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## Introduction

- Indian Summer Monsoon Rainfall (ISMR) is highly correlated (C.C=0.8) with monsoon rainfall over the monsoon zone (figure 1) ranging from 18°N to 28°N and 65°E to 88°E.
- Blanford (1886) first described the ISMR fluctuation over the monsoon trough zone between different spells.
- ISMR fluctuate on intra seasonal scale between good rainfall as active spells and little rainfall as break spells.
- Active and break spells were identified by averaging the daily rainfall over the core monsoon zone.

## Objectives

- Identify the active and break spells using IMD daily rainfall data for July & August over core monsoon zone (18°N to 28°N and 65°E to 88°E).
- To examine the variability in active and break days for every 10 day period and for every decade during 1901-2020.
- Examine various statistical features of active and break spells during cold phase (1901-1960) and warm phase (1961-2020).
- To understand the evolution of active and break spells from the lagged (0, -5, -10, -15 and -20 days) composites of rainfall, SST, OLR, 10m wind, latent and sensible heat flux.
- Examine the composite anomaly pattern of rainfall, OLR, SST, Surface pressure and wind during active and break spells.

## Data & Methodology

- Daily gridded IMD rainfall dataset for the period 1901-2020.
- NOAA daily average OISST and OLR dataset for the period 1982-2020.
- Daily mean Latent Heat Flux, Sensible Heat Flux and 10m wind from NCEP-NCAR for the period 1982-2020.
- We divide the period 1901-2020 into cold phase (1901-1960) and warm phase (1960-2020) based on SST trend over Indian Ocean.
- Active (break) spell has been identified as the period during which the standardized rainfall anomaly is more (less) than +1.0 (-1.0), consecutively for three days and more (Rajeevan et al. 2010).

## Results & Discussion

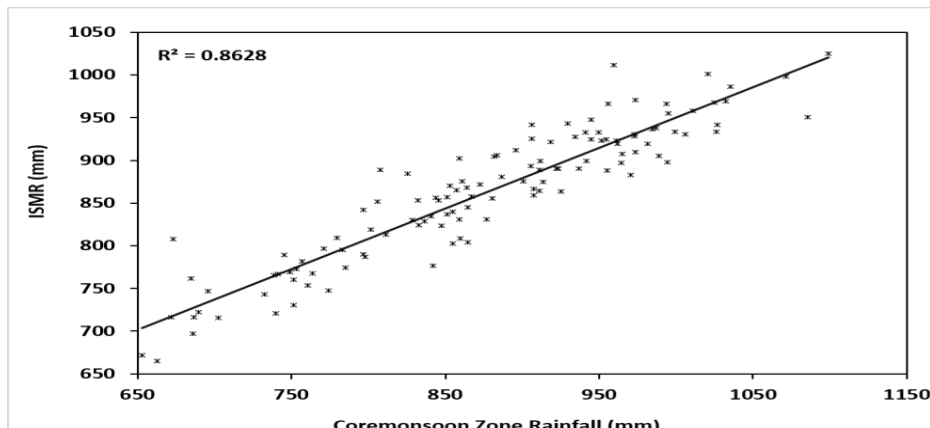


Fig 1: Variation of the ISMR with the rainfall over core monsoon zone for the monsoon season.

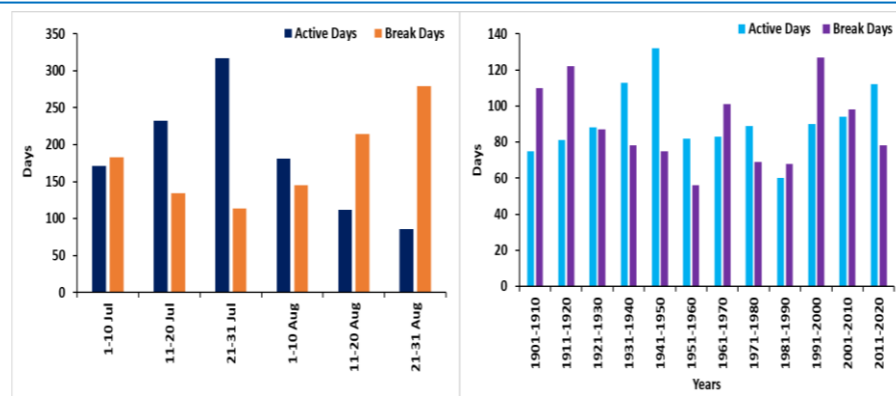


Fig 2: 10-days and Decade wise period statistics.

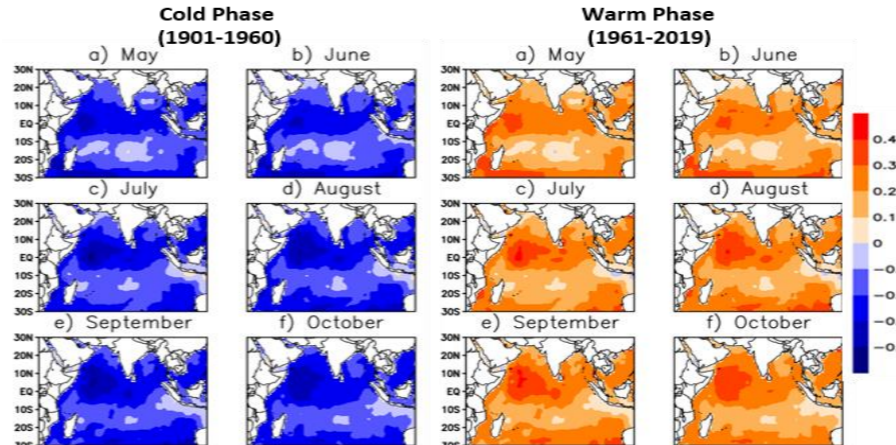


Fig 3: SST trend during cold and warm phase.

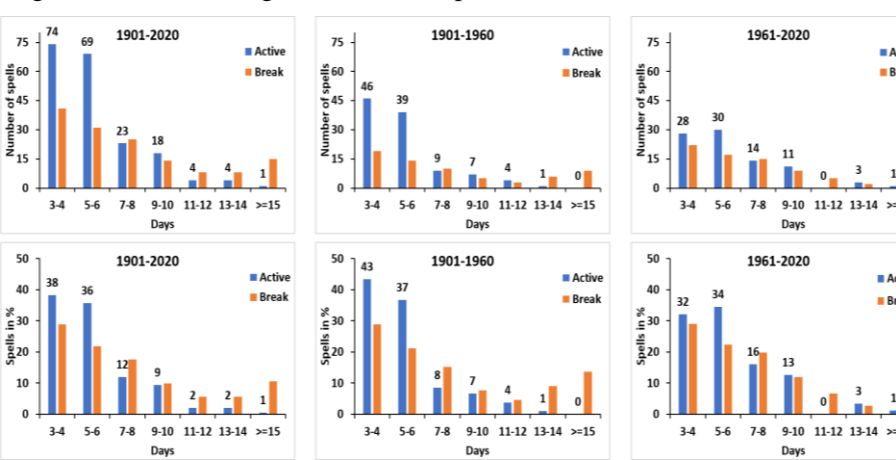


Fig 4: Frequency distribution of active and break spells.

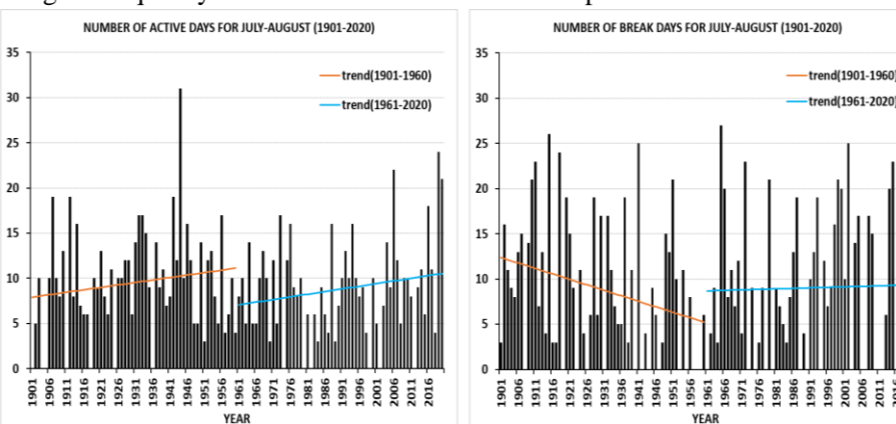


Fig 5: Interannual variation and trend.

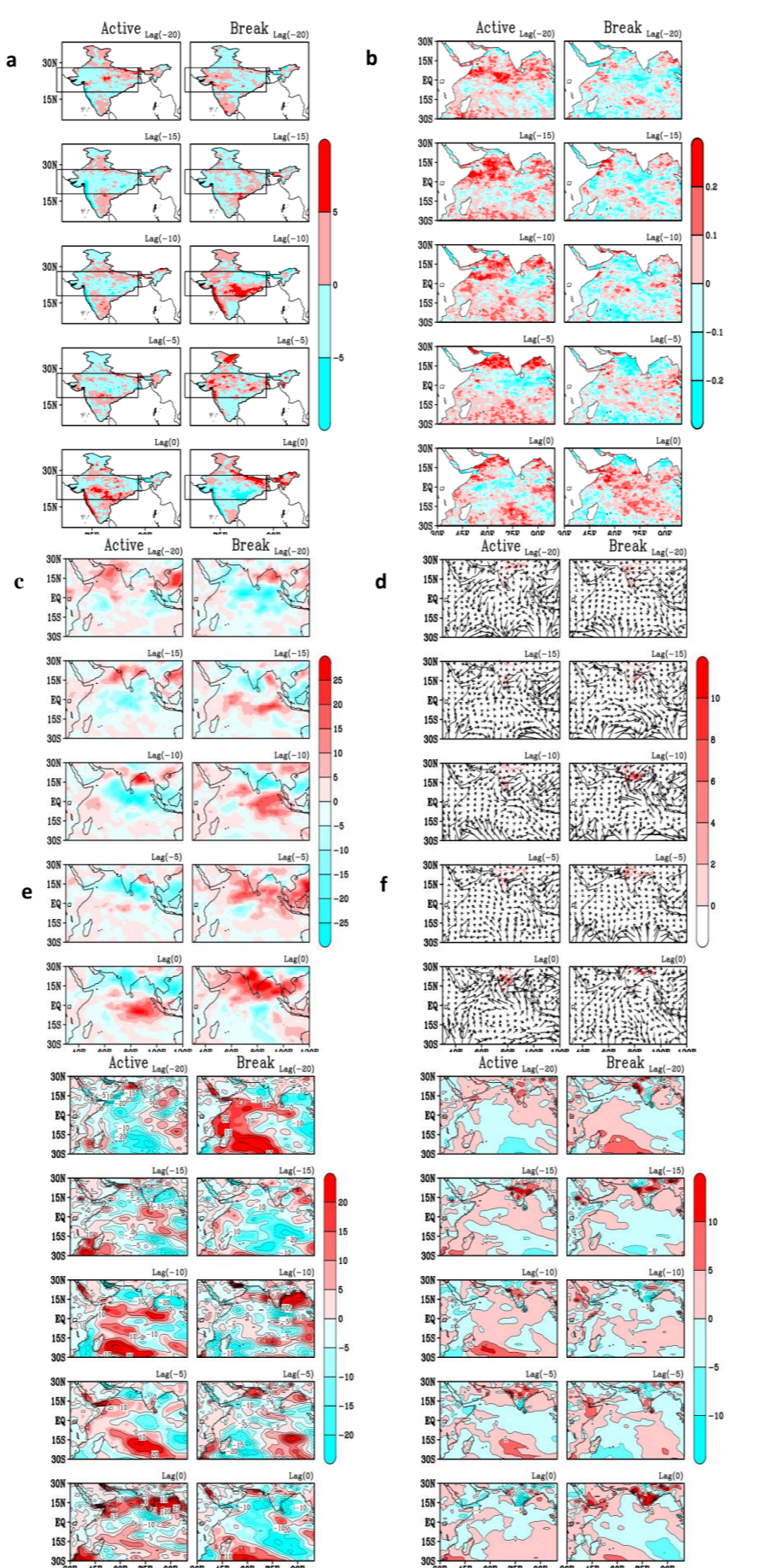


Fig 6: Lagged composite of a) rainfall, b) SST, c) OLR, d) Wind, e) latent heat flux and f) sensible heat flux for active and break spells.

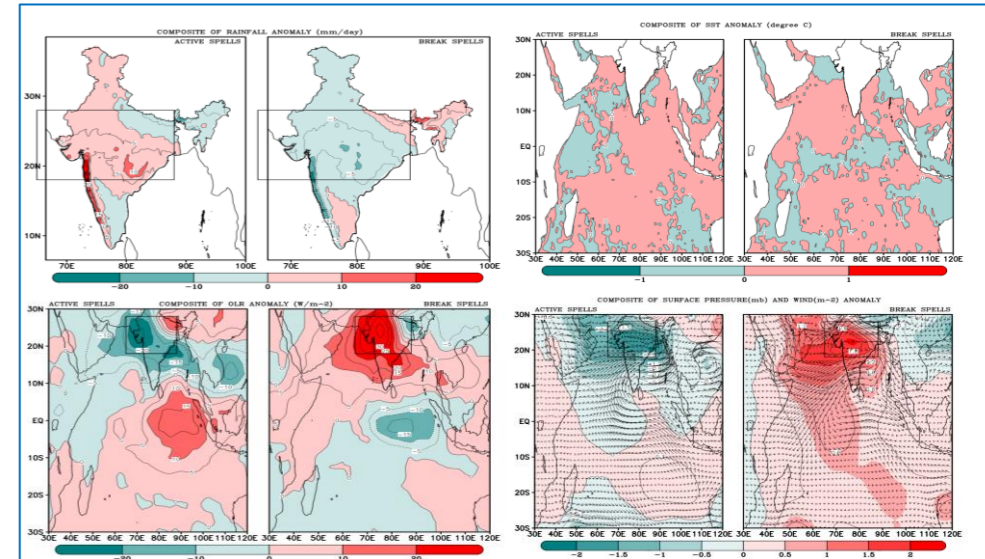


Fig 7: Composite anomaly of a) rainfall, b) SST, c) OLR and d) surface pressure and 10m wind for active and break spells.

## Summary/Conclusion

- We find 193 active spells and 142 break spells of different duration during 1901 to 2020, out of which more(less) no active (break) spells are observed during cold phase (1901-1960) while the reverse trend is observed during warm phase (1960-2020).
- Active spells of 3-4 days followed by 5-6 days are more as compared to longer spells(>6days).
- However, for longer spells (>11 days) break spells are more than the active spells irrespective of warm and cold phase.
- During both cold and warm phase an increasing trend is found in active days while break days show a decreasing (increasing) trend in cold(warm) phase.
- Considering decadal variability, active (break) days are more during 1941-1950 (1991-2000).
- During July-August, number of active (break) days are maximum during 21-31 July (21-31 August).
- After 31 July, decreasing( increasing) trend is observed in active(break) spells.

## Acknowledgements & References

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