This presentation participates in OSPP

Outstanding Student & PhD candidate Presentation contest

EGU General Assembly 2022

EGU22-220

INTERMODEL COMPARISON OF SHORT TO MEDIUM RANGE PRECIPITATION FORECAST OVER THE INDIAN SUB-CONTINENT

Authored by:

IIT PALAKKAD

Sakila Saminathan (101814002@smail.iitpkd.ac.in)

Subhasis Mitra

INTRODUCTION

- Numerical Weather Prediction (NWP) models provides precipitation forecast for the near future.

- Need for Precipitation forecast:

PRECIPITATION FORECAST

- FREQUENCY
- DURATION
- INTENSITY

WATER DEMAND

IRRIGATION SCHEDULING

DROUGHT MANAGEMET

RESERVOIR MANAGEMENT

SOIL MOISTURE

STREAM FLOW

RESEARCH QUESTION

- WHY NWP INTERMODEL COMPARISION ??
  - ❑Precipitation forecast is such a valuable information !!
  - ❑But various Numerical Weather Prediction (NWP) models !!
  - ❑Need for spatio-temporal assessment to find the better performing models !!

- OBJECTIVES
  - ❑To quantify the performance of short to medium range (1 to 7days) NWP models precipitation forecast over the Indian subcontinent.
  - ❑Intercompare precipitation forecast information from four different NWP models.
  - ❑Season and basin wise analysis of precipitation forecast information over the Indian subcontinent.

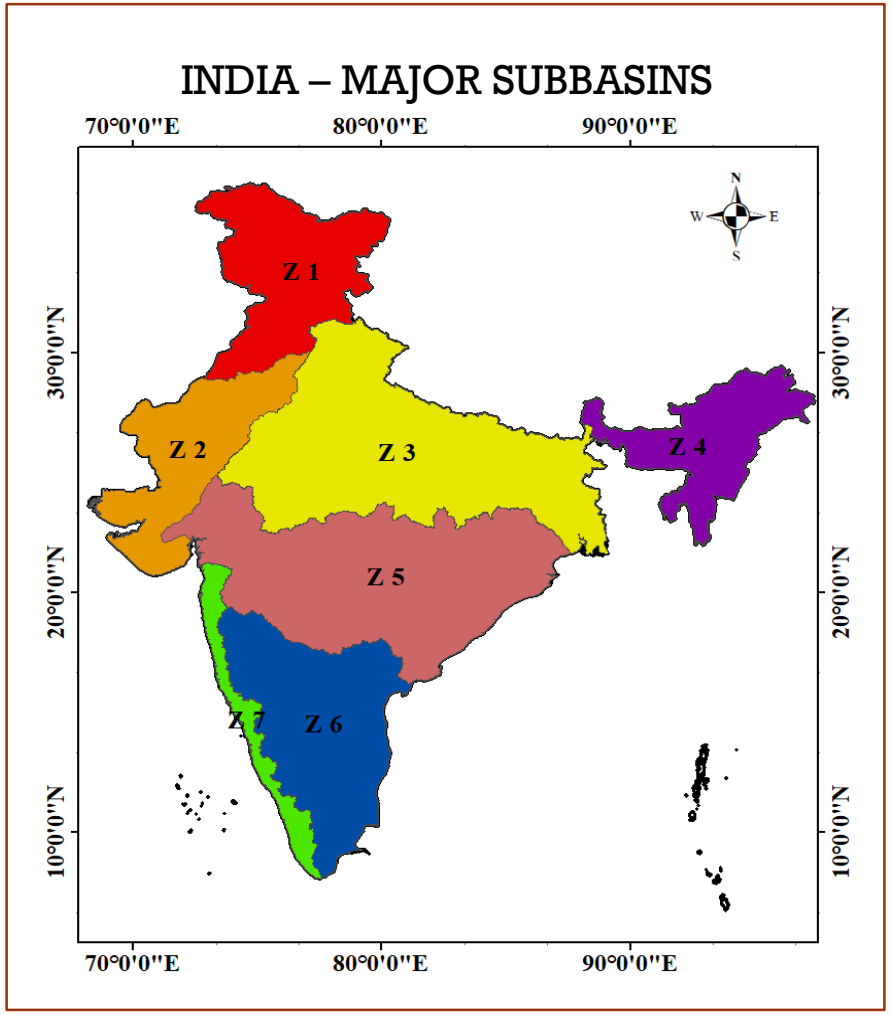
STUDY AREA

- Subbasin: (CWC classification)

Basins	Code
Northern basin	Z 1
Northwestern basin	Z 2
Indo Gangetic plain	Z 3
Northeastern basin	Z 4
Central basin	Z 5
Southern basin	Z 6
Western Ghats	Z 7

- Seasons: (IMD classification)

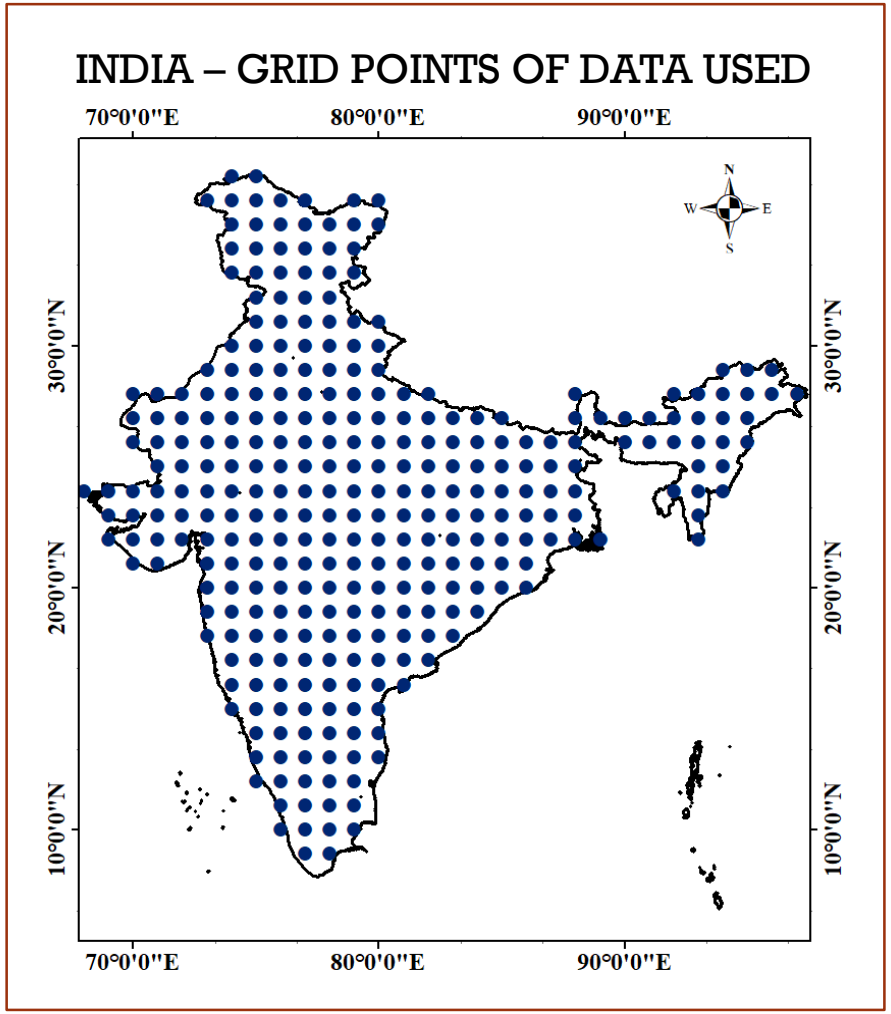
Seasons	Months
Monsoon [S1]	June - September
Non monsoon [S2]	January - May & October –December



DATA USED

Data used in the study	
Verification/ Observation Data	
India Meteorological Department	IMD
Forecast Data	
Climate Forecast System version 2	CFSv2
European Centre for Medium Range Weather Forecasts	ECMWF
Global Ensemble Forecast System	GEFS
Indian Institute of Tropical Meteorology (CFST126, CFST382, GFST126, GFST382)	IITM

- Spatial resolution: 1° × 1°; Temporal resolution: 2003 - 2018;
- Lead days: 1 to 7 lead days (short to medium range)



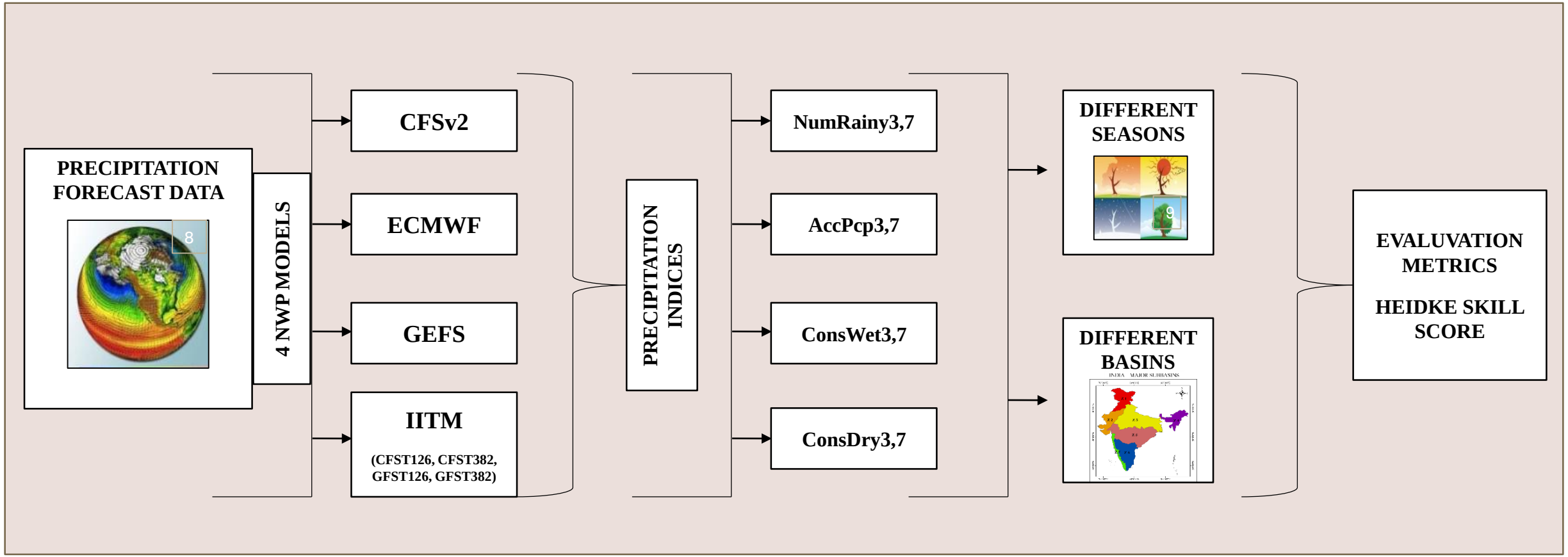
PRECIPITATION INDEX

- Indices used to assess the models:

Precipitation Index	Description of Index	Abbreviation used
Number of Rainy Days	number of days Pcp > 1mm in three lead days	NumRainy3
	number of days Pcp > 1mm in seven lead days	NumRainy7
Accumulated Precipitation	accumulated Pcp for three leads > 1mm	AccPcp3
	accumulated Pcp for seven leads > 1mm	AccPcp7
Consecutive Wet Days	Pcp > 1mm for consecutive three days	ConsWet3
	Pcp > 1mm for consecutive seven days	ConsWet7
Consecutive Dry Days	Pcp < 1mm for consecutive three days	ConsDry3
	Pcp < 1mm for consecutive seven days	ConsDry7

- Evaluation Metrics: "Heidke Skill Score (HSS)"
  - Range: - ∞ to 1; Perfect Score : 1

EXPERIMENTAL SETUP

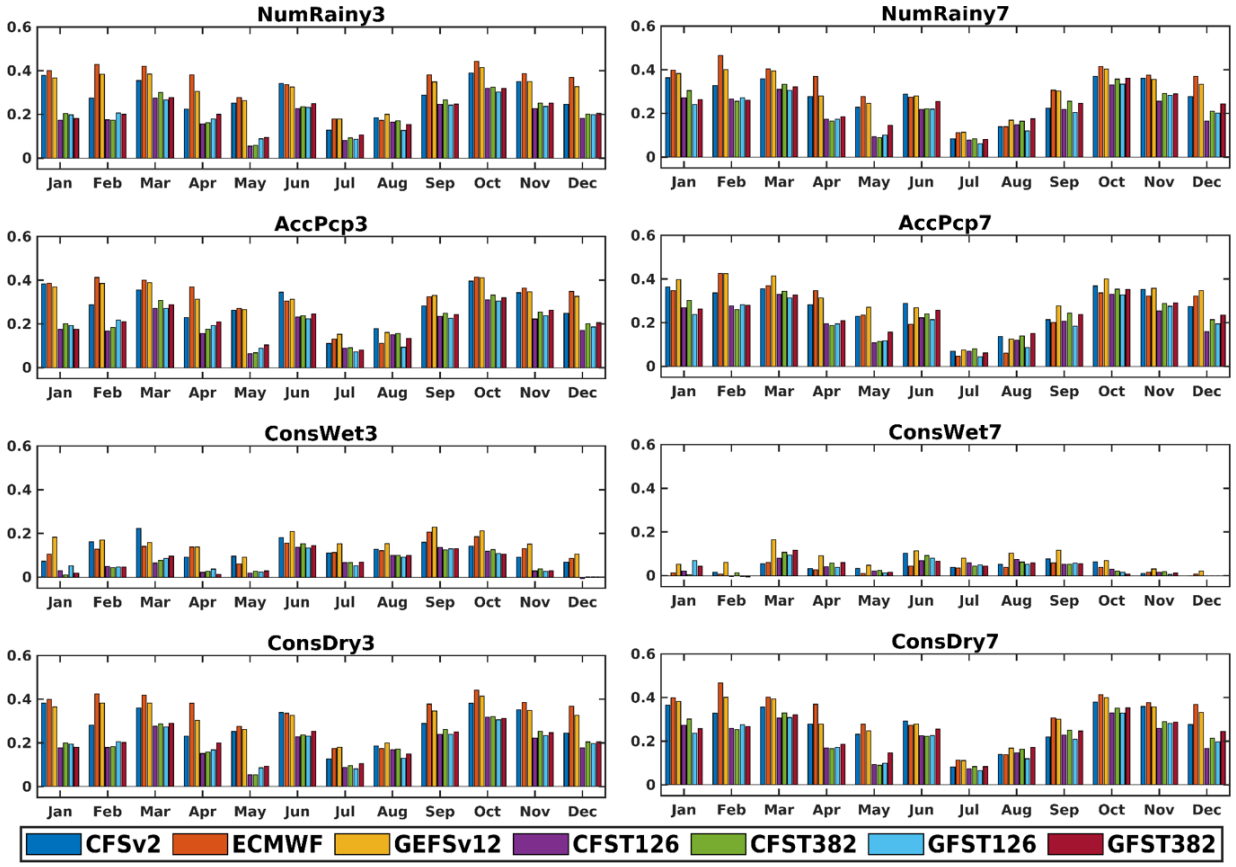


RESULTS

Models - monthly analysis:

- The GEFSv12, CFSv2, ECMWF forecasts precipitation correctly.
- Satisfactory performance of models for number of rainy days and accumulated precipitation .
- Model's performance good for consecutive dry days than wet days.

Domain averaged Monthly HSS skill score over the Indian region for different precipitation indices and models.

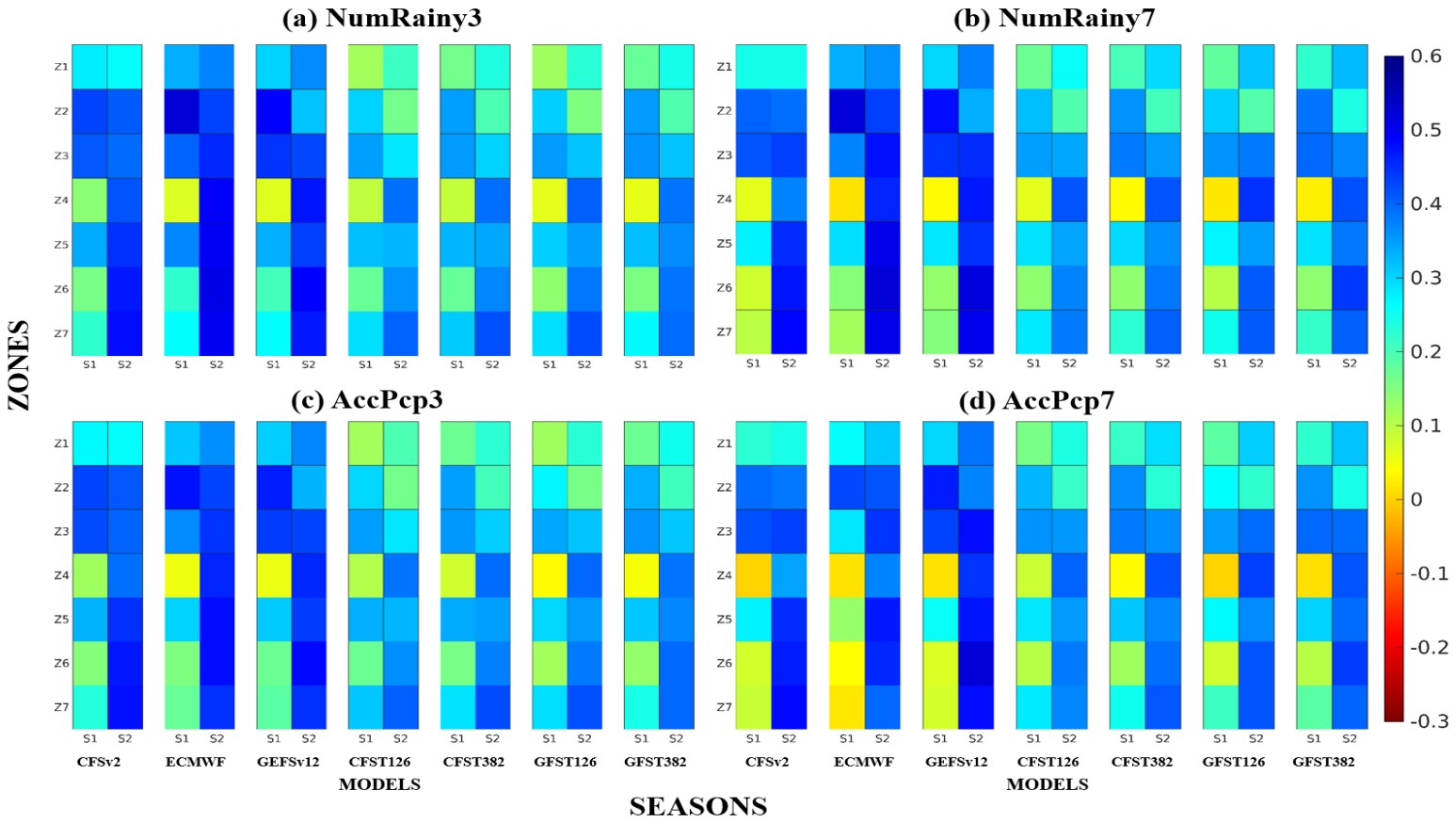


RESULTS

Models -seasonal & basin analysis:

- Models showed better a performance in the non-monsoon season than monsoon.

HSS skill score of different precipitation indices ,
for different models, seasons (S1 – monsoon, S2 – non-monsoon) and subbasins

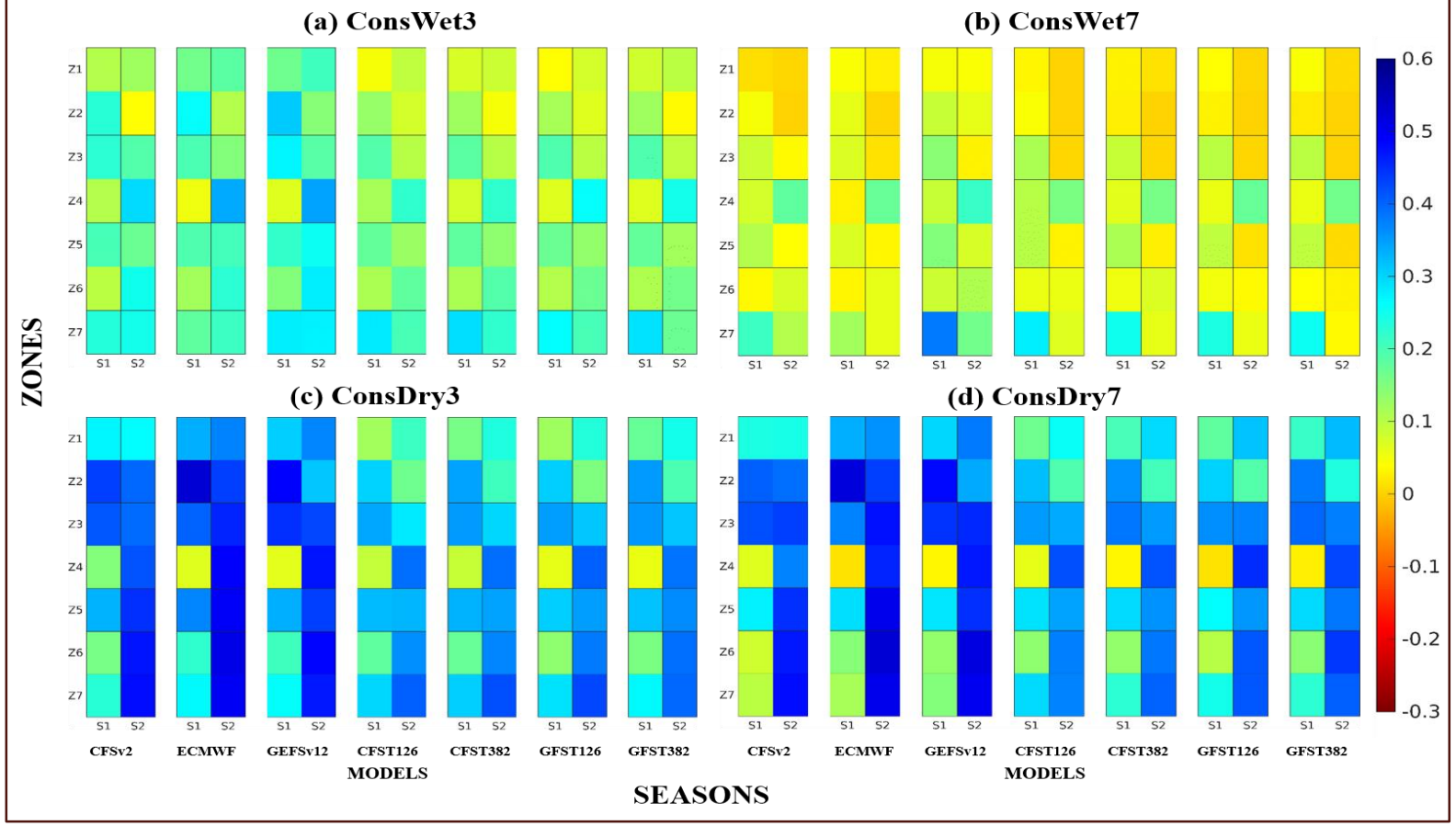


RESULTS

Models -seasonal & basin analysis:

- Models performance good for consecutive dry days than wet days.
- Models showed better a performance in the non-monsoon season than monsoon.

HSS skill score of different precipitation indices ,
for different models, seasons (S1 – monsoon, S2 – non-monsoon) and subbasins

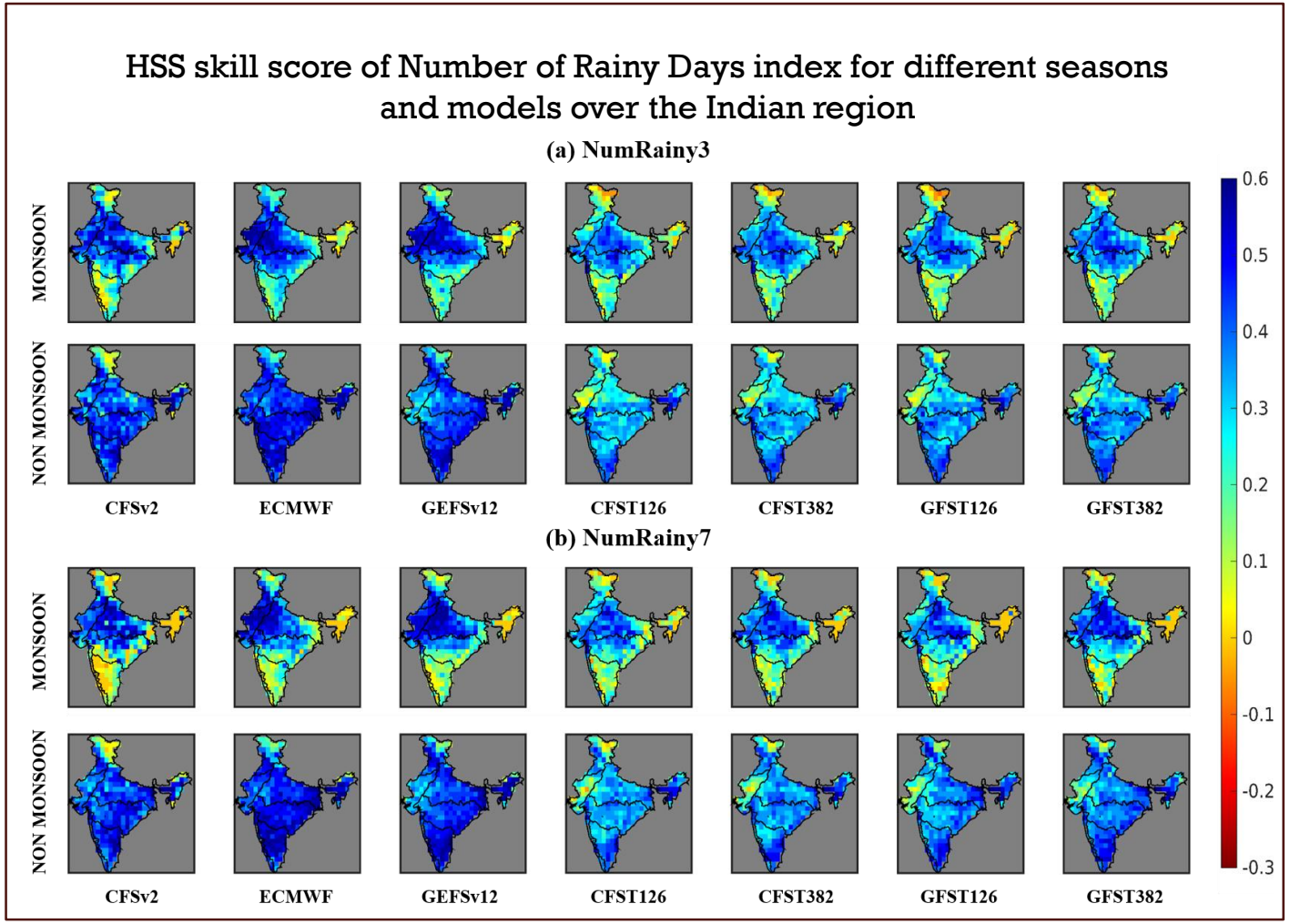


RESULTS

Models spatial representation

- season and basin analysis:

➢The evaluation of models and indices spatially over different basins in India showed that the performance was good in the central region (i.e., Narmada and Tapti basin).



CONCLUSION

- The GEFSv12, CFSv2, ECMWF forecasts precipitation correctly in comparison to IITM datasets.
- No significant changes in forecast seen for different model and versions of IITM dataset.
- The assessment of models and indices for monsoon and non-monsoon season showed better performance in the non-monsoon season.
- The evaluation of models and indices spatially over different basins in India showed that the performance was good in the central region (i.e., Narmada and Tapti basin).
- Models performance was good for the consecutive dry days than consecutive wet days.
- Models are able to capture the number of rainy days and accumulated precipitation satisfactorily.

REFERENCES

- Sillmann, J., Kharin, V.V., Zwiers, F.W., Zhang, X., Bronaugh, D., 2013b. Climate extremes indices in the CMIP5 multimodel ensemble: Part 2. Future climate projections: CMIP5 PROJECTIONS OF EXTREMES INDICES. Journal of Geophysical Research: Atmospheres 118, 2473–2493. https://doi.org/10.1002/jgrd.50188
- Tian, D., Wood, E.F., Yuan, X., 2017. CFSv2-based sub-seasonal precipitation and temperature forecast skill over the contiguous United States. Hydrology and Earth System Sciences 21, 1477–1490. https://doi.org/10.5194/hess-21-1477-2017
- Zhang, X., Alexander, L., Hegerl, G.C., Jones, P., Tank, A.K., Peterson, T.C., Trewin, B., Zwiers, F.W., 2011. Indices for monitoring changes in extremes based on daily temperature and precipitation data. WIREs Clim Change 2, 851–870. https://doi.org/10.1002/wcc.147

ACKNOWLEDGEMENT

DATA PROVIDERS:

- INDIAN INSTITUTE OF TROPICAL METEROLOGY (IITM)

  (Dr. ATUL KUMAR SAHAI, Mr. RAJU MANDAL)
- INDIA METEOROLOGICAL DEPARTMENT (IMD)
- NOAA
- ECMWF

SOURCE:

1. https://www.relexsolutions.com/resources/measuring-forecast-accuracy/
2. https://steemit.com/watersupply/@samsonike/water-supply-and-its-types
3. https://www.shutterstock.com/search/agriculture
4. https://www.feednavigator.com/Article/2018/06/01/Drought-leads-Argentina-to-buy-US-soybeans
5. https://www.water-technology.net/features/feature-ten-largest-dams-in-the-world-reservoirs/
6. https://www.drought.gov/drought/news/new-soil-moisture-research-results
7. https://pixels.com/featured/flowing-stream-in-vermont-randall-nyhof.html
8. https://blogs.egu.eu/divisions/cl/author/davenport/
9. https://www.ecmwf.int/en/about/media-centre/focus/2017/fact-sheet-ensemble-weather-forecasting

This presentation participates in OSPP

Outstanding Student & PhD candidate Presentation contest

THANK YOU ALL