



# Simulation of Indian Summer Monsoon – 2010 using WRF

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## Introduction

- Indian Summer Monsoon (ISM) is one of the spectacular features of the global atmospheric general circulation.
- Simulation of ISM circulation features and rainfall by numerical model have been the most challenging problem so far.
- Monsoon Intraseasonal Oscillations (MISO's) play major role in influencing the seasonal (June-September) mean monsoon features and their interannual variability.
- MISO's are very difficult to reproduce by models due to its internal chaotic dynamics.

## OBJECTIVE

Study the Indian Summer Monsoon (ISM) Features and its Intraseasonal Variability using High resolution atmospheric Model

## Model Experiments

Initial & Boundary Conditions: NCEP FNL Reanalysis (1°X1°)

Model verification with IMD, TRMM and AIRS Satellite Observations

Model integration period : 1 May-30 September 2010

Model type

Primitive equation, non – Hydrostatic model (V3.2.1)

Domain of integration

40°E – 110°E  
5°S – 40°N

Vertical resolution & Horizontal resolution

38 sigma levels  
45 km x 45 Km

Convection scheme

Betts-Miller-Janjic scheme

Microphysics

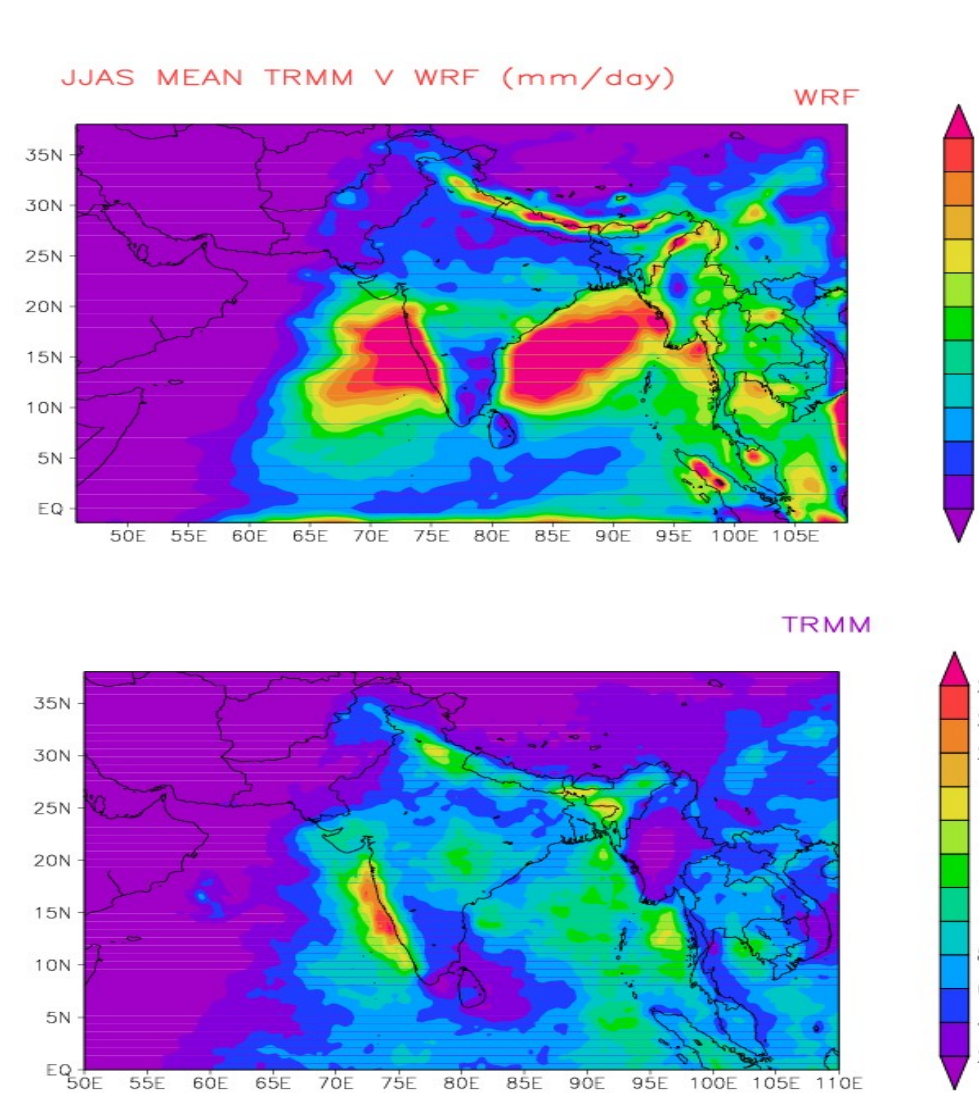
Lin scheme

Sea Surface Temperature

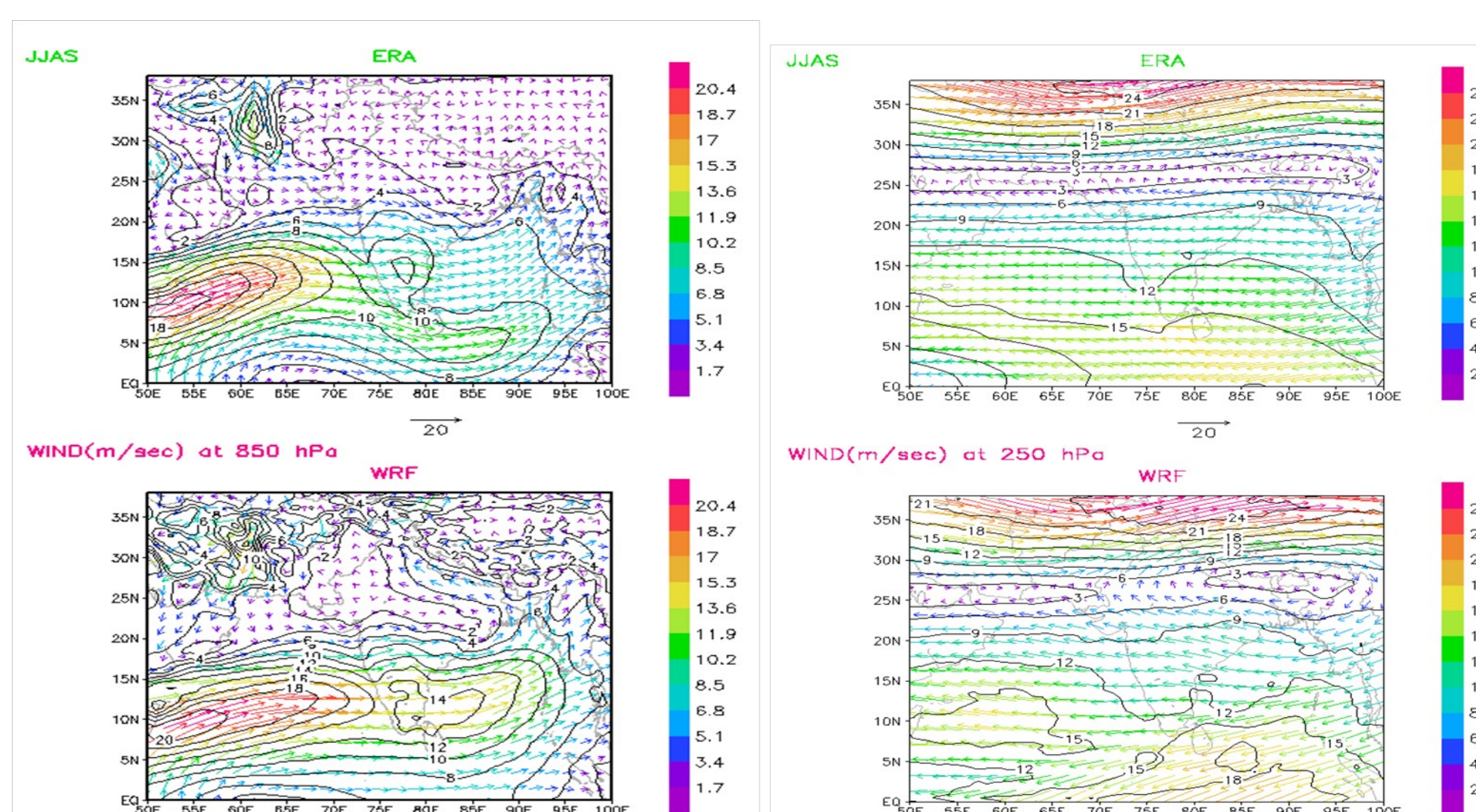
RGT SST

## RESULTS

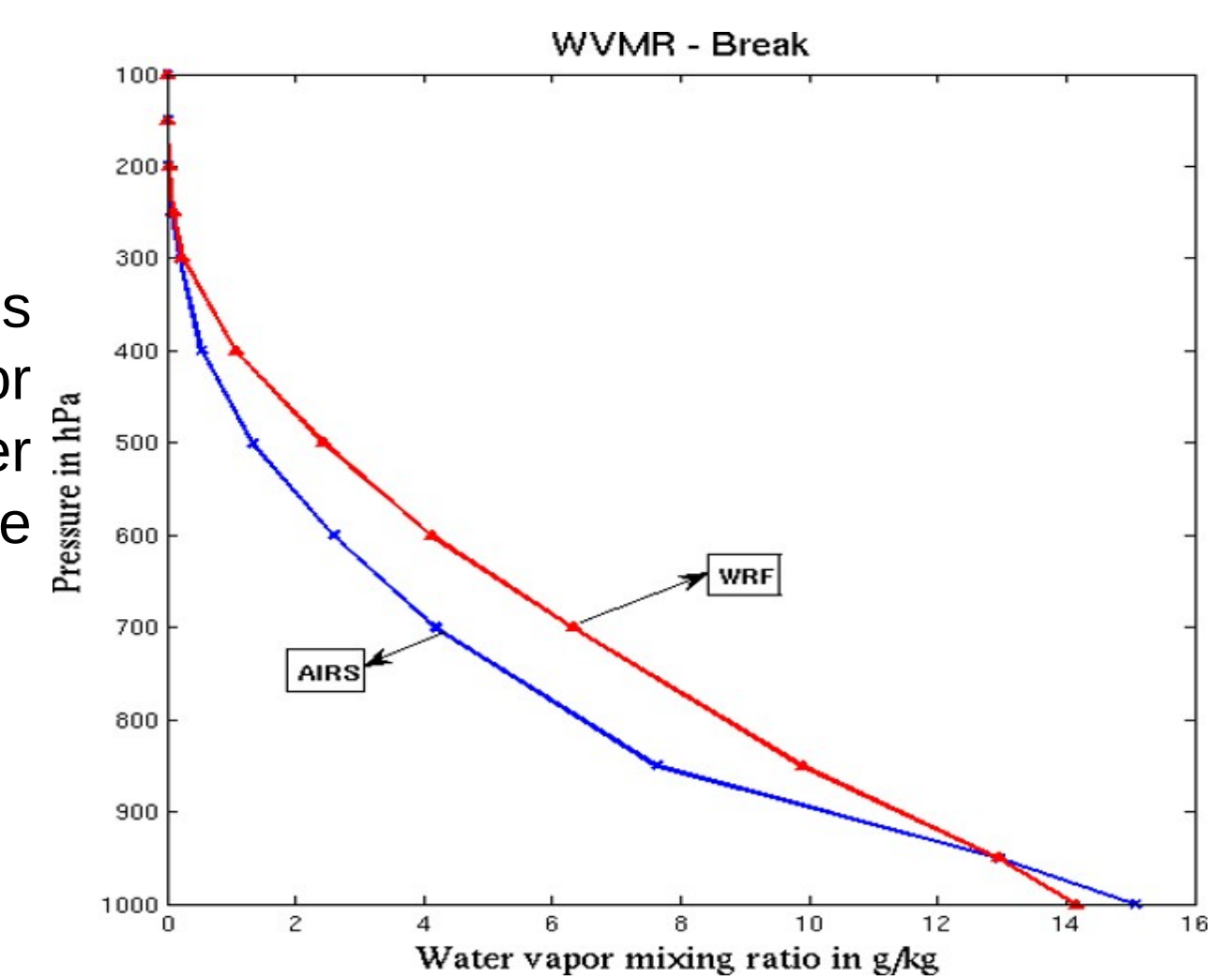
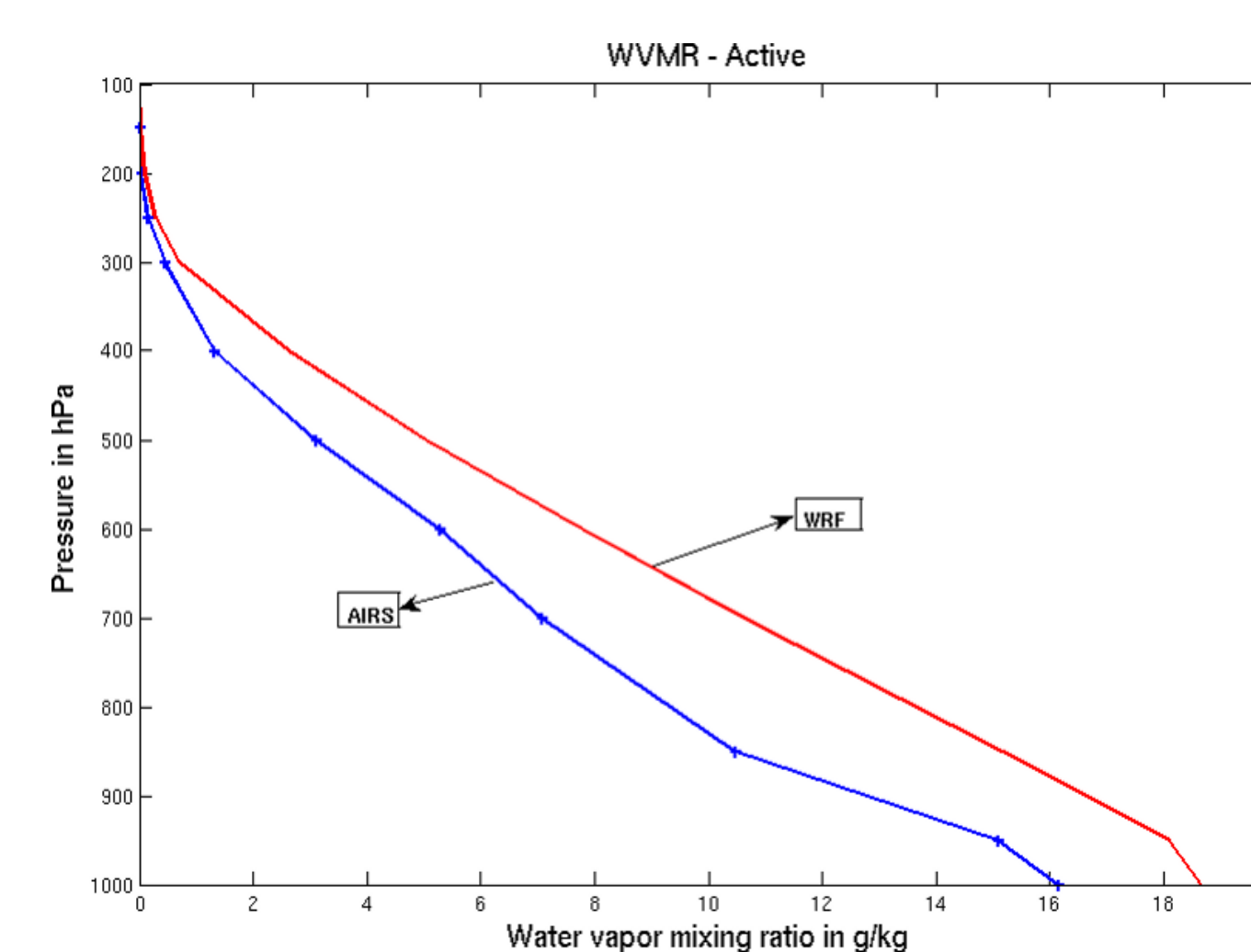
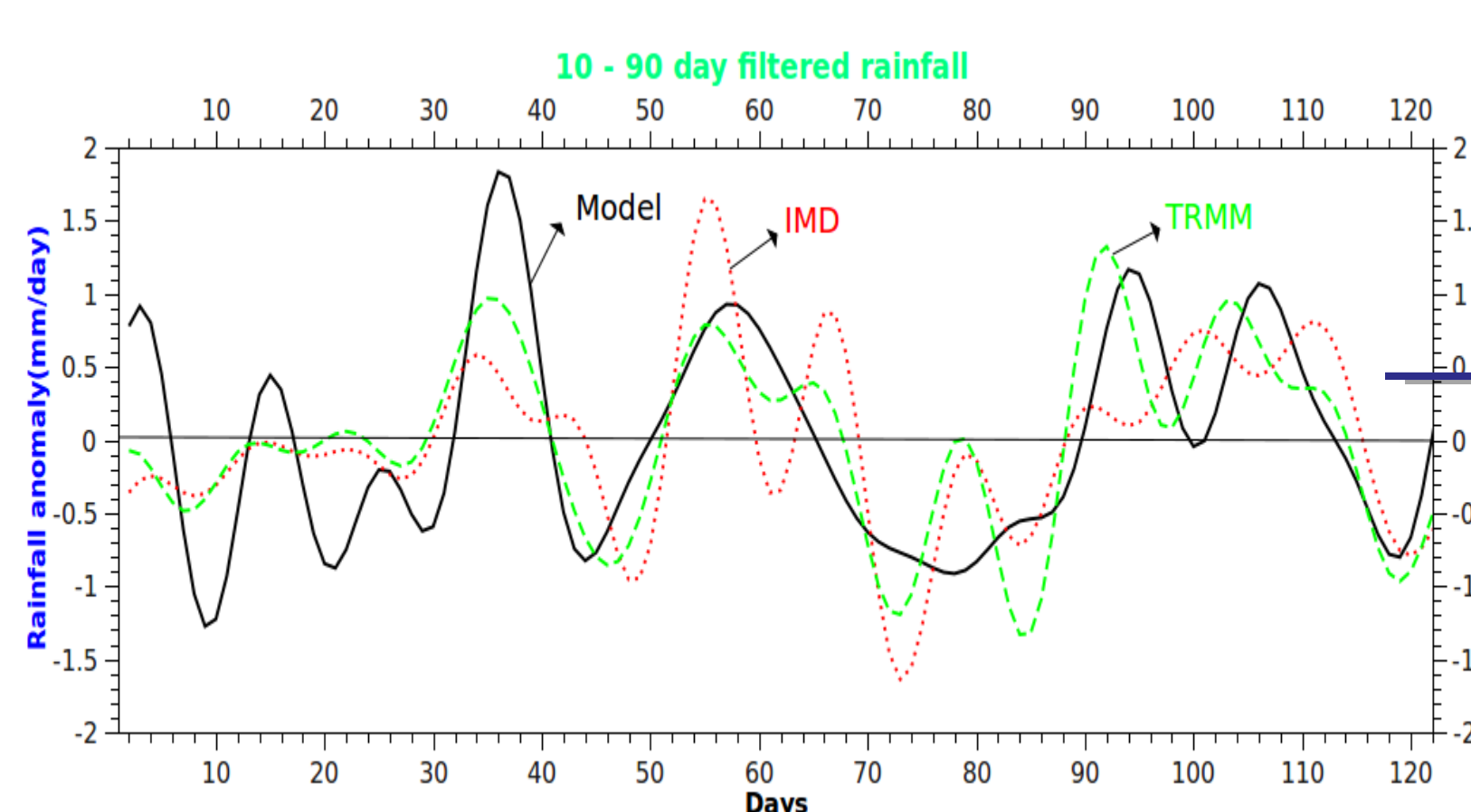
Spatial Distribution of Seasonal Mean (JJAS-2010) Precipitation



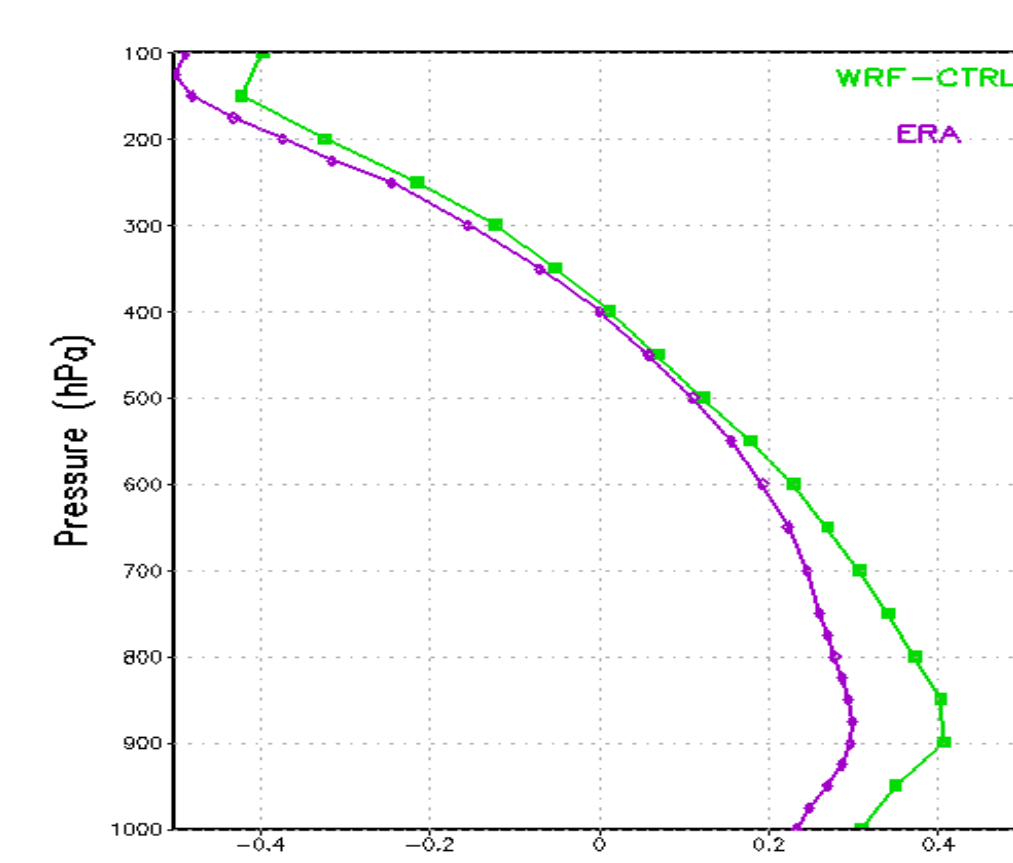
Wind Vectors and Isotachs for JJAS-2010



Area averaged JJAS rainfall time series (filtered) for Central Indian (CI) region (65°E-88° E & 18° N-28° N) for the year 2010.



Vertical profiles of Water vapor mixing ratio over CI during Active & Break



Vertical profile of Vorticity (x10<sup>-4</sup> s<sup>-1</sup>) over CI for JJAS-2010

	IMD	WRF	TRMM
Mean	7.63	7.11	8.13
Standard Deviation	5.07	4.46	4.54
RMSE (Correlation Coefficient)	4.83(0.5)	(IMD-Model)	4.38(0.55) (TRMM-WRF)

Table showing the statistics of rainfall over CI domain (RMSE in mm/day)

## CONCLUSIONS

- Wind circulation and precipitation patterns are simulated by high resolution WRF model.
- Results revealed that model could capture active and break cycles of Indian summer monsoon rainfall reasonably good with observations.
- Vertical structure of water vapour mixing ratio are shown for active and break phases by model and AIRS satellite observations.
- Low level convergence and upper level divergence is revealed by model from vertical profile of vorticity is close to the observations over Central Indian Domain.

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## References

- Goswami BN, Ajayamohan RS (2001) Intra seasonal oscillations and interannual variability of the Indian summer monsoon. *J Clim* 14:1180–1198.
- Mukhopadhyay, P., S. Taraphdar, B. N. Goswami, and K. Krishna Kumar (2010), Indian summer monsoon precipitation climatology in a high resolution regional climate Model: Impact of convective parameterization on systematic biases, *Wea. Forecast.*, 25, 369 – 387S
- Rajeevan, Sulochana Gadgil and Jyoti Bhate (2010) Active and break spells of the Indian summer monsoon *J. Earth Syst. Sci.* 119, No. 3, June 2010, pp. 229–247.

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