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Monsoon Rain Prediction for Vidarbha in the Year 2025

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Abstract - The present research is based on past 32 years of rainfall data. Computations are based on 4 methods which are: The Time Series method, the Root Mean Squared method (RMS), the Artificial Neural Network method (ANN), and the Fast Fourier Transform method (FFT). After making computations on these methods, their average is determined and used as the prediction for the next year's rainfall.
The results are presented in the form of graphs for each of these months. The summary of the results is presented in the form of a table.

KEYWORDS: Monsoon rain prediction, Fast Fourier Transform method, Water shortage, Drought and Famine

I. INTRODUCTION AND LITERATURE SURVEY

The world today is facing climatic change. This results in excessive rain, drought, land erosion, and severe storms including forest fires [1-4]. This has resulted in water shortages [5-26].
Of the total surface water in India, 87% is stored in lakes, whereas 2% is stored in rivers, and the rest 11% in swamps. Since all these sweet waters is not extractable - only 1% can be used for drinking
The lack of rainfall also affects hydropower generation [27].
The farmers in this area need advanced information to plan for next year's crop planting. They must buy seeds, fertilisers etc. at high interest rates. The failure of the crop many times result in farmers suicides.
Present research results are made known about 7 months ahead of time to assist the farmers in planning the crops. The Government of India Meteorological Department (IMD) makes his predictions in the month of April which is not well ahead of time of planting b seeds which is normally done in the month of June.
Besides the farmers, this research helps in flood control also. If there is excessive rain in a given river basin a large number of dams overflow. To prevent sudden release of water - this forecast helps the authorities to release water at predetermined safe interval
One can also refer to the literature available regarding water availability in [28-34]. The rainfall data is made available by IMD also and it can be seen in [35].
References [36-38] discuss the details about the Time Series method and FFT method and the ANN method.

II. METHODOLOGY

In this research work Computations 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 are discussed in [45-47].
in the Time Series method, the rainfall of June July August and September are divided into separate seasons. Based on the data overall trend is computed using linear regression. Then the rainfall for the coming for each of these months is computed based on this overall trend.
In the RMS method, regression analysis is carried out for each of the months of June, July, August, and September. Prediction for each of these moms is carried out by extending this regression line.

In the ANN method one has to train the network using a batch of 32-year history – one at a time going back to the year 1877. Here, for every 32 years of data used as an input and the 33rd year data is used as the output. One repeats the process until we come to the current year. This way one trains the network and then use is made for the prediction for the next year

Here, one uses the relationship between input and output using a linear system of equation

$$\{O\} = [W]\ \{I\} \qquad (1)$$

where {O} and {I} are output and input vectors of sizes mx1 and nx1 respectively. The size of the weight matrix [W] is mxn.

While using several input and output vectors, trains the network which is one determine the matrix [W]. Once this matrix is known then new set of vector {I}, and [W} are used to determine the coming year's rainfall in the output vector.

III. RESULTS AND DISCUSSIONS

In Fig. 1, one sees the location of Vidarbha. The monsoon approaches from the south- western side where the mountain ranges called the Western Ghats obstruct the pattern of the monsoon clouds thereby introducing uncertainty in the rain pattern.

In Fig. 2, actual rainfall has abrupt changes. The RMS and the Time Series method have straight line relationship with increasing trend.

Fig. 3 shows the results for the month of July. It also shows that the actual rainfall values change very drastically. The RMS method and the Time Series method have a straight-line relationship. The Time Series method has lower values. The results of the ANN Method and the FFT method follow closely to each other.

Fig. 4 results are similar to Fig 3 where the actual rainfall has sharp variations. Fig 4 results are slightly less than those of Fig. 3.

The Fig 5 shows the rainfall for the month of September. Here, their amounts are less than the ones in July and August.

Total amount of rainfall is shown in Fig 6 as well as in Table 1. In this case, the values obtained by different methods are much closer than in those in individual months.

Fig. 7 shows the frequency distribution of the total rainfall values. The figure shows that the frequency numbers 1, 3, 12, and 13 have magnitudes greater than 4 centimetres. The presence of many frequencies result in complicated rainfall distribution.

Table 1 shows the average of past 32 years. The predicted rain amount for the year 2025 is the average of four methods. This predicted amount is greater than the average of past 32 years.

IV. CONCLUSIONS

1. Table 1 shows that this year the rain will be slightly more than past 32 years average.
2. Fig. 7 shows that there are several high amplitude frequencies present.
3. Fig. 6 shows that the total rain amounts calculated by various methods do not show vast differences.
4. The actual rainfall values show abrupt changes.

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TABLE 1: RAIN FORECAST IN CENTIMETERS FOR VIDARBHA DURING MONSOON MONTHS 2025

METHOD	YEAR	JUNE	JULY	AUGUST	SEPTEMBER	TOTAL	COMMENTS
TIME SERIES	2025	22.6	23.2	16.1	13.7	75.6	
FFT	2025	19.3	45.5	29.2	22.9	116.9	
ANN	2025	13.6	34.0	46.3	19.8	113.7	
RMS	2025	22.7	33.9	22.7	22.7	101.9	
PREDICTED AMOUNT	2025	19.5	29.6	25.5	21.6	97.6	Slightly more than the 32 Year Average Value
32 YEAR AVERAGE		18.1	32.8	26.3	18.5	95.7	

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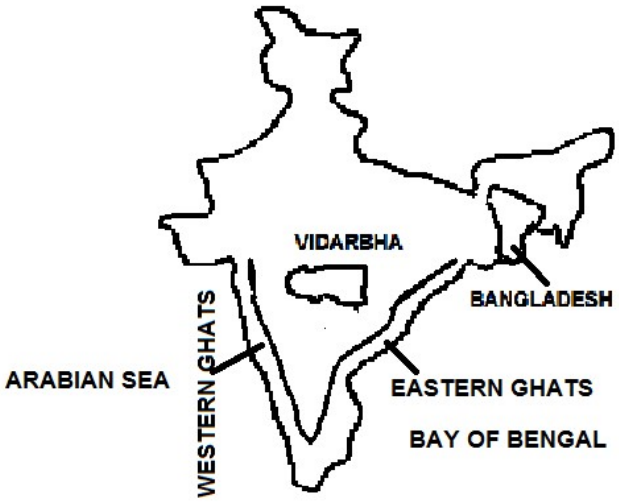
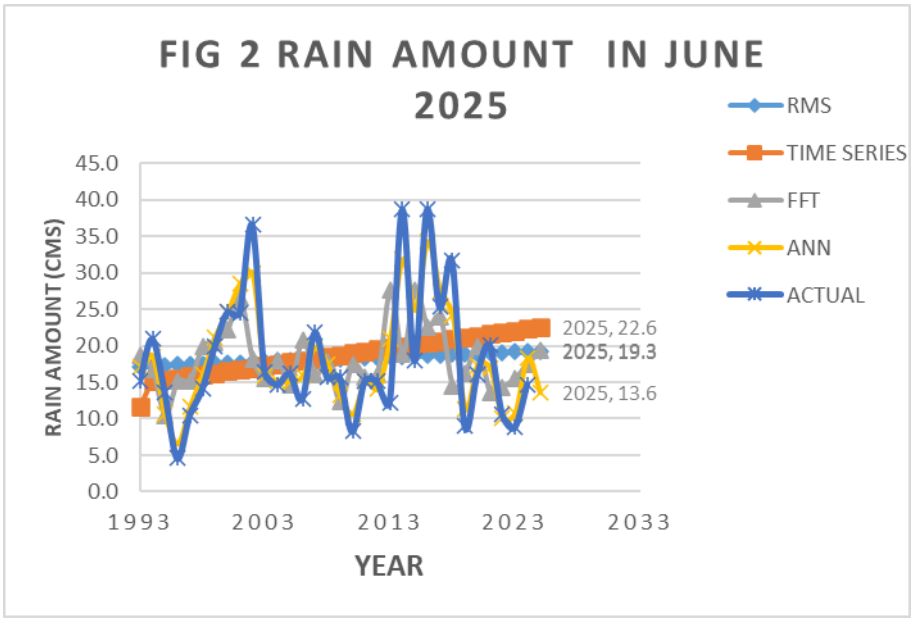


FIG. 1 LOCATION OF VIDARBHA BETWEEN EASTERN AND WESTERN GHATS



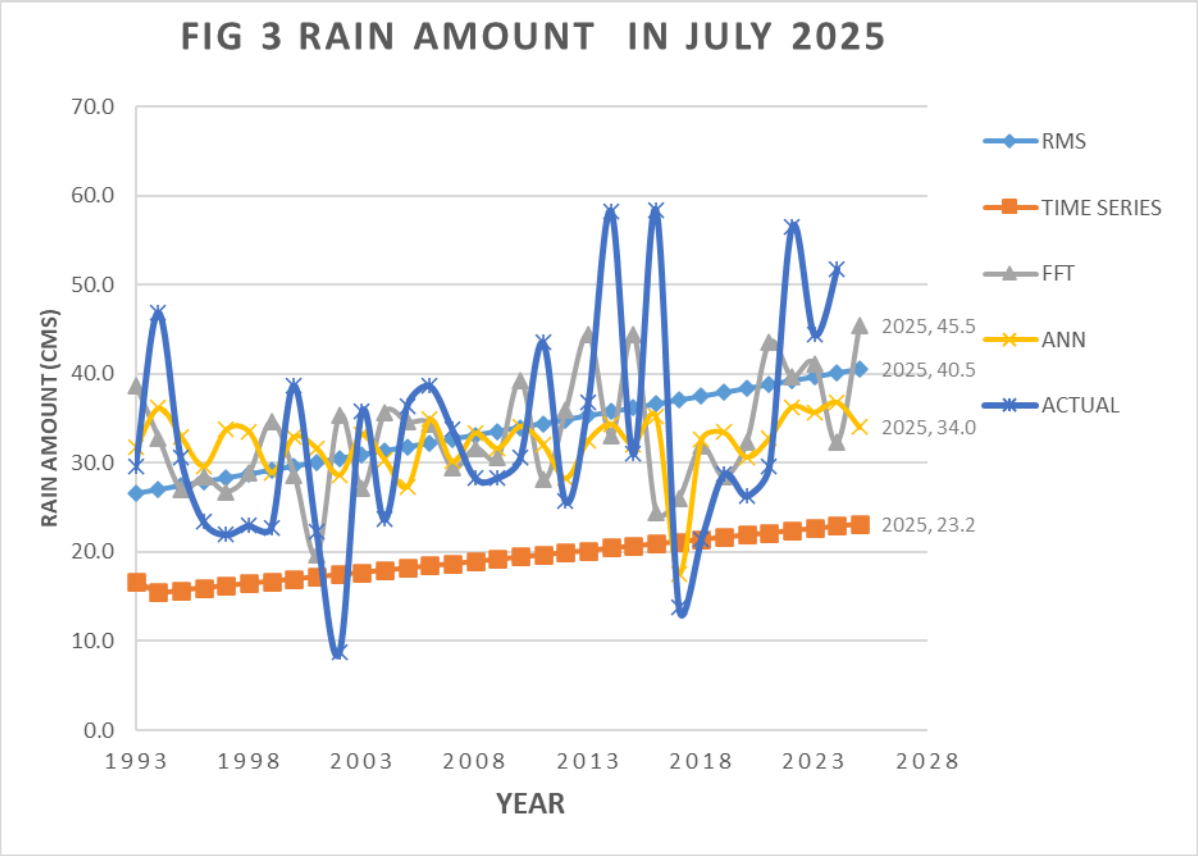


FIG 3 RAIN AMOUNT IN JULY 2025
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
RAIN AMOUNT (CMS)
1993
1998
2003
2008
2013
2018
2023
2028
YEAR
RMS
TIME SERIES
FFT
ANN
ACTUAL
2025, 45.5
2025, 40.5
2025, 34.0
2025, 23.2

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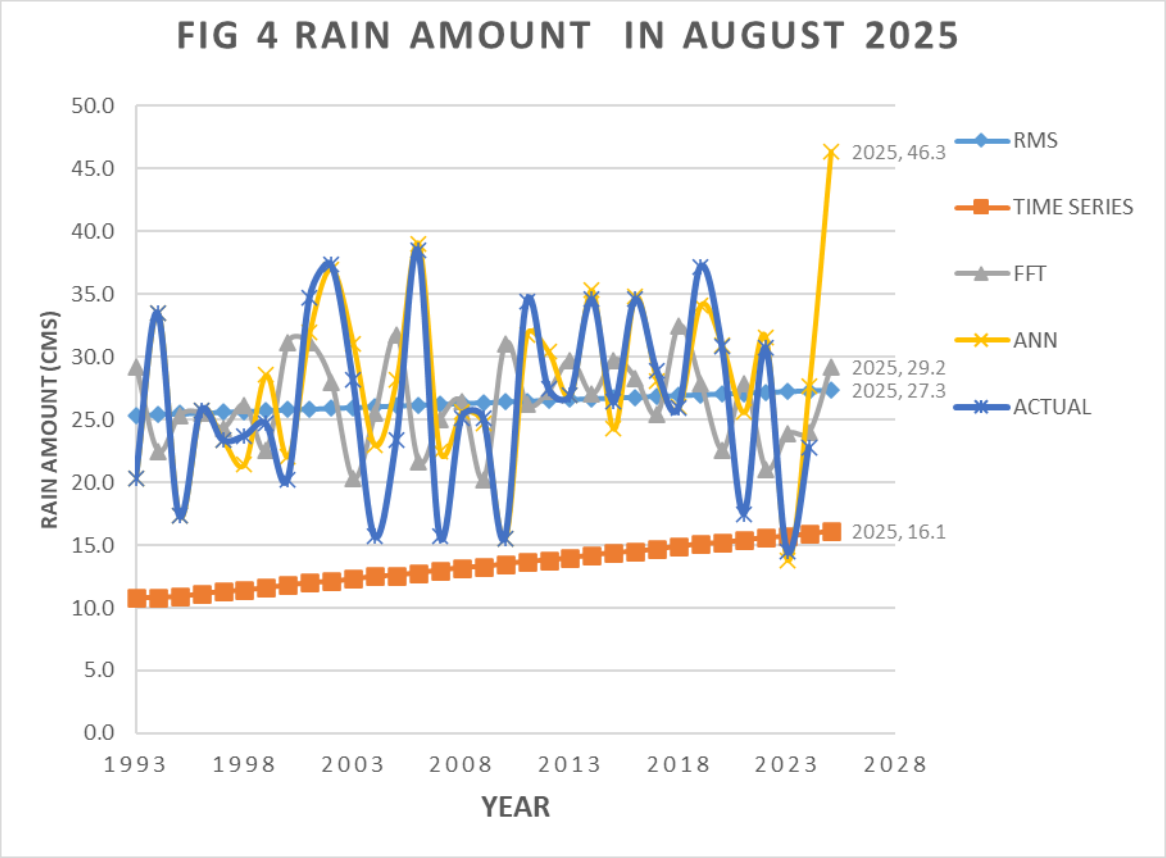

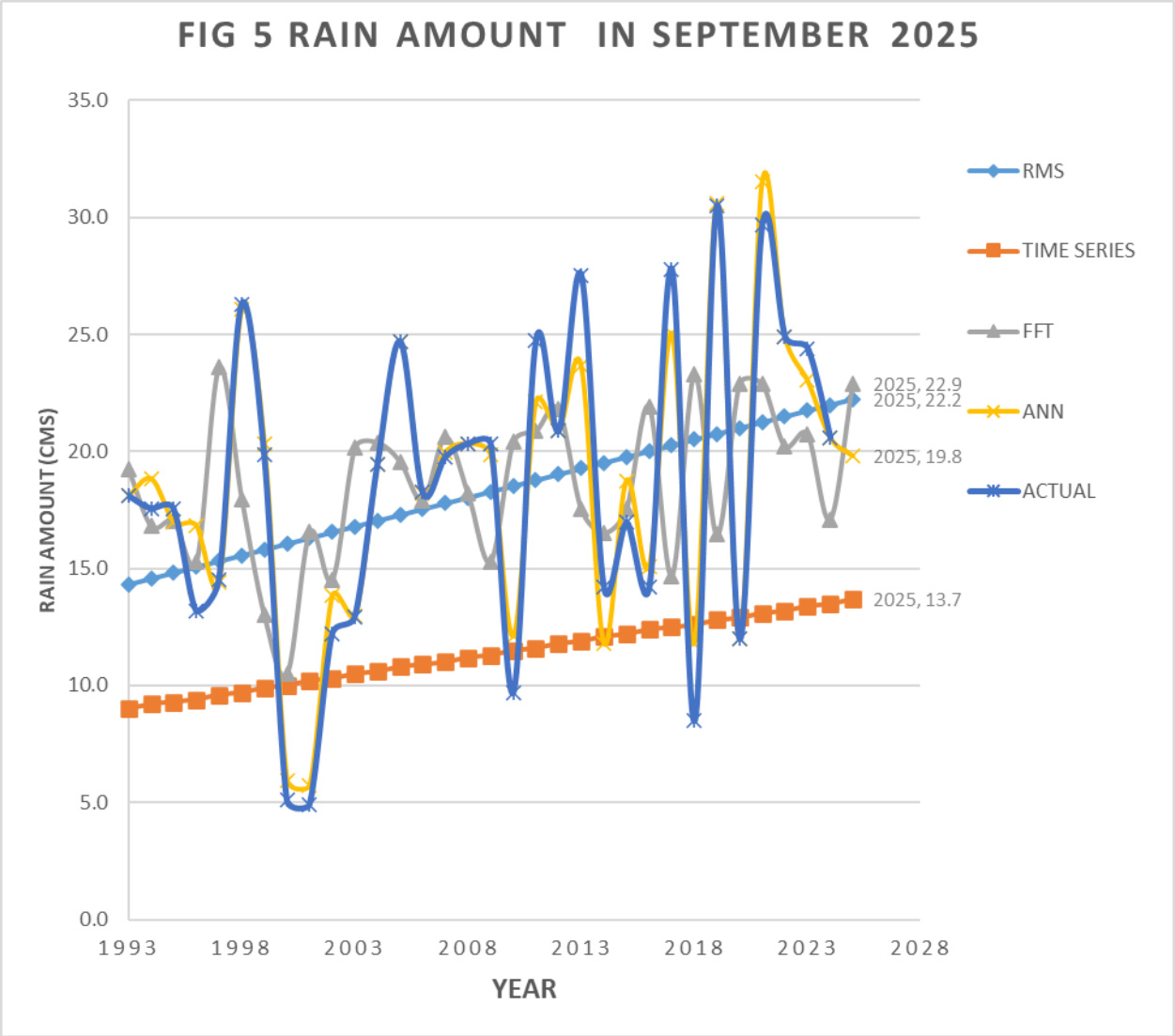
FIG 5 RAIN AMOUNT IN SEPTEMBER 2025
RAIN AMOUNT (CMS)
YEAR
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1993
1998
2003
2008
2013
2018
2023
2028
RMS
TIME SERIES
FFT
ANN
ACTUAL
2025, 22.9
2025, 22.2
2025, 19.8
2025, 13.7

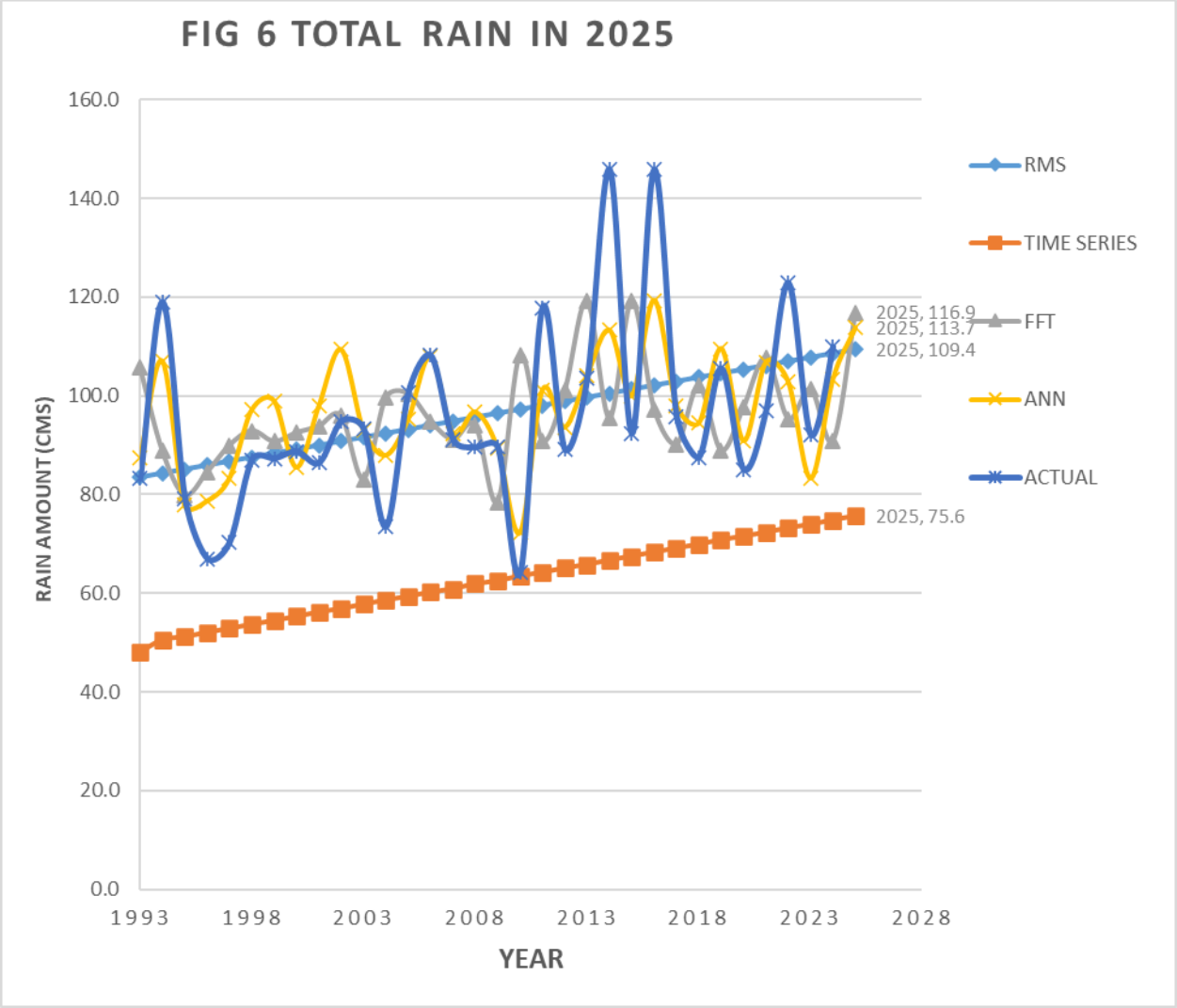
FIG 6 TOTAL RAIN IN 2025
RAIN AMOUNT (CMS)
YEAR
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
1993
1998
2003
2008
2013
2018
2023
2028
RMS
TIME SERIES
FFT
ANN
ACTUAL
2025, 116.9
2025, 113.7
2025, 109.4
2025, 75.6

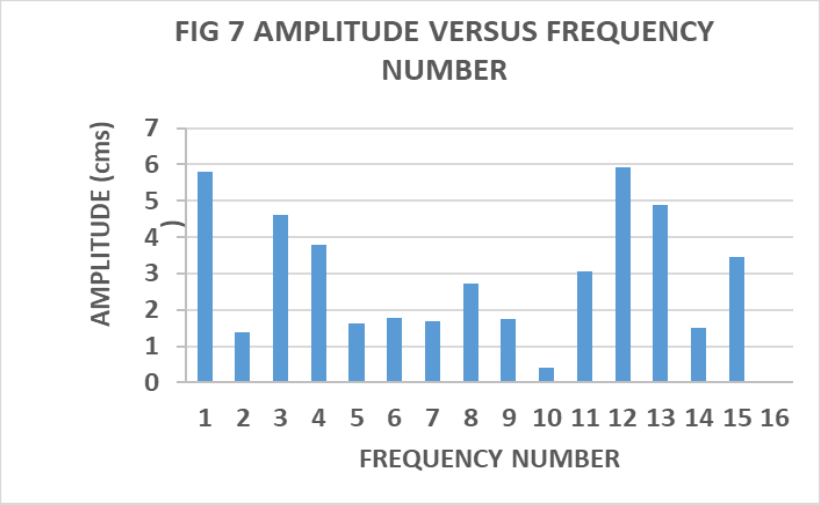
FIG 7 AMPLITUDE VERSUS FREQUENCY NUMBER
AMPLITUDE (cms)
FREQUENCY NUMBER
7
6
5
4
3
2
1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16