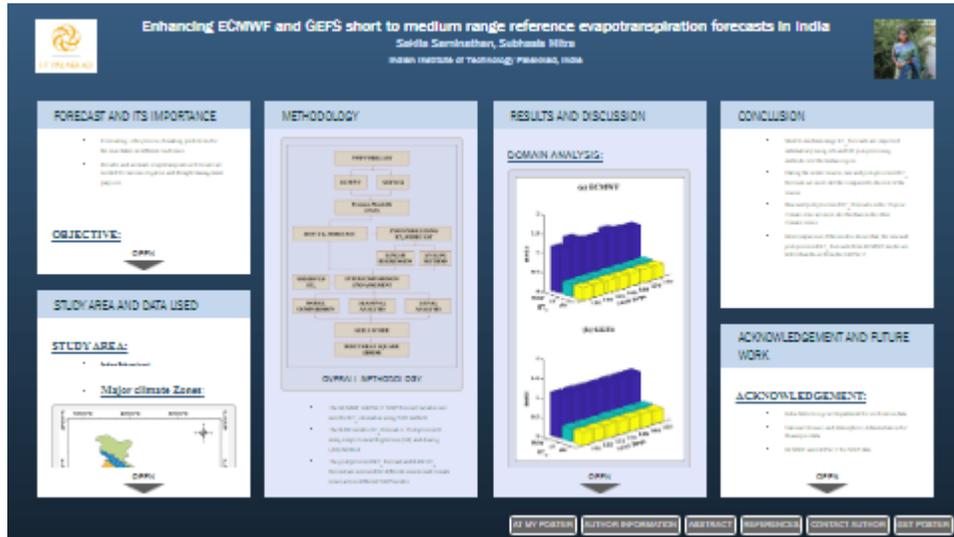


# Enhancing ECMWF and GEFS short to medium range reference evapotranspiration forecasts in India



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PRESENTED AT:



## FORECAST AND ITS IMPORTANCE

- Forecasting is the process of making predictions for the near future at different lead times.
- Reliable and accurate evapotranspiration forecasts are needed for various irrigation and drought management purposes.

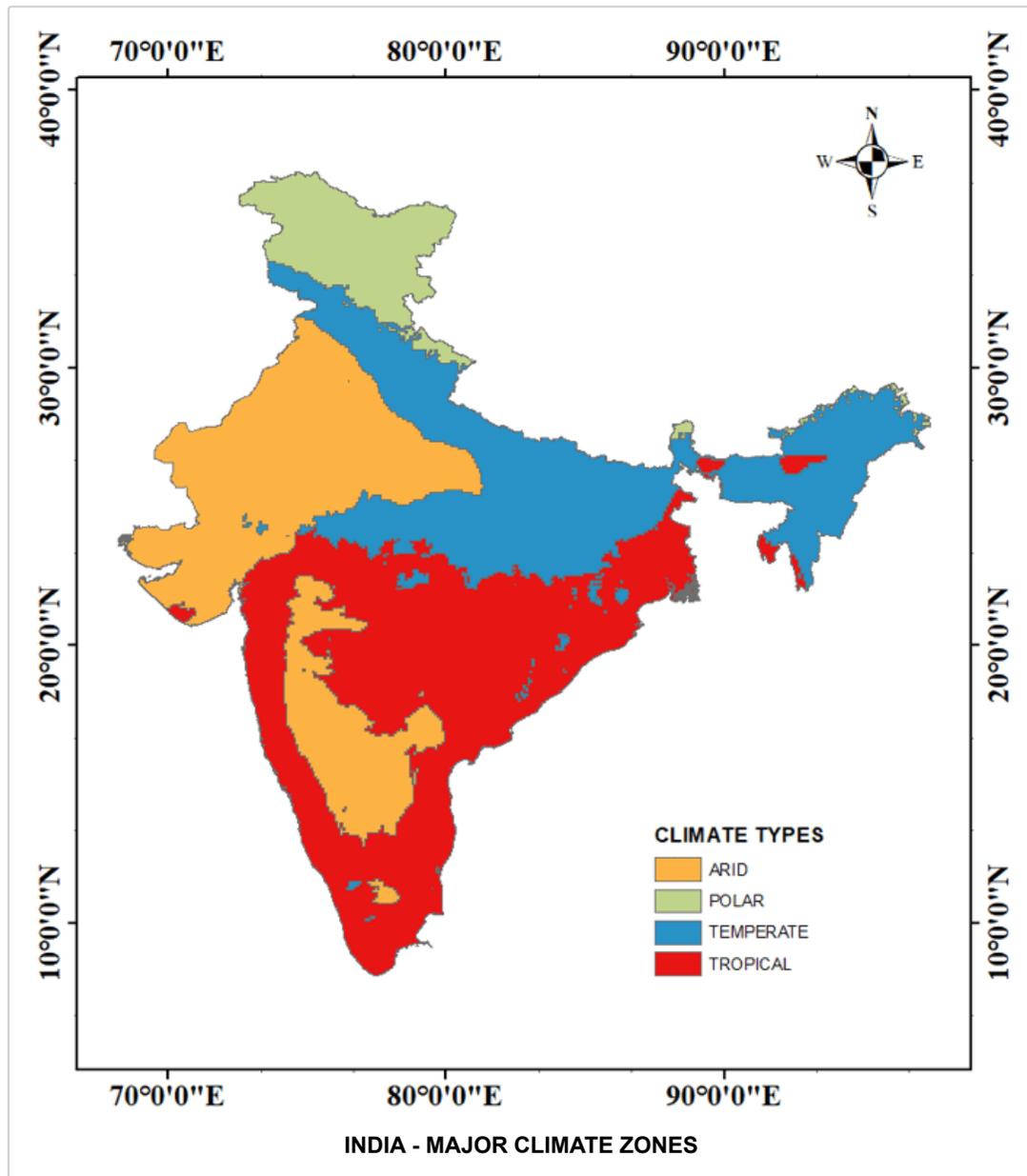
### **OBJECTIVE:**

- To compare the skill of reference evapotranspiration ( $ET_0$ ) forecast from multiple models .
- To evaluate the skill of  $ET_0$  forecast for different seasons and basins.

## STUDY AREA AND DATA USED

### STUDY AREA:

- **Indian Subcontinent**
- Major climate Zones:



<b>CLIMATE TYPE</b>	<b>CODE</b>
ARID	Z 1
POLAR	Z 2
TROPICAL	Z 3
TEMPERATE	Z 4

**MAJOR CLIMATE TYPES**

- **Seasons:**

<b>SEASON</b>	<b>CODE</b>
WINTER	S1
SUMMER	S 2
MONSOON	S 3
POST MONSOON	S 4

**MAJOR SEASONS**

**DATA USED:**

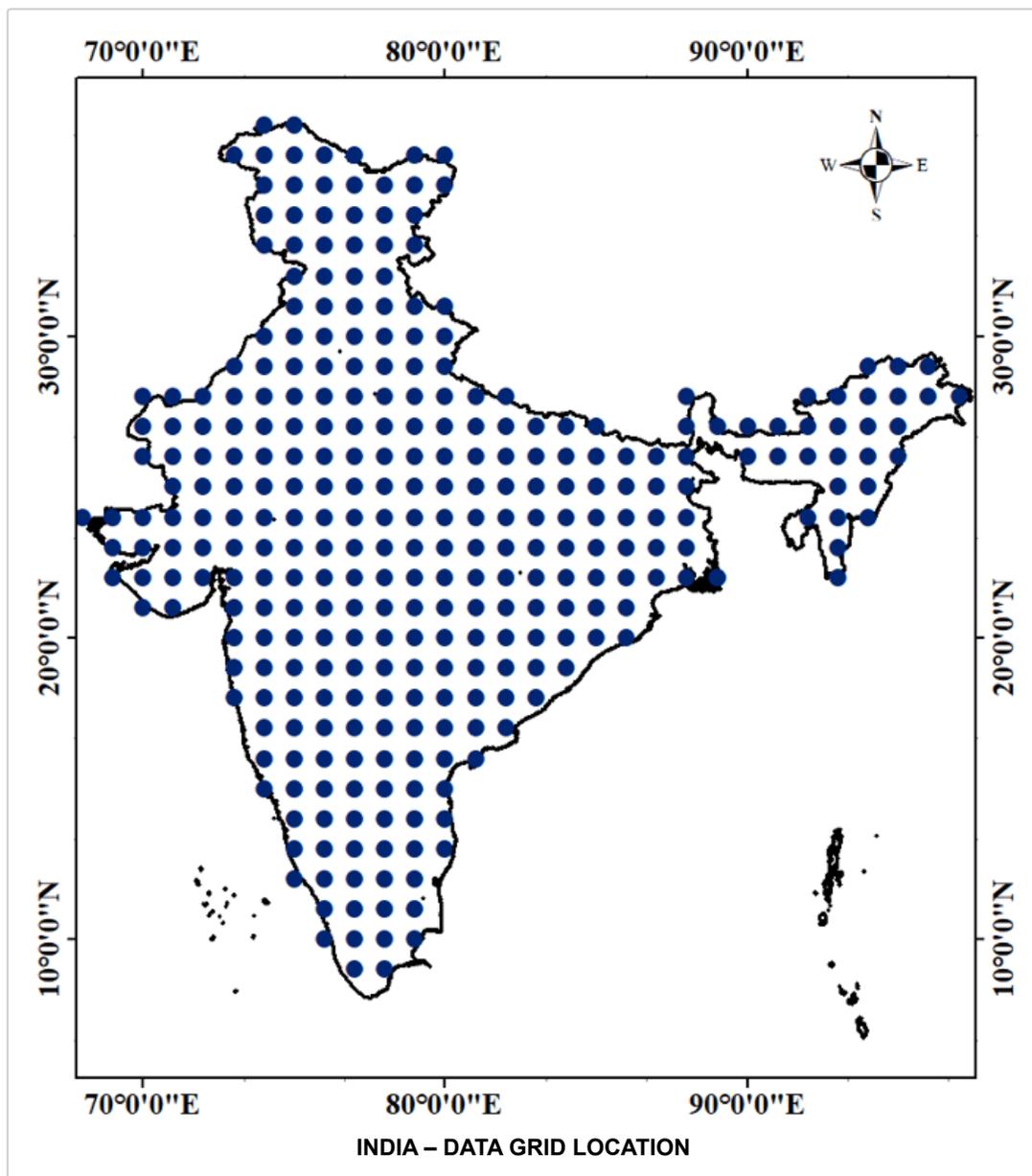
**Forecast Data:**

- European Centre for Medium Range Weather Forecasts [ECMWF]

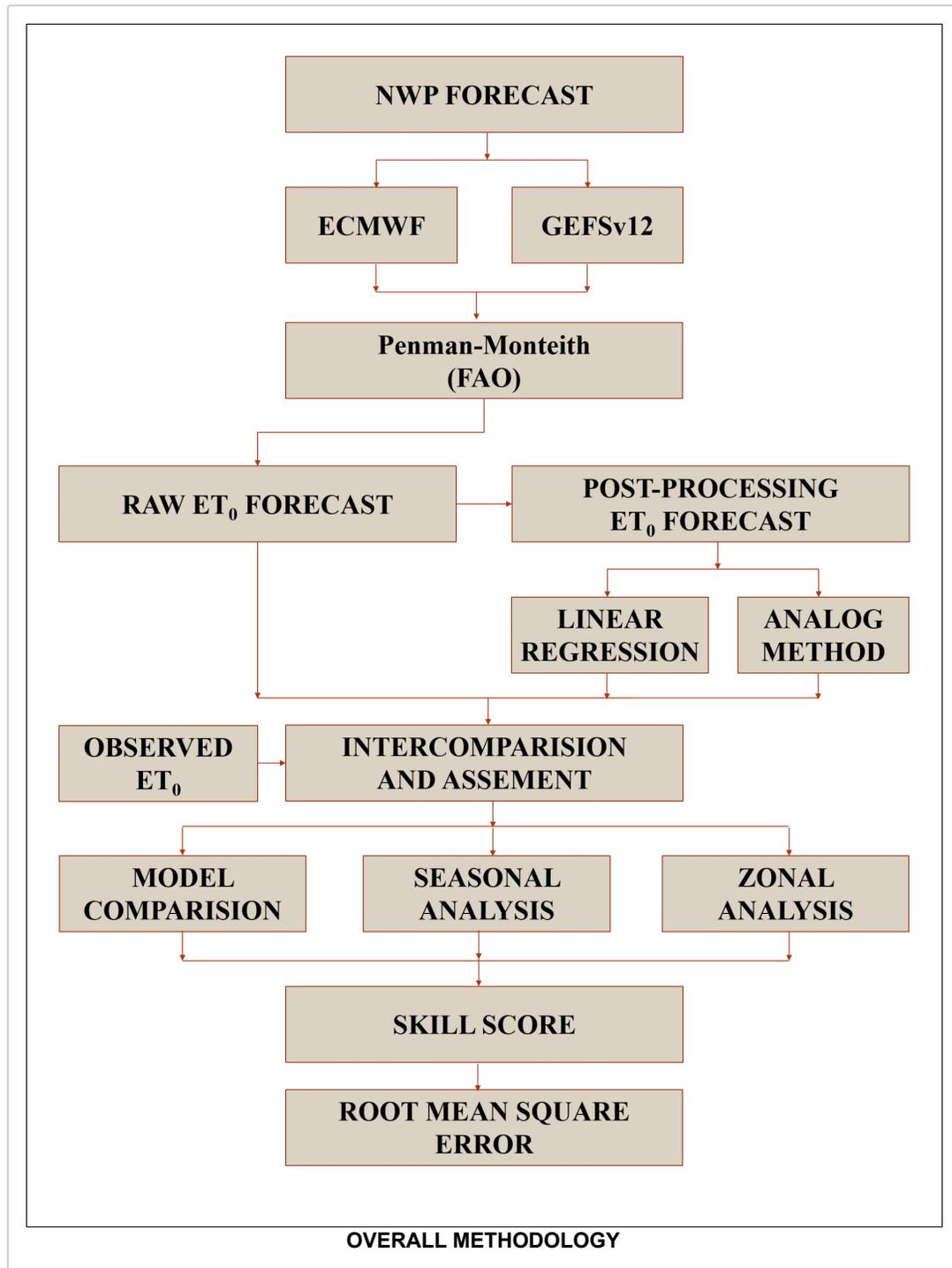
- Global Ensemble Forecast System [GEFSv12]

**Observed Data:**

- India Meteorological Department [IMD]
  - National Oceanic and Atmospheric Administration [NOAA]
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- Spatial Resolution:  $1^\circ \times 1^\circ$
  - Temporal Resolution: Daily.
  - Lead Days: One to Seven.



## METHODOLOGY



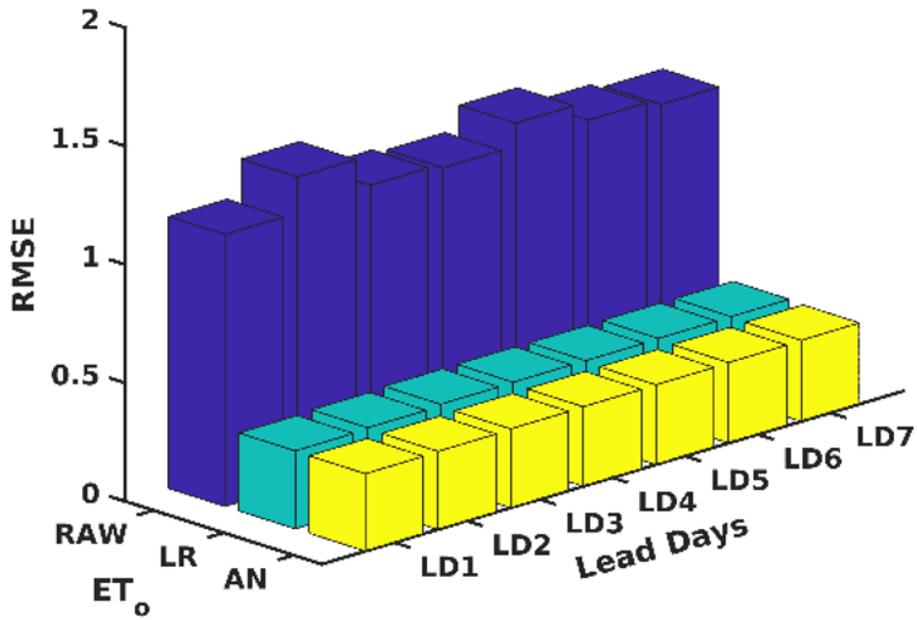
- The ECMWF, GEFSv12 NWP forecast variables are used for ET<sub>0</sub> estimation using FAO method.
- The RAW models ET<sub>0</sub> forecast is Post-processed using simple Linear Regression (LR) and Analog (AN) Method.
- The post-processed ET<sub>0</sub> forecast and RAW ET<sub>0</sub> forecast are assessed for different seasons

and climate zones across different NWP models.

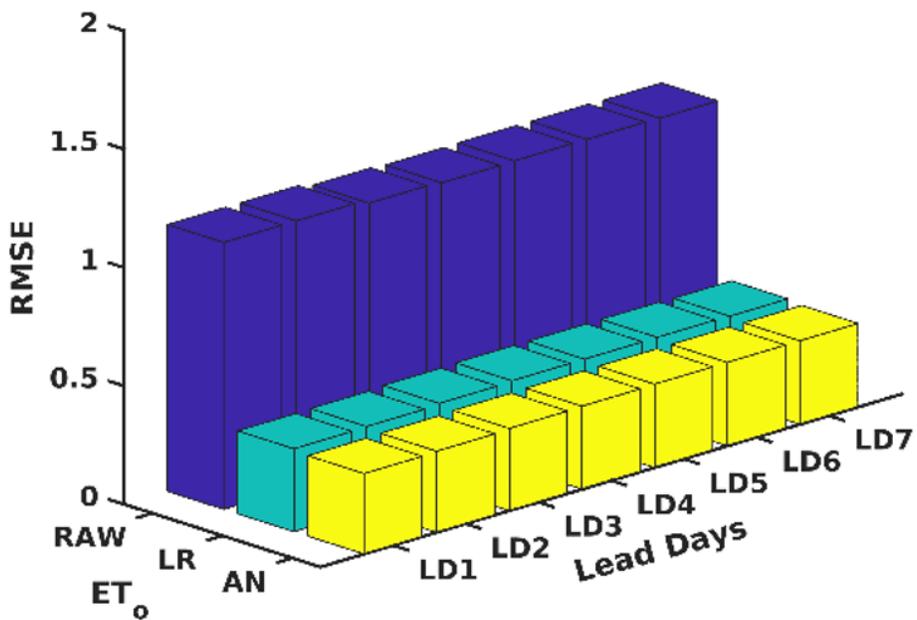
## RESULTS AND DISCUSSION

### **DOMAIN ANALYSIS:**

**(a) ECMWF**

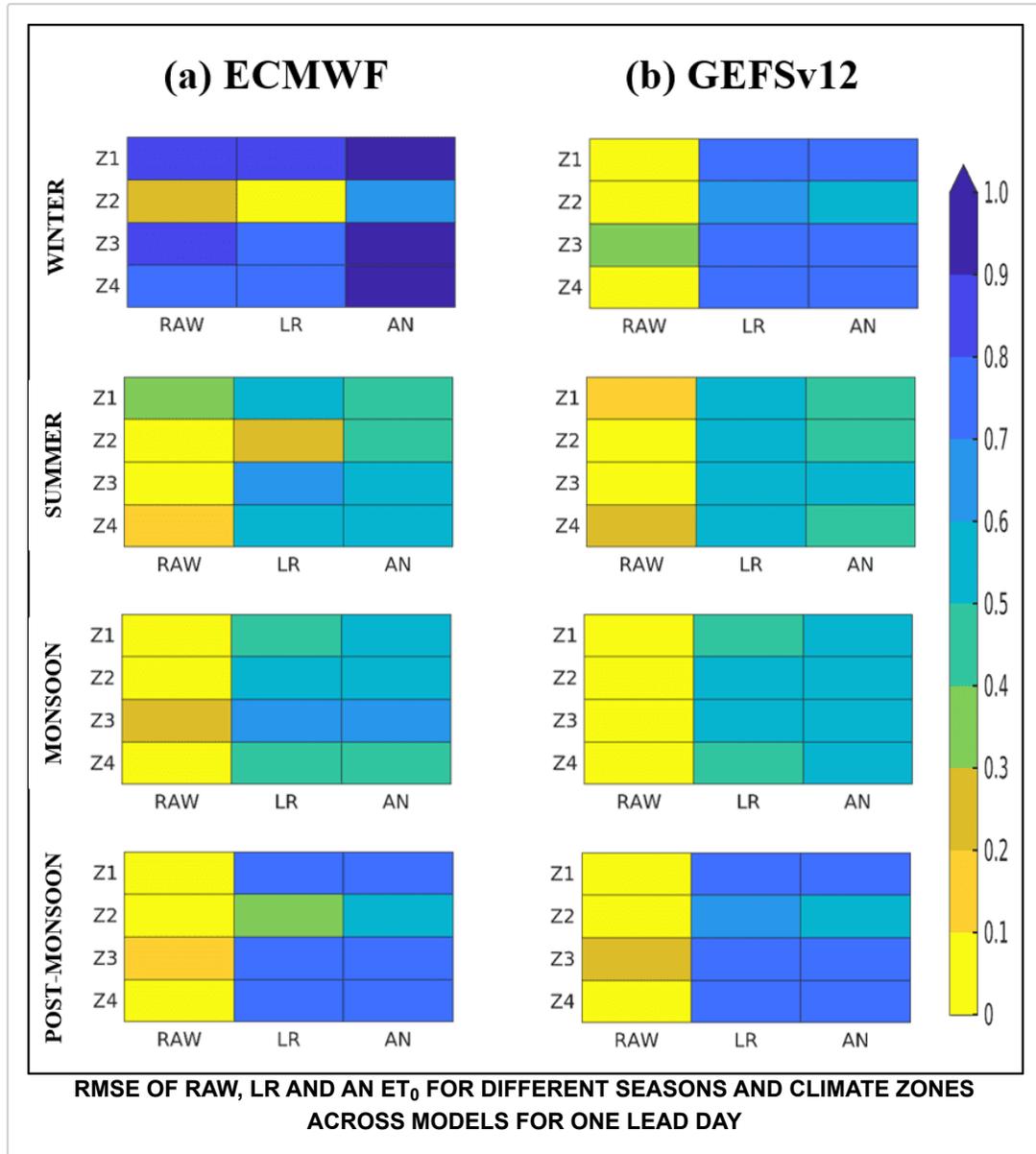


**(b) GEFS**



RMSE OF RAW, LR AND AN ET<sub>0</sub> ACROSS ALL THE LEAD DAYS FOR DIFFERENT MODELS

**SEASONAL AND ZONAL ANALYSIS:**



## CONCLUSION

- Short to medium range  $ET_0$  forecasts are improved substantially using AN and LR post-processing methods over the Indian region.
- During the winter season, raw and post-processed  $ET_0$  forecasts are more skillful compared to the rest of the season.
- Raw and post-processed  $ET_0$  forecasts in the Tropical climate zone are more skillful than in the other climatic zones.
- Intercomparison of the models shows that, the raw and post-processed  $ET_0$  forecasts from ECMWF model are better than those from the GEFSv12.

## ACKNOWLEDGEMENT AND FUTURE WORK

### ACKNOWLEDGEMENT:

- India Meteorological Department for verification data.
- National Oceanic and Atmospheric Administration for Reanalysis data.
- ECMWF and GEFSv12 for NWP data.

### FUTURE WORK:

- Forcing  $ET_0$  ensembles into a Hydrological model for forecasting Streamflow.
  - Post-processing of  $ET_0$  forecast using probabilistic techniques.
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## ABSTRACT

The study aims to enhance the accuracy of the European Centre for Medium-Range Weather Forecasts (ECMWF) and Global Ensemble Forecast System (GEFS) reference evapotranspiration forecast at short to medium range (1-7 days) using the post-processing methods: Analog technique (AN) and Simple Linear Regression (LR) over the Indian subcontinent. The FAO, Penman-Monteith (PM) equation, is used for the estimation of reference evapotranspiration ( $ET_0$ ) reforecasts from meteorological reforecasts from ECMWF and GEFS models. The post-processing technique AN and LR was applied to the  $ET_0$  reforecasts and compared against the  $ET_0$  estimated using observed and reanalysis dataset. The deterministic evaluation metrics, such as Root Mean Square Error (RMSE) and Correlation Coefficient (R), were used for the performance assessment of raw  $ET_0$  forecast and post-processed  $ET_0$  forecasts. Results showed that short to medium range  $ET_0$  forecasts improved substantially using AN and LR post-processing methods over the Indian region. Assessment across the different climatic zones in India showed that raw and post-processed  $ET_0$  forecasts in the Tropical climate zone are more skillful than in the other climatic zones. A comparison of raw and post-processed  $ET_0$  forecasts across different seasons in India showed that model forecasts are more skillful during the winter season compared to the rest. Intercomparison of the models also show that overall the raw and post-processed  $ET_0$  forecasts from ECMWF are better than GEFS. Results emphasize the use of post-processing methods to enhance the skill of  $ET_0$  forecasts over the Indian subcontinent before their application in irrigation scheduling and water demand estimation purposes.

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