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ASSESSMENT OF RAINFALL FORECAST ACCURACY FOR VIZIANAGARAM DISTRICT OF NORTH COASTAL ANDHRA PRADESH

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ABSTRACT

The rainfall forecast and validation are important because of the socio-economic implications for the nation. An attempt was made to confirm the correctness and dependability of the spatial rainfall forecast of Vizianagaram district of North Coastal Andhra Pradesh during the year 2024 - 2025.The rainfall forecast provided by IMD, Pune for Vizianagaram districtwas verified with daily observed weather data obtained from the Chief Planning Office,by calculating a variety of categorical statistical measures from the elements of the contingency table on seasonal basis. Statistics were presented for Percentage correct (PC),Probability of Detection(POD), Critical Success Index (CSI), Heidke Skill Score (HSS) and Hansen Kuipers score(HKS) of the district wise forecast.Overall, rainfall accuracy was found to be successful, with moderate to high performance. The positive HSS and HKS indicated the reliability of forecast at satisfactory level.

Key words: Forecast,Rainfall, Verification, Vizianagaram

INTRODUCTION

Rainfall is very crucial for agriculture, impacting crop production directly. Precise prediction of district wise rainfall in medium range time frame for the country like India will greatly benefit the farmers.Because of their socio-economic impact on the country, monsoon forecast and verification are always of great interest.Forecast verification entails assessing the quality, skill, and value of a given forecast.The forecast and a matching observation of an actual event are compared in the prediction verification procedure.Various verification approaches can reveal details about various statistical and physical aspects of the accuracy of the forecast-observations. Sahu *et al.* (2022) used various skill scores for rainfall verification in Bihar. In order to improve forecasting methods and provide value for end users, an attempt has been made to verify the accuracy and dependability of the rainfall forecast of Vizianagaram district.

MATERIAL AND METHODS

The Andhra Pradesh state has different geographical regions and the climate varies in each of these regions. South West Monsoon contributes maximum to the rainfall in the state. Based on soil characteristics, rainfall pattern, cropping systems and other additional ecological straits, Andhra Pradesh iscategorized into six Agro-Climatic zones. In

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Table1. 2 × 2 Contingency table for verification of rainfall forecast based on yes/no forecast

Observed	Forecast	
	YES	NO
YES	A	B
NO	C	D

the present study Vizianagaram district of North Coastal Zone of Andhra Pradesh was chosen.The medium range weather forecast on rainfall for the district was received from India Meteorological Department (IMD), Pune for 365 days for the year 2024-25, which was further value added by Cyclone Warning Centre, Visakhapatnam and confirmed using the daily observed weather data for corresponding days obtained from Chief Planning Office to investigate the verification of rainfallby calculating many categorical statistical skill measures from the components of the contingency table on seasonal basis. They include Percentage Correct (PC), Probability of Detection (POD), Critical Success Index (CSI), Heidke Skill Score (HSS) and Hansen Kuipers score (HKS) to consider the performance of the forecast and were calculated using contingency table for various rainfall thresholds.The detailed procedure of this forecast verification was given in Table 1& 2.

The four count (A, B, C, D) events in the 2 × 2 contingency table that contains the number of hits (A), false alarms (B), misses (C)and correct rejections (D) at different rainfall thresholds are used to assess the performance of rainfall forecast.

For 2 × 2 contingency table, the percent correct was the percent of accurate forecasts. It served as the forecast verification standard score. The percentage of detected “yes” events is indicated by the probability of detection. Although it overlooks false alarms, it is sensitive to hits.Critical success index indicates the degree to which the forecast “yes” events matched the observed “yes” events. It calculates the percentage of forecasted and/or observed events that were accurately predicted. The forecast’s fractional improvement over the standard forecast is measured by the Heidke Skill Score (HSS). Like other skill scores, it is normalized by the entire range of possible improvement over the standard, which means Heidke Skill scores can safely be compared on various datasets. HK score is the measure of forecasting accuracy and is used for verification of quantitative precipitation. Brief findings of these statistical scores are provided by

Table 2. Indices adapted for qualitative evaluation of rainfall forecast accuracy

Error structure indices	Expression	Range
Percent Correct (PC)	(A+D)/(A+B +C+D)	0 (no correct forecast) to +1 (all forecast correct)
Probability of Detection (POD)	A/(A+B)	0 (poor end) to +1 (perfect end)
Critical Success Index (CSI)	A/(A+B+C)	0 (poor end) to +1 (perfect end)
Heidke Skill Score (HSS)	2(ADBC)/[(A+C) (C+D) +(A+B)(B+D)]	HSS=1 (perfect forecast); HSS=0 (no skill) HSS < 0, (worse than reference forecast)
Hansen and Kuipers Scores (HKS)	(AD-BC)/(A+C) (B+D)	-1 (= poor end)to +1 (=perfect end), 0=no skill

Chauhan *et al*. (2008) and Debnath and Das (2017).

RESULTS AND DISCUSSION

Seasonal analysis was focused as there is precise need for improvement of rainfall forecast during major rainy months in North Coastal zone. It was quite clear that percent correct (PC) for the district was extremely high in winter period (0.9). Chakraborty *et al*. (2022) reported accuracy of correct forecasts at maximumduring the winter season followed by the post-monsoon season. POD and CSI were highest during the south west monsoon period followed by North east monsoon period. Joseph *et al*. (2017) noted highest CSI index for Tirunelveli district of Tamil Nadu. Lowest CSI index was noticed during pre-monsoon months and no score in winter.During the North East monsoon period,the HSS score attained an index greater than 0.5, with more skill and reliability, followed by pre-monsoon period. Saha *et al*. (2024) observed remarkably higher forecast skill score during February to May and the highest in April month in Mizoram. The HSS score was not particularly promising during the south west monsoon period. Sarmah *et al.* (2015) conducted a study at AMFU, Sonitpur, Assam and reported similar results of Heidke Skill Score (HSS), which is positive in all three seasons except monsoon where the HSS is zero.

The true skill score (HKS) was remarkably higher during the monsoon period (0.57) indicating a good forecast which is more economical compared to other seasons. Similar findings of higher HK score during monsoon season was observed by Kaur and Singh (2019). Sahu *et al*. (2022) recorded HK scores between 0.6 and 0.7 for all the blocks of Bihar. The overall skill score during the year was moderate to high with good success.More than 50 percent districts of Chhattisgarh state had moderately accurate rainfall forecasts most of days (Rajavel *et al*., 2019).Chattopadhyay *et al*. (2016) observed moderate improvement in skill of predicting rainfall in Telangana state. The results insighted huge scope for future improvement in qualitative regular rainfall

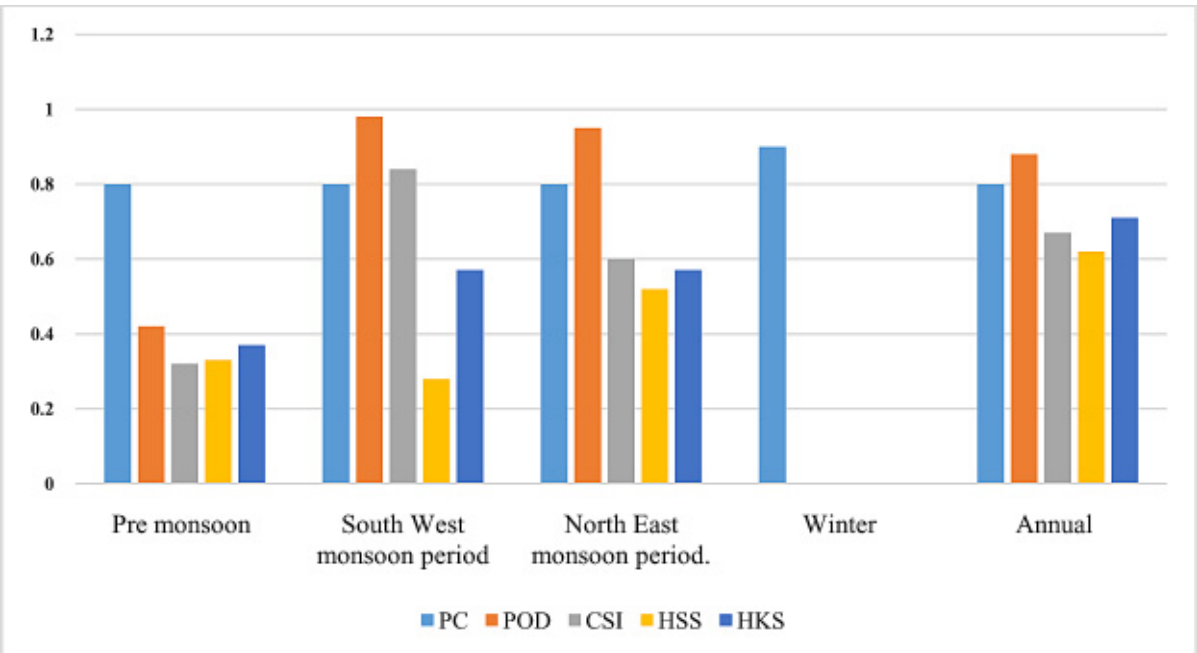

Fig. 1. Qualitative evaluation of Seasonal and Annual Rainfall forecast of Vizianagaram district

forecast skills which inturn increases the actual quality of the agro-advisories issued under Gramin Krishi Mausam Seva (GKMS) scheme in North Coastal Zone of Andhra Pradesh.

CONCLUSION

The analysis shows very good PC, POD and CSI during South west monsoon period followed by North east monsoon period. HSS and HKSshowed moderate score during North east monsoon period followed by South west monsoon period. For the year as a whole,good success was observed for rainfall correctness with moderate to high performance. The reliability of forecast to the satisfactory levelwas indicated by the positive HSS and HKS. Improvement in forecast accuracy and by reducing the number of false alarms and the number of misses undoubtedly benefit Agriculture.

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