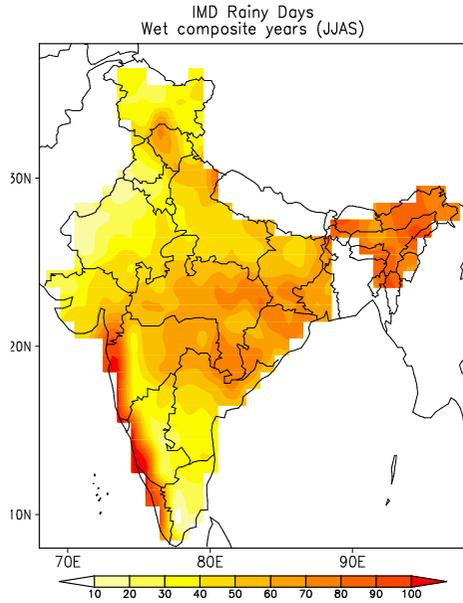


**A rainy day is considered when the amount of daily rainfall exceeding 2.5mm/day over a grid point.**

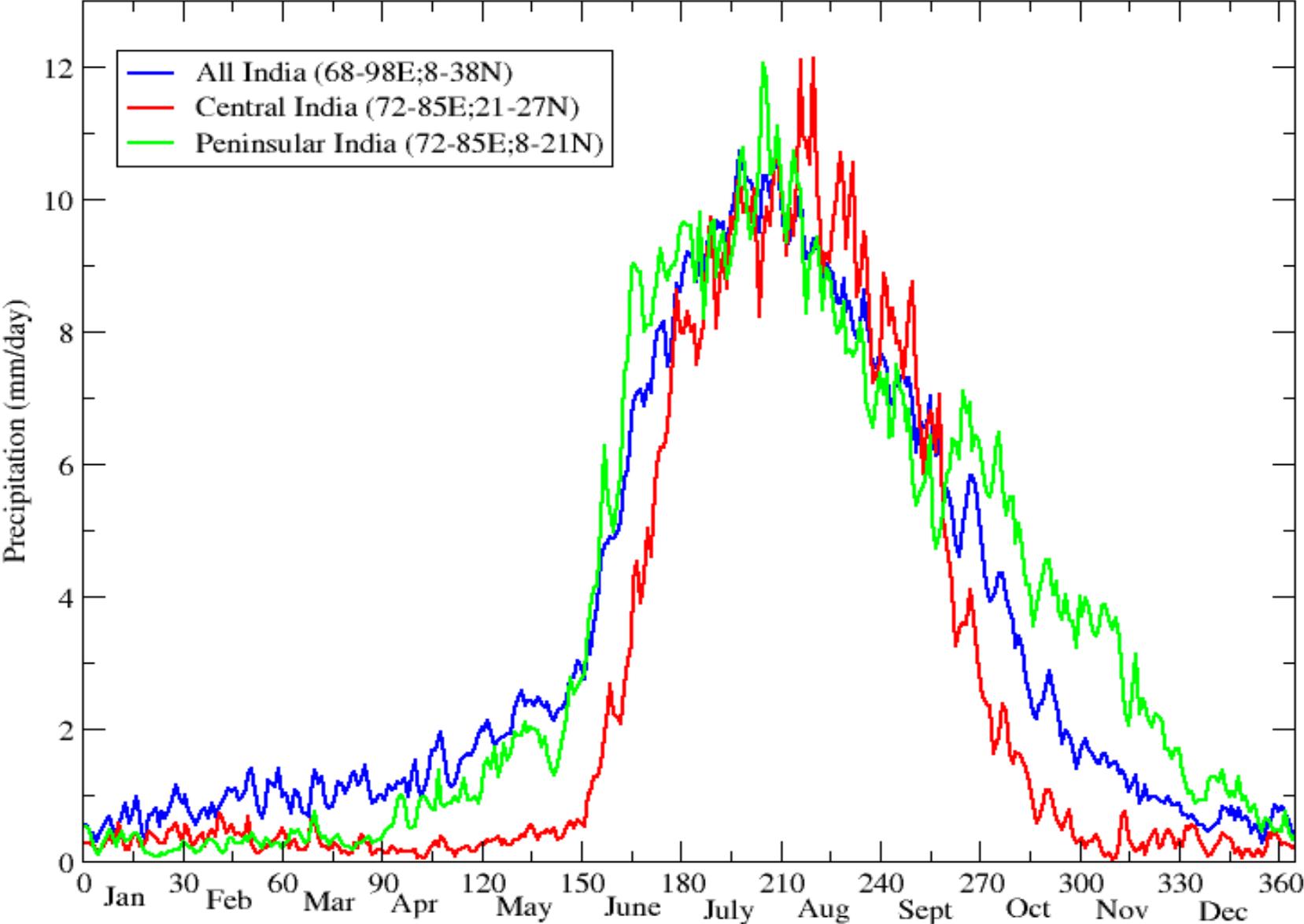
# No of Rainy Days (or Rain Spell)

## Wet Years

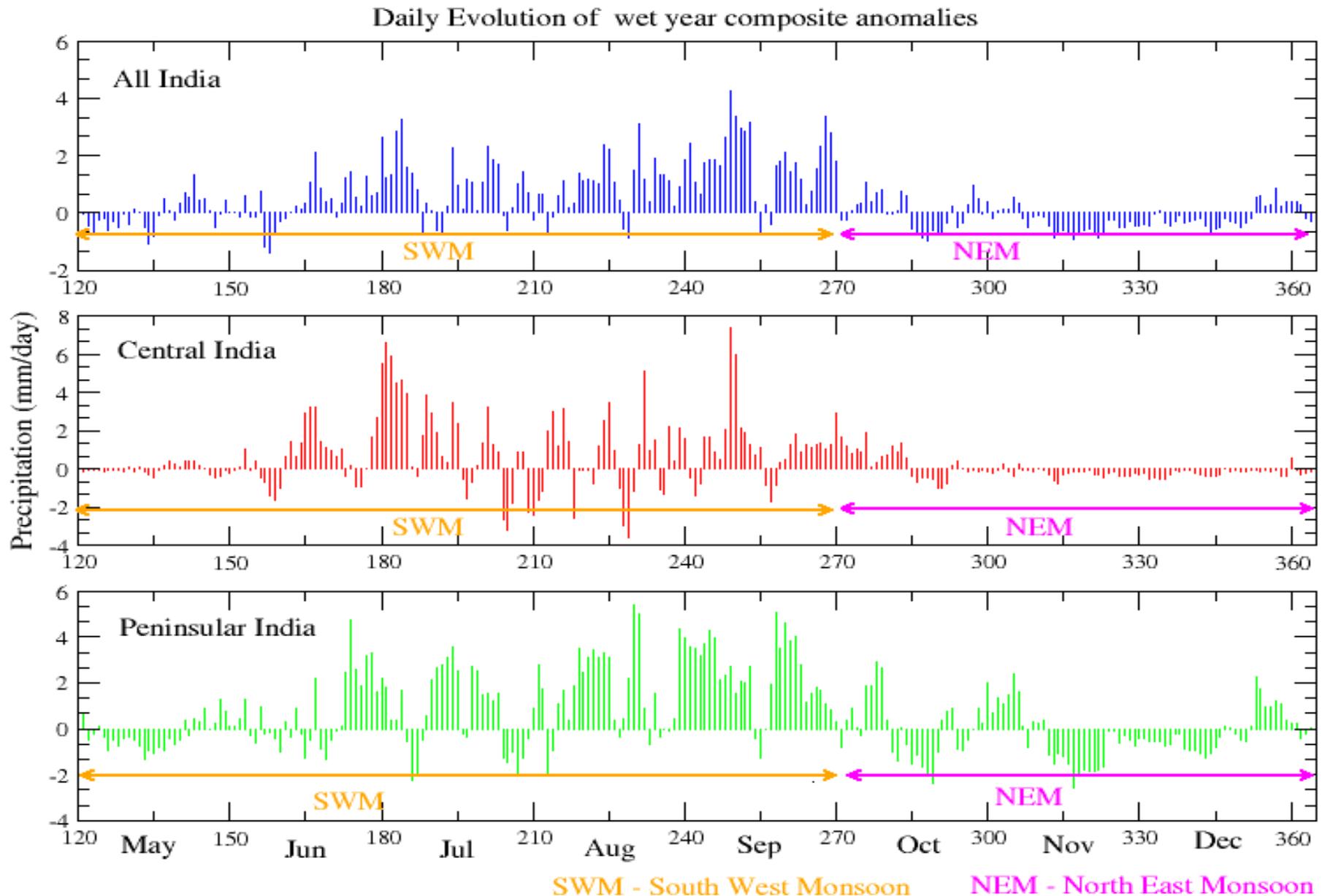
## Dry Years



# Daily Climatological evolution of monsoons over different domains

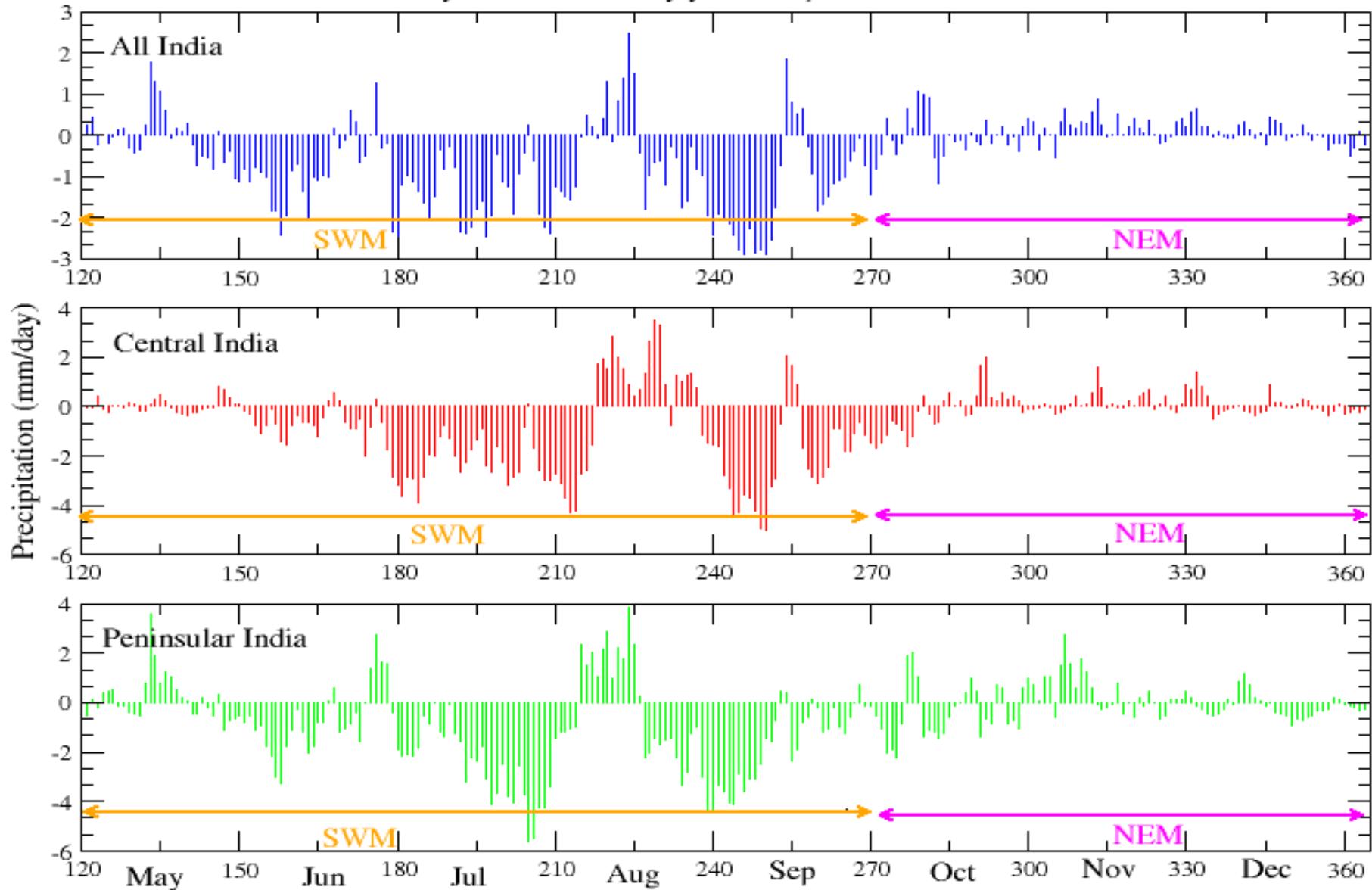


# Daily evolution of Wet Year Composites



# Daily evolution of Dry Year Composites

Daily Evolution of dry year composite anomalies



SWM - South West Monsoon

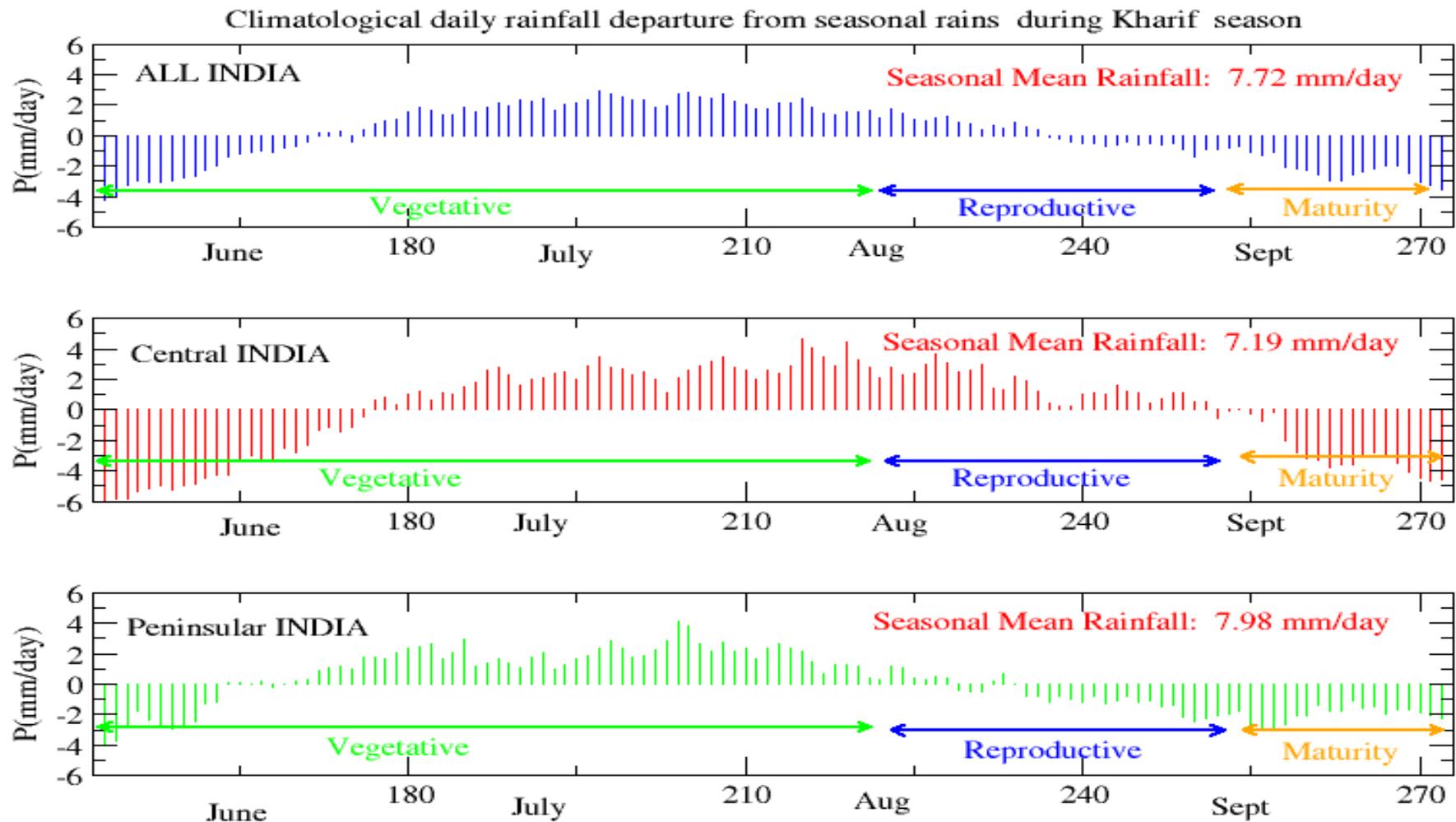
NEM - North East Monsoon



Why daily rain anomalies are so important?



# Rainfall anomalies during South West Monsoon (Jun-Sep)



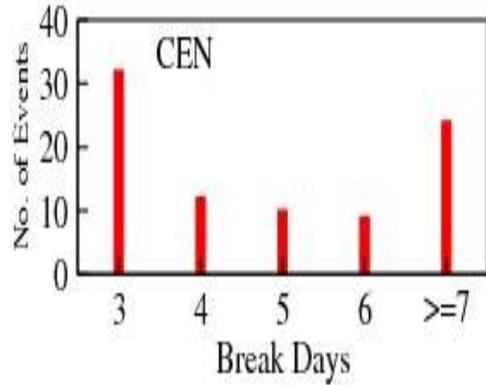
Climatological evolution of daily rainfall anomalies averaged over the All India, Central and peninsular Indian region



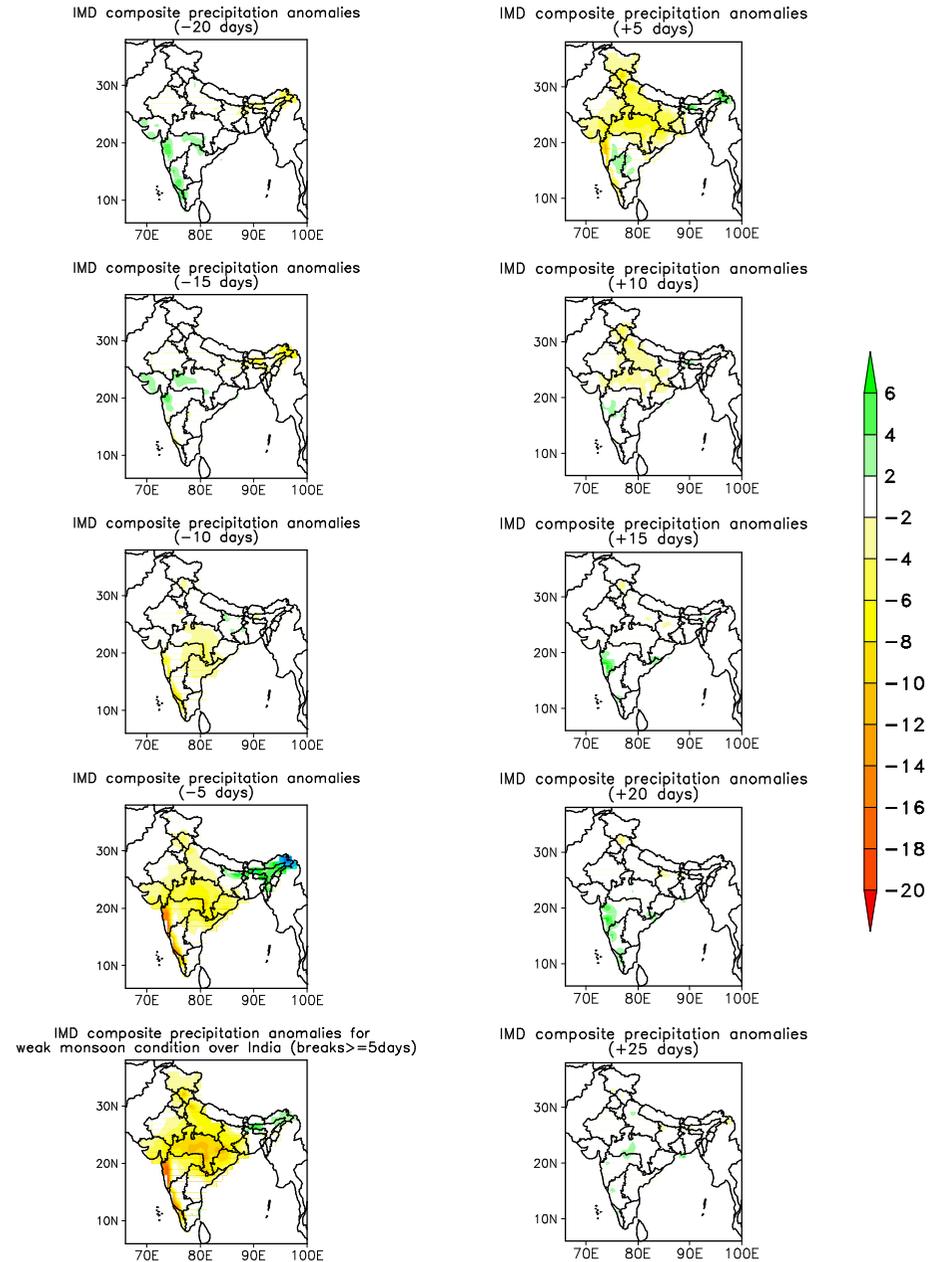
Impact of prolonged break episodes



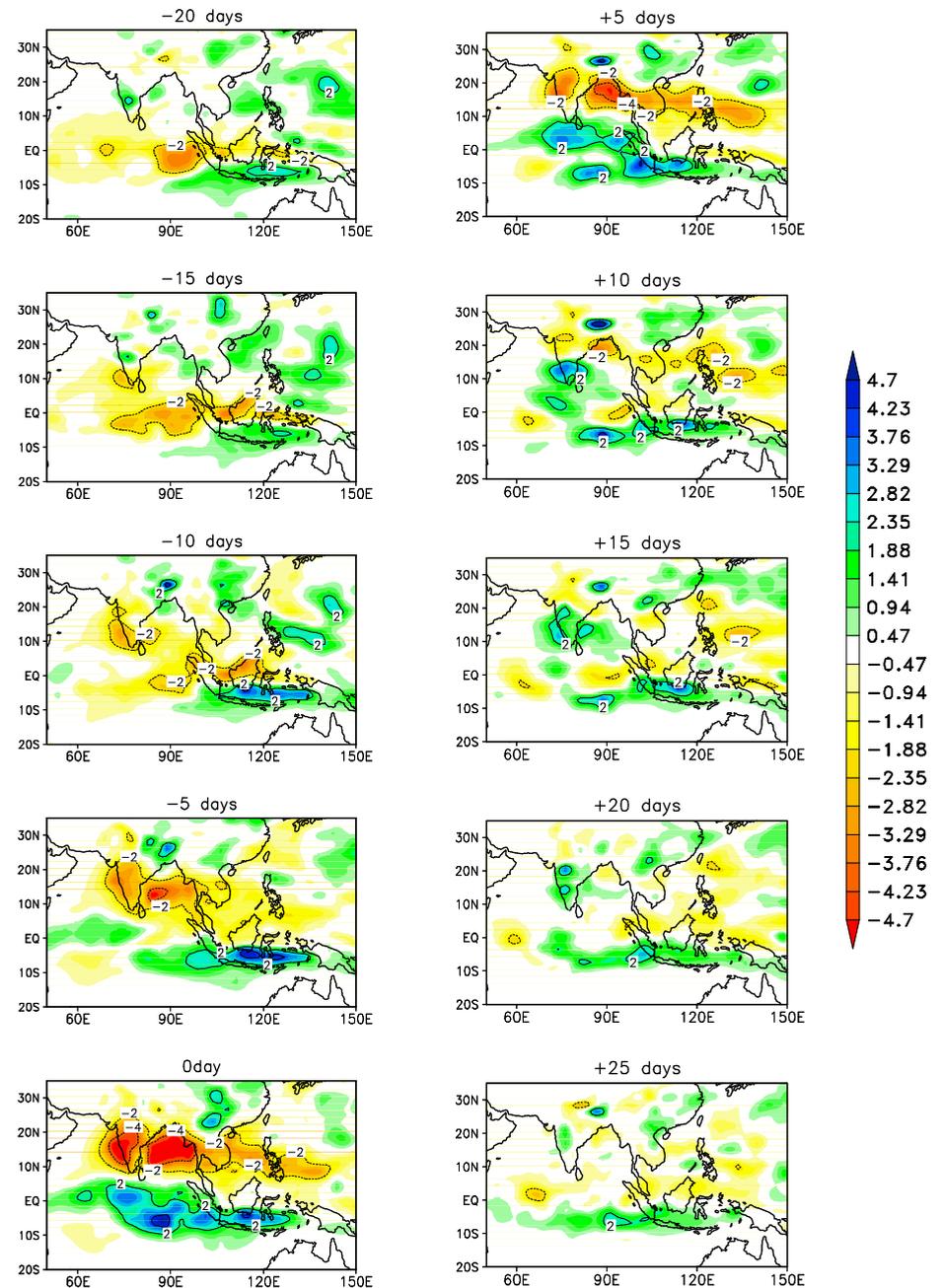
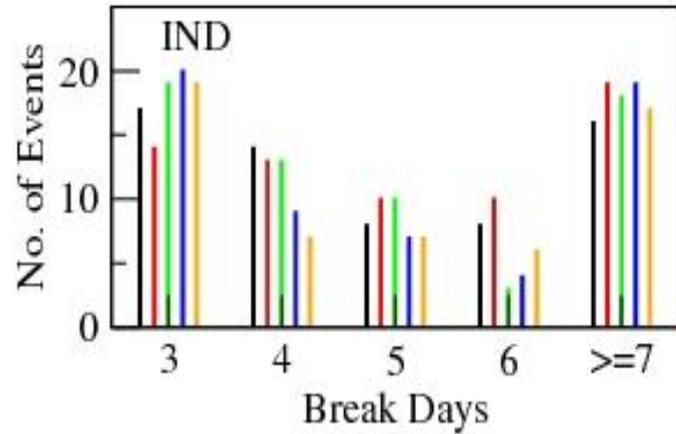
# Prolonged Monsoon Break Episodes in observations



Prasanna and Annamalai J. Clim. (2012)



# Extended Monsoon Break Episodes simulated by GFDL CM2.1





Monsoon rainfall variability as a food grain production indicator!!



## WET Year Crop - Climate Relationship

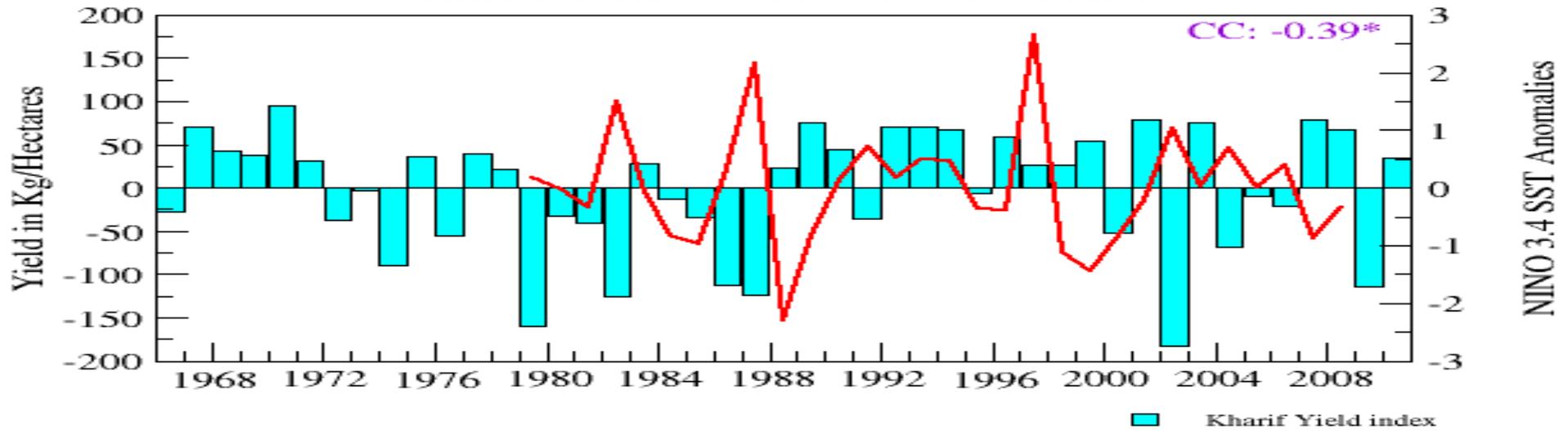
Year	Standardised RF anomaly (JJAS)	Crop productivity in Kharif season	corresponding crop productivity in Rabi season	Corresponding Standardised RF anomaly (OND)
1970	1.33	94.91	56.87	-0.94
1975	1.61	35.68	-15.41	0.92
1983	1.52	28.71	-4.64	0.18
1988	1.59	23.49	102.09*	-1.42
1994	1.49	68.01	118.16*	0.11
2007	1.27	78.82	-29.34	-1.26

## Dry Year Crop - Climate Relationship

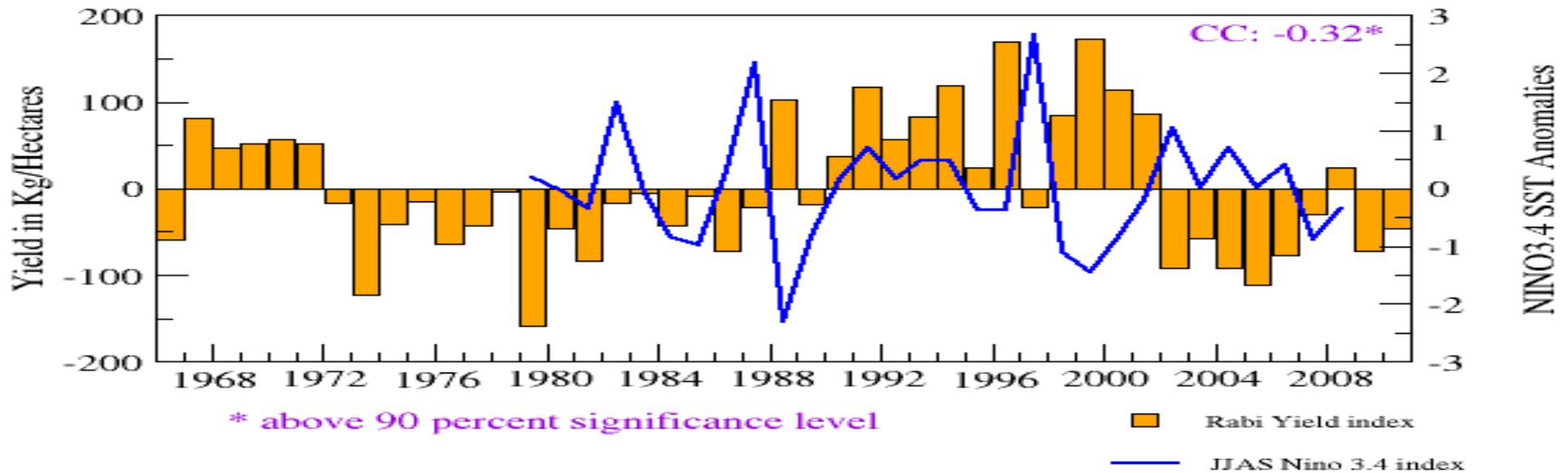
Year	Standardised RF anomaly (JJAS)	Crop productivity in Kharif season	corresponding crop productivity in Rabi season	Corresponding Standardised RF anomaly (OND)
1972	-2.14	-37.58	-17.44	-0.46
1974	-0.99	-90.07	-41.75	-0.02
1979	-1.47	-159.3	-159.02*	0.81
1982	-1.14	-125.04	-15.98	-0.65
1986	-1.05	-113.02	-8.95	0.8
1987	-1.6	-124.27	-21.26	1.43
2002	-2.03	-181.96	-92.07*	-1.03
2004	-1.03	-68.45	-92.38*	-0.52

# All India Crop Yield Index Vs Summer Nino3.4 index

## Kharif Yield vs JJAS NINO3.4 index



## Rabi Yield vs JJAS NINO3.4 index



\* above 90 percent significance level

# Summary

- ❖ Summer monsoon has shown statistically significant relation with total food grain production.
- ❖ Impact of daily rainfall anomalies on the total food grain production is significant.
- ❖ Due to strong correlation of food grain production to NINO3.4 SST, APCC climate outlook should be considered for exploitation in creating agriculture production outlooks.
- ❖ Needs further study on sub divisional and state level statistics to exploit seasonal outlooks on agricultural production indices.

**THANK  
YOU!**

