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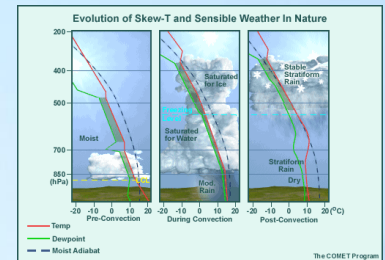
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Thermodynamic/convective evolution

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.
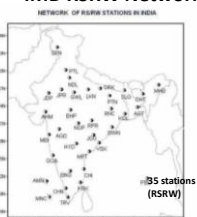
Data, Methodology, Results & Summary

- ❑ IMD RSRW Monthly Normals (1971-2000) for 35 stations ,ERA5 Reanalysis data/TRMMLIS (Lighnting Imaging Sensor Data) (Background synoptic forcing/Lightning climatology)
- ❑ Methodology: 29 Thermodynamic Indices based on NCL Inbuilt functions Cape computation is based on Kerry and Emanual 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, θe LCL, θe (surface), MMIX θ, THK(1000-500),PPW
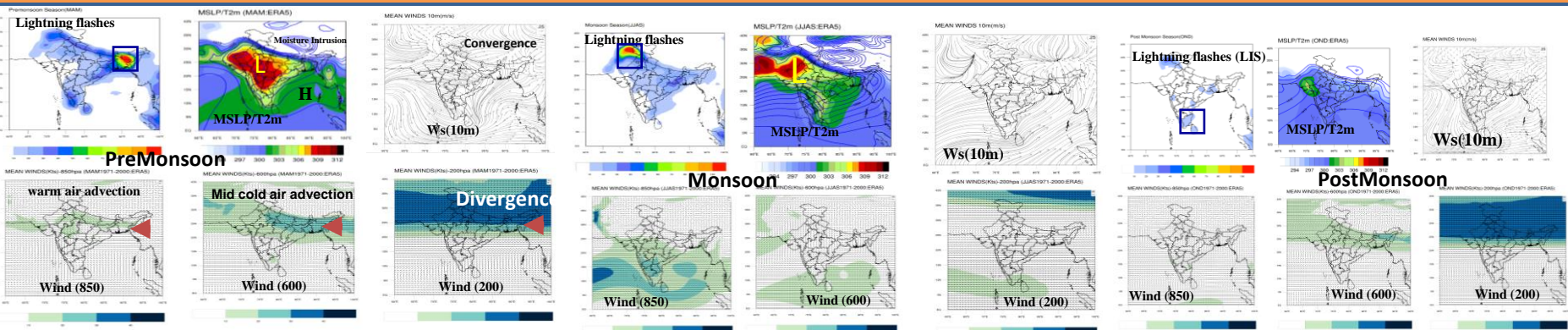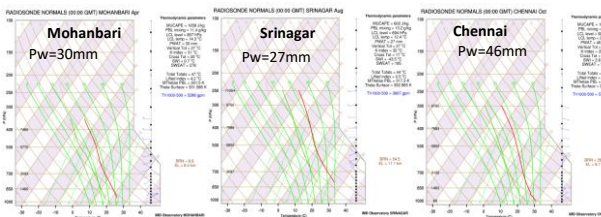

- ❑ Lightning hot spots regions (blue rectangles) are driven by moisture, instability, warm temperatures driven by background synoptic systems over respective seasons.
- ❑ Premonsoon(high insolation, humidity, high instability, moderate wind shear, more vertical development), Monsoon(strong winds, less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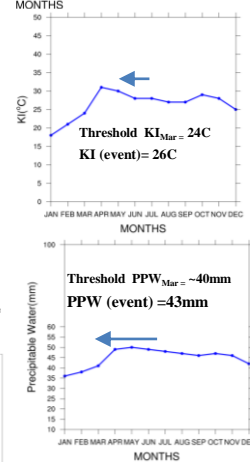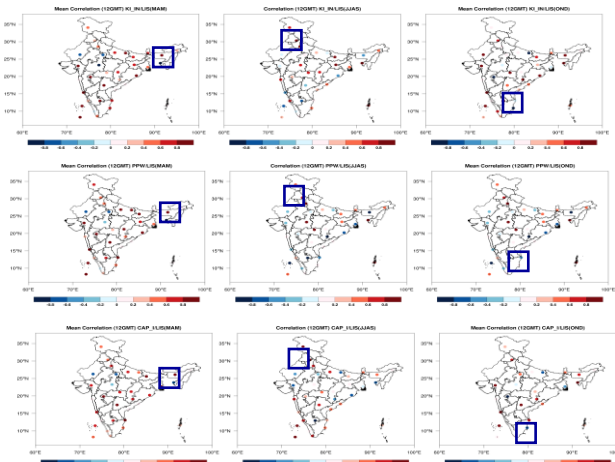

Seasonal variation of indices (KI, PPW, CAPE 35 stations)
Typical Picture of indices (three ingredients: Temperature, Moisture, Instability)
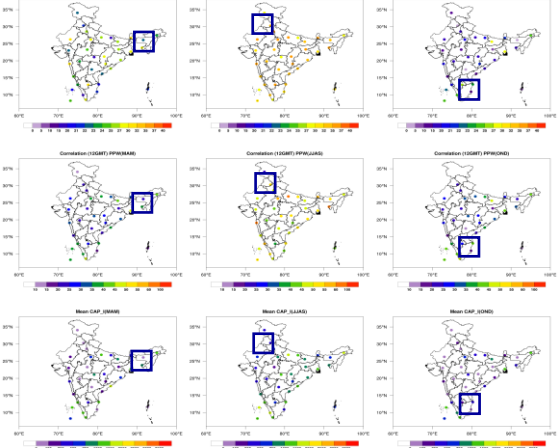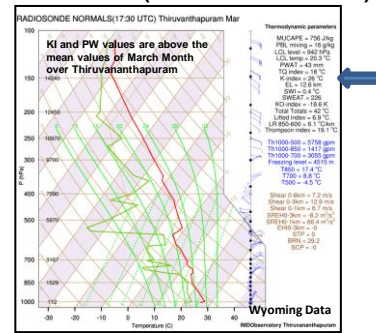
References: IMD Forecasting Manuals

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