



Forecasting of Monsoon Rain for Telangana in the Year of 2025

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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Abstract

Telangana is one of the areas which has mostly deficient rainfall and it results often in crop failure. To give farmers sufficient time to plan for planting crops – here the prediction is made about seven months in advance. Here, the prediction is made based on the average amount obtained by 4 methods. These methods are: The Time Series method, the Root Mean Square (RMS) method, the Fast Fourier Transform (FFT) method, and the Artificial Neural Network (ANN) method.

Keywords: Monsoon rain; root mean square; fast Fourier transform, rainfall.

1 Introduction and Literature Survey

The climate in India and the rest of the world is changing quite rapidly and it has become very unreliable. This causes excessive rain or drought quite frequently [1-4]. India has large area of land which is cultivable but shortage of water is quite common [5-21].

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Besides the farmers and ordinary people - the shortage of water affects the hydropower generation also [22].

Regarding the prediction of rainfall one can also refer to the works of various scientists working in this field [23-30].

The aim of this research is to come up with the forecasting of the coming monsoon's rainfall about seven months in advance so that farmers get sufficient time for planting the crops. The government of India's weather forecasting department called IMD makes forecasts in the beginning of April which is not far away from beginning of monsoon in the month of June. Therefore, this research will help the farmers plan for the purchasing of seeds, renting of the fields, and other needs of growing crops.

2 Methodology

The rain forecasting is made using four methods which are: (1) the Time Series method, (2) the Fast Fourier Transform method (FFT), (3) the Artificial Neural Network method (ANN), and Root Mean Square method (RMS). The details about these methods can be known by going through references [31-35].

In the RMS method the error between various points and the regression line is minimized.

In the Time Series method each of the months of June, July, August, and September are considered as separate seasons. In this case the regression line is selected based on overall minimalization considering all these four months.

In the ANN method at first the input vector consists of rain data for the 32 years starting in the year 1877. The output vector consists of rain data for the 33rd year from 1877. Based on Eq (1) the elements of the weight matrix are determined by numerical optimization.

In the ANN method one has a relationship of the form

$$\{O\} = [W] I \tag{1}$$

where $\{O\}$ and $\{I\}$ are output and input vectors respectively of sizes $m \times 1$ and $n \times 1$ respectively. The size of the weight matrix $[W]$ is $m \times n$.

After this, the input vector elements are increased by 1 and the same is applied for the output vector. This means the starting vector for the input vector will be the rain data for 1878 and other 31 points. The output vector will be 34th element starting from the year 1877. In this way this process is continued until the output vector element consists of the year 2024. In this way the weight matrix is arrived at.

In the FFT method the Fourier coefficients are arrived at using a fast algorithm. After this the Fourier series for the 32 year is determined and its trend is also found out. Using this trend, the function value of the 33rd point becomes the value of the first point plus 32 times the slope of the trend curve.

One can see the location of Telangana in Fig. 1. The summary of the results is shown in Table 1, whereas the details of the results are shown in Figs 2 to 7. Here, the monsoon months are from June to September.

3 Results and Discussion

The summary of calculations is shown in Table 1. In the 1st 4 rows - the numerical values of the results obtained for the month of June to September for various methods - are given. Then, the predicted values are given in the following row. This predicted value is the average of the results of the four-methods month wise. It shows that in the monsoon season which is to come - the rain amount will be 73.5 centimeters. This

table shows that the 32-year average is equal to 61.5 centimeters. Therefore, the total rainfall in the coming monsoon season will be much above the average value of the last 32 years.

Table 1. Rain forecast in centimeters for Telangana during 2025 monsoon months

Method	Year	June	July	August	September	Total	Comments
RMS method	2025	9.7	25.3	16.3	21.3	72.6	
Time series method	2025	22.6	23.2	16.1	13.7	75.6	
Fast Fourier Transform (FFT) method	2025	8.7	26.7	18.0	15.8	69.2	
ANN method	2025	8.2	48.7	11.9	8.1	76.7	
Predicted amount	2025	12.3	31.0	15.6	14.7	73.5	Greater than 32 year average
32 year average		10.0	18.9	18.2	14.7	61.9	

Fig. 1 shows the map of India and the location of Telangana. It shows that the Telangana lies between two mountain ranges which are the Western Ghats and the Eastern Ghata. The pattern of rainfall gets disturbed due to the presence of these two mountain ranges.

Fig. 2 shows the rainfall amounts for various methods. The Time Series method and the RMS method show a linear relationship due to linear regression. Both of these relationships have an increasing trend. The actual rainfall, the ANN method, and the FFT method show fast changing patterns.

The results in Fig. 3 are similar to Fig 2. However, the amount of rain is higher in the month of July as compared to that of June.

Fig. 4 also shows similar results. Fig. 5 shows the amount of rainfall for the month of September and the amount of rainfall is less in September as compared to that of July or August.



Fig. 1. Locations of Marathawada. Vidarbha, Jharkhand and Telangana between western and Eastern Ghats

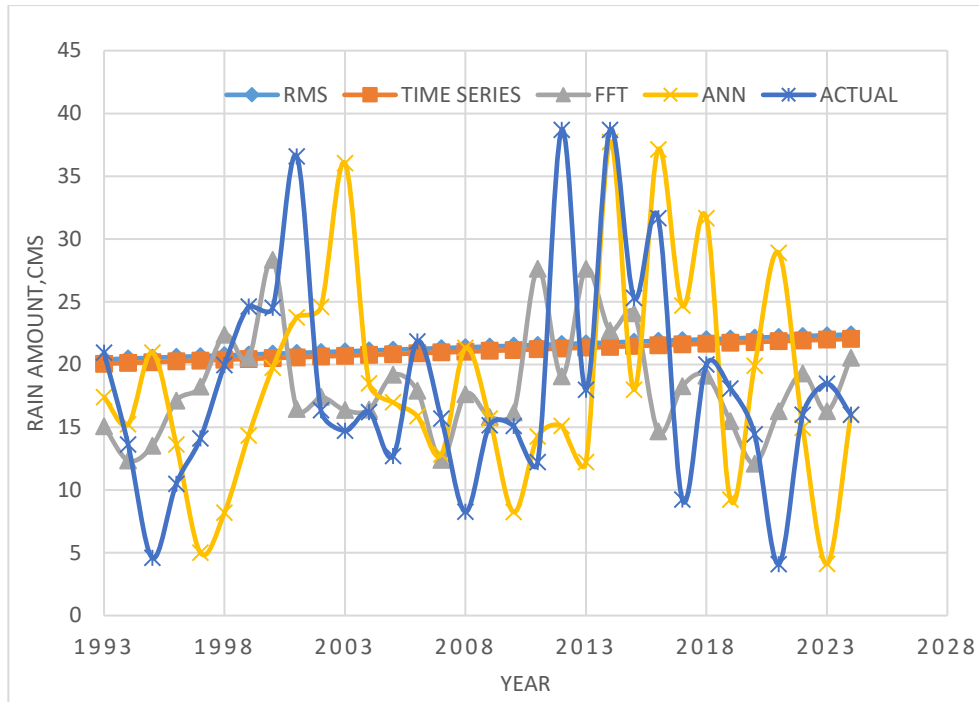


Fig. 2. Rain amount (CMS) in the month of June 2025

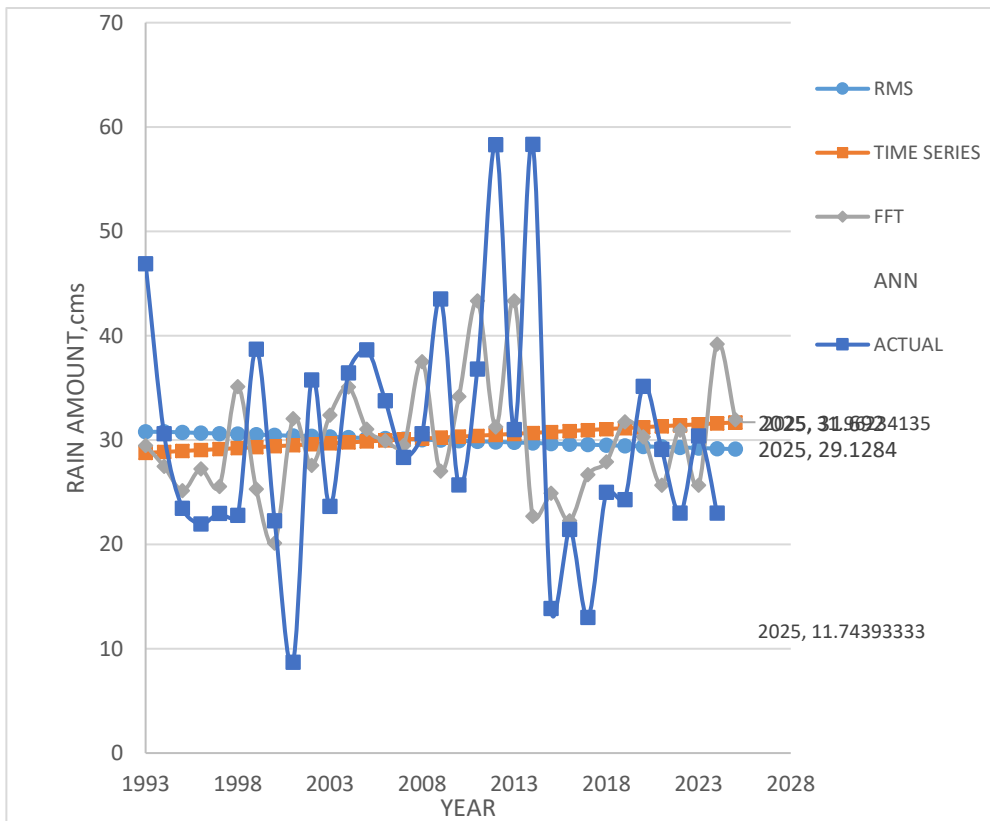


Fig. 3. Rain amount in July in CMS

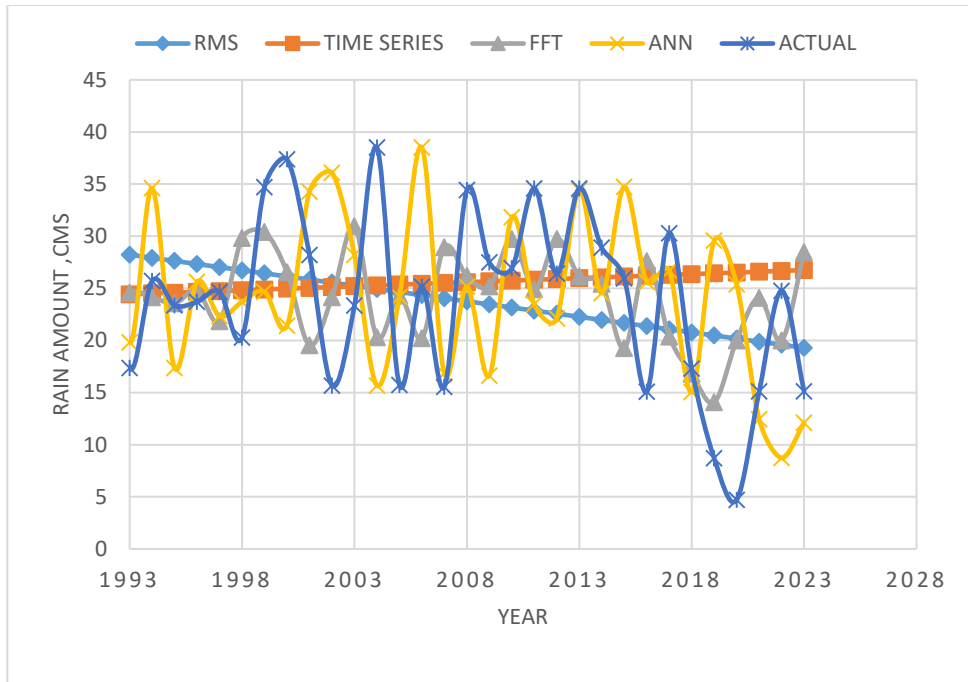


Fig. 4. Rain amount in August 2025

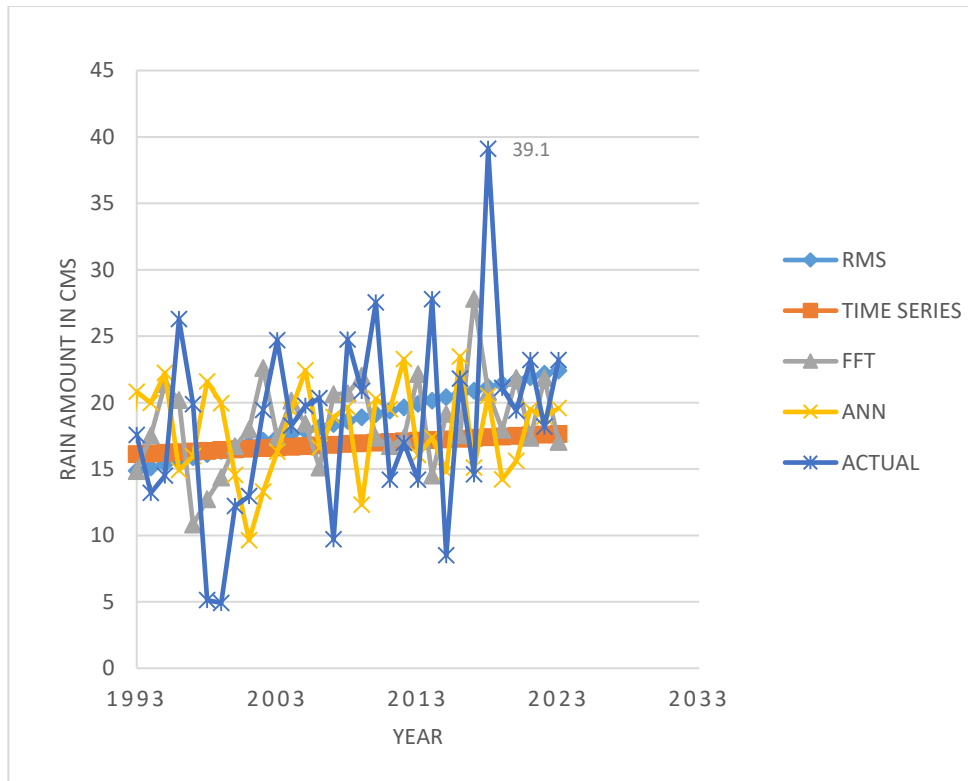


Fig. 5. Rain amount in September 2025

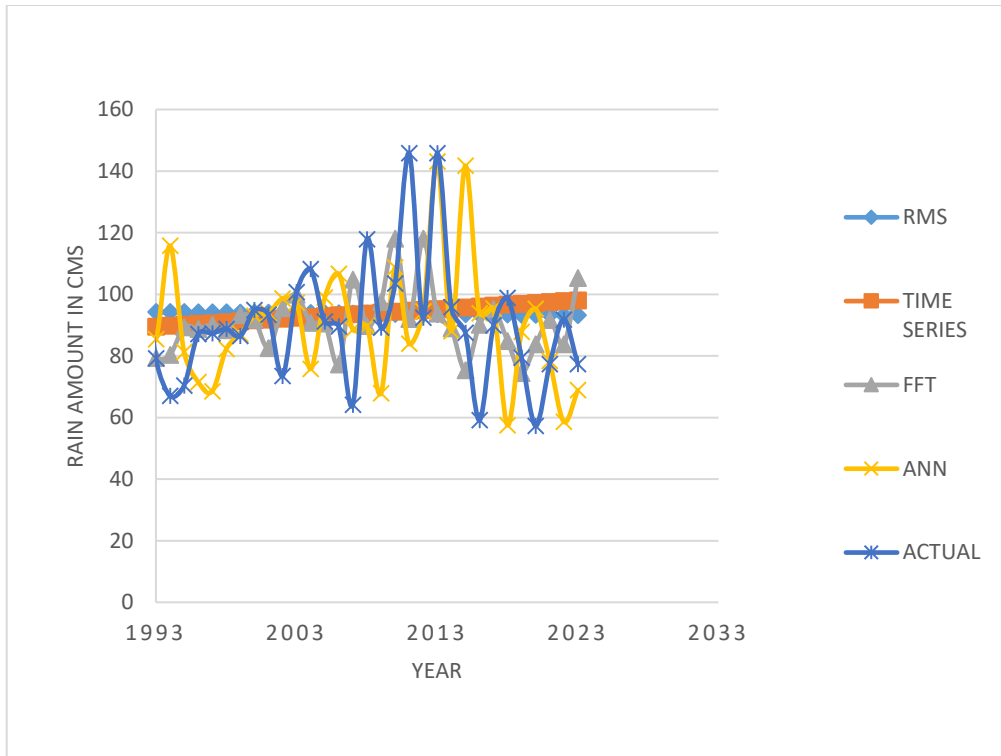


Fig. 6. Total rain amount in CMS in the year 2025

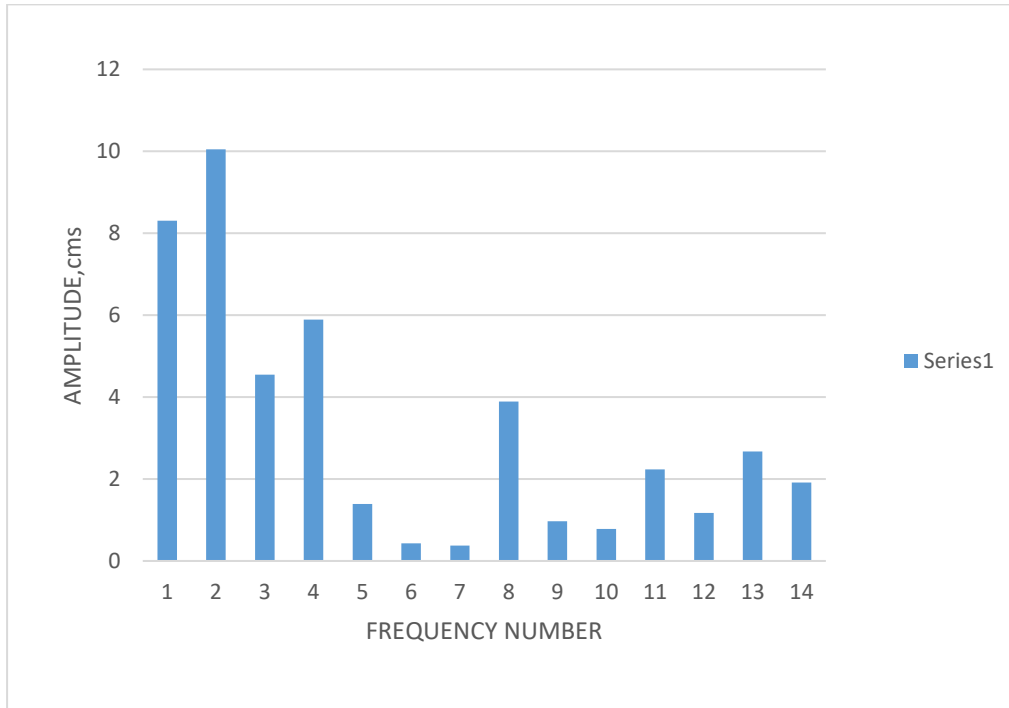


Fig. 7. Amplitude (CMS) versus frequency numbers

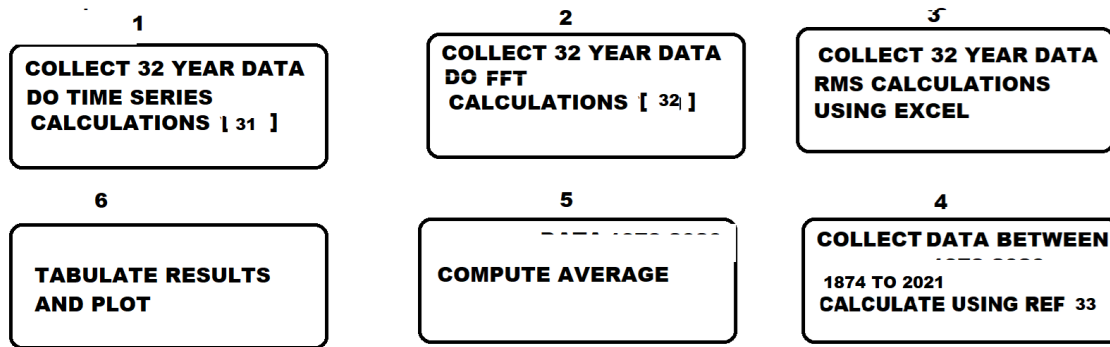


Fig. 8. Numbered block diagram of the computations

The total amount of rainfall shown in Fig 6 is obtained by adding the amounts of months of June to September. Here, the difference between the results of different methods is small.

Fig. 7 shows the frequency distribution where some of the frequencies have much higher amplitude compared to the others. Frequency numbers 1,2 and 4 are fairly high having magnitudes of six and above.

Fig. 8 shows the details of the sequence of computations performed to arrive at Table 1 or the numbers in various figures.

4 Conclusions

In this work, the rainfall history of Telangana was discussed and based on 32-year history the coming year's rainfall was predicted as an average of the results of four methods discussed in this work. The result showed that the amount of rain in the coming year will be more than the 32 year average. This greater rainfall can be used to fill up the existing reservoirs and possibly new ones should be constructed to make more water available to the farmers.

Disclaimer (Artificial Intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

Competing Interests

Author has declared that no competing interests exist.

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