



**Seventh WMO International Workshop on Monsoon (IWM-7)
22-26 March, 2022, IMD, MoES, New Delhi, India**

Climatology of Thermodynamic Indices and Background Synoptic conditions responsible for severe convection during pre to post monsoon seasons over Indian region

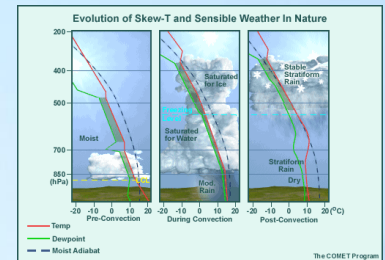
A.Madhulatha¹, M.Mohapatra¹, K.Sathi Devi¹, R.K. Jenamani¹, D.R. Pattanaik¹ and M.Rajeevan²

1 India Meteorological Department (IMD), MoES, New Delhi

2 Ministry of Earth Sciences (MoES)

Presented by:

madhulatha11@gmail.com



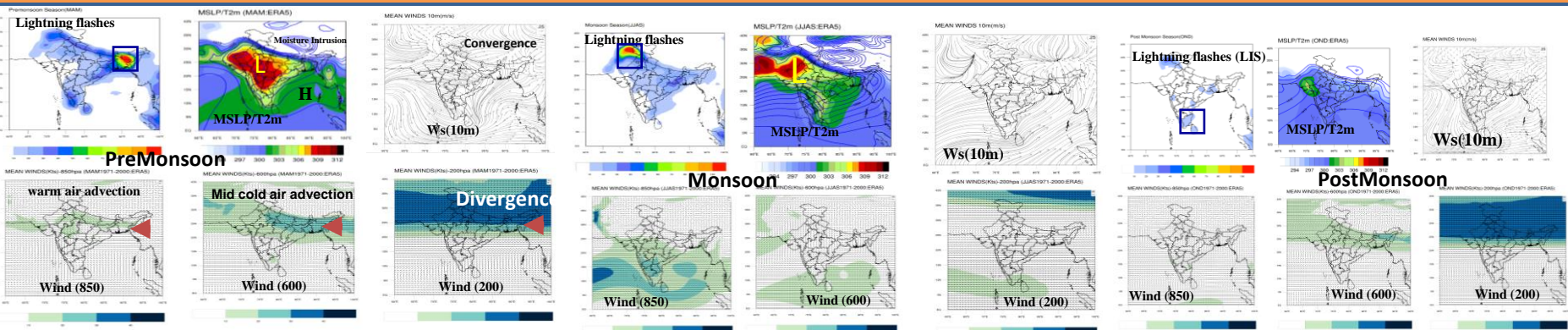
Thermodynamic/convective evolution

Objective of the paper :

- ❑ Accurate forecasting of severe convective systems requires the knowledge of complex, non-linear interaction between the local thermodynamics and background synoptic conditions.
- ❑ Using IMD RSRW/Reanalysis (ERA5)/Lightning (TRMM LIS) products local thermodynamics; Synoptic forcings associated with lightning hot spot over Indian Region are analyzed.
- ❑ Investigating the monthly thresholds of thermodynamic indices can provide helpful proxy to operationally forecast the severe convective systems over different regions in different seasons.

Data, Methodology, Results & Summary

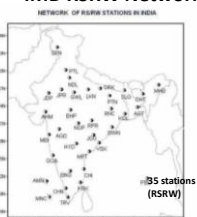
- IMD RSRW Monthly Normals (1971-2000) for 35 stations ,ERA5 Reanalysis data/TRMM LIS (Lightning Imaging Sensor Data) (Background synoptic forcing/Lightning climatology)
- Methodology: 29 Thermodynamic Indices based on NCL Inbuilt functions Cape computation is based on Kerry and Emanuel 1994 (Conservation of Moist Static Energy)
- SW, LI, LI(Tv), SWEAT, KI, CT,VT,MCAPE MCAPE, CIN, CIN(Tv),BRN, BRN(Tv), TLcl, PLcl, HLcl, Thetaelcl, TCCL,PCCL,HCCL, θ_e LCL, θ_e (surface), MMIX θ , THK(1000-500),PPW



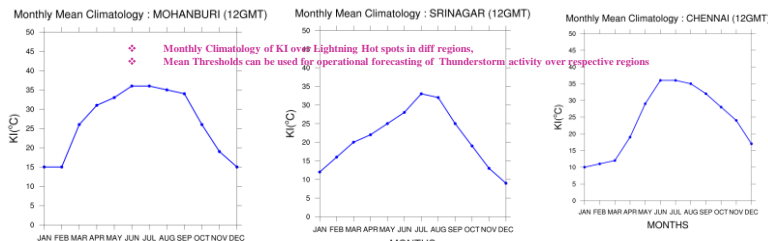
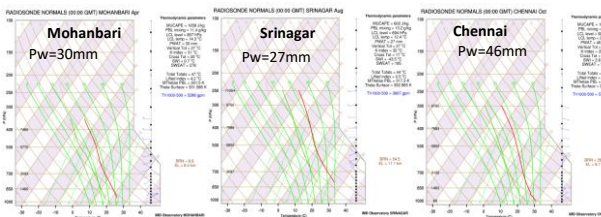
- Lightning hot spots regions (blue rectangles) are driven by moisture, instability, warm temperatures driven by background synoptic systems over respective seasons.
- Premonsoon (high insolation, humidity, high instability, moderate wind shear, more vertical development), Monsoon (strong winds, less temperature, high moisture, high wind shear, low vertical clouds), Post Monsoon (low Temperatures, Moistures, Less intense)

IMD RSRW Network

Mean Climatology of RSRW over Lightning hot spot regions (NE,NW, south India) in diff seasons

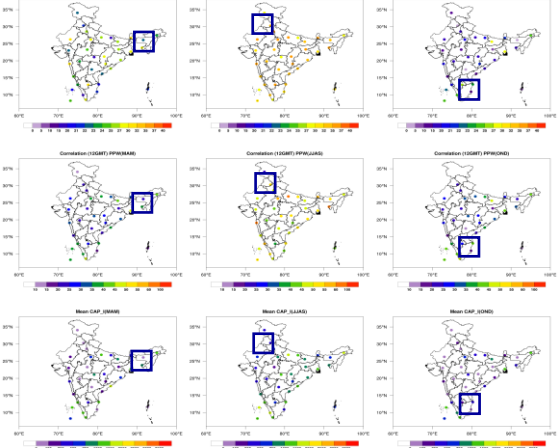


Variation in values in mean indices in diff seasons, regions
This is due to varied background forcing

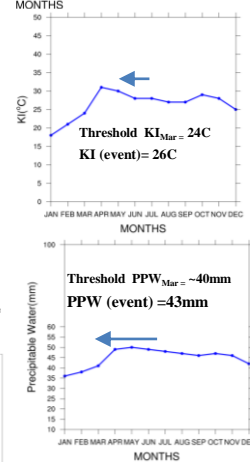
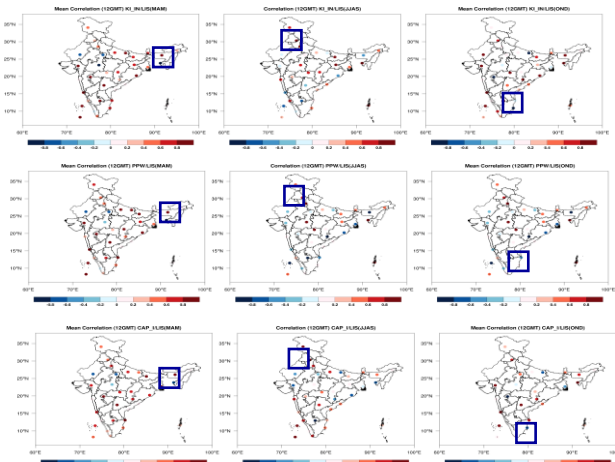


Seasonal variation of indices (KI, PPW, CAPE 35 stations)

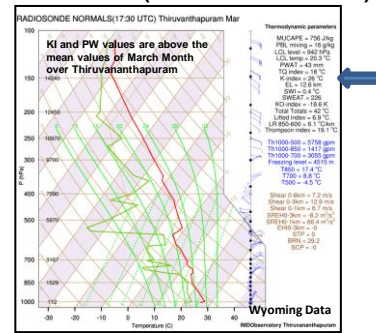
Typical Picture of indices (three ingredients: Temperature, Moisture, Instability)



Correlation between (Lightning /Thermodynamic parameter over 35 stations)



Verification (Thst case 19Mar 2022)



- Mean Thresholds of correlated indices can be used for forecasting severe convection over respective regions.
- Bias from the mean climatological values provide useful proxy in operational forecasts. (From Numerical Models and also observations)
- Calculated Mean Thresholds will be included in IMD Thunderstorm webis for operational usage.

References: IMD Forecasting Manuals

LIS Vs CAPE/KI/PPW (showed good correlation > 0.6 over lightning hot spot regions)

Acknowledgments: Dr Soma Sen Roy, Dr Naresh Kumar, Dr A.K.Das, Dr D.S.Pai