

# On The Forecasting of Rainfall Amount for Vidarbha in the Year 2021

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**Abstract - For the forecasting four independent methods have been used and the average of these methods is taken as the forecasted amount. The four methods are: (1) the Time Series method, (2) the Root Mean Square (RMS) method value is based on month-wise linear regression, (3) the Fast Fourier Transform (FFT) method and Artificial Neural Network (ANN) method where the adjusted weights are determined based on records going back to 1873. This year's rain amount for this Monsoon season will be slightly above the average of past 32 years. This should be good for farmers and others including the recharging of the groundwater. This will help in replenishing the waterin reservoirs and other water storage facilities, including hydro-power electricity generation.**

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

## I. INTRODUCTION

In Vidarbha wells go dry due to deficient rains. Drought is not uncommon in Vidarbha and neighbouring regions [1-7]. Since the wells go dry, the governments are compelled to make water available to people by trains and tankers. The city of Nagpur undergoes severe water crisis. The city of Nagpur due to water shortage–has had to allow only 50% of its raw water to be used for domestic purposes. Five districts in Amravati division in Vidarbha faced shortage of water in the past as the water levels in reservoirs dropped drop of water level in reservoirs and other due to the drop in the water stock. The average water stock in the reservoirs in five districts had in the past dropped to 19.71%. . This had resulted in the reservoirs running dry faster than their annual rate. The drop in the water level had led to a rise in the number of water tankers being used for supply of potable water. Some of the districts in Marathwada quite often had faced shortage of drinking water.

Out of the surface water, 87% is stored in lakes, 11% in swamps and 2% in rivers. As all the sweet water is not extractable, only 1% of the total water can be used by humans [7]. Other references applicable for this region are available in public domain [8- 22]. Water shortage also affects the hydropower generation [23].

In view of the above mentioned facts, the present waorks attempts to form a mathematical model for forecasting the rainfall far in advance to that of the Indian Meteorological Department (IMD) to enable people to prepare in advance about any water shortages as about 90% of the annual rain takes place during the Monsoon season. It would help various governments at different levels in planning for water shortages in case of deficient rain. This way, the farmers get freedom to plant the crop of their choice and decide about how much to plant? The farmers are usually under heavy loans and a drought has catastrophic effect on their financial planning or loan avoidance. . In addition, one can plan better for floods if there is a heavy rainfall.

One can refer to work of some scientists working in this area [24-30]. The rainfall predictions by IMD can be seen in [31]. References 32, and 33 show the details of the Time Series method and FFT method.

## II. RESULTS AND DISCUSSIONS

The location of Vidarbha can be seen in the map of India ( Fig. 1 ). In India, the south - west Monsoon arrives on the land where it faces the Western Ghats, a mountain range, before raining over Vidarbha. Here, much of the rain is blocked due to the fact that these Ghats ( mountain ranges ) are quite high. Additionally, it gets the rain from the southern side also, Here, another set of mountain ranges are there but these are not as high as the previous mountain ranges. These on the southern side are called the Eastern Ghats.

Figure 2 shows the rainfall for the month of June. It shows the rain amounts by:(1) Artificial Neural Network (ANN) method, (2) Root Mean Square (RMS) values of the month of June, (3) Time Series Method, (4) the Fast Fourier Transform method and the actual rain values. The actual rain values change very drastically from year to year as do the ones by FFT and ANN methods. The RMS and the Time Series methods are based on regression analysis where the errors are minimized using a linear regression method - so these curves are straight line estimations. This figure shows the actual rainfall to be quite erratic from year to year. The change in the magnitudes of the rainfall is quite high. As can be seen in Table 1 and Fig 2, except for the ANN method, other methods yield closer results. .

Figure 3 shows the results for the month of July. It also shows the actual rainfall values change very drastically. The amount of rain in July is more than that of June but there is slight increase in the difference between the values obtained by different methods. The values for August as shown in Figure 4 are less than those of July but the divergence between the results by various methods is less. Figure 5 values for September are less than that of August.

The rain amount for the month of August is shown in Figure 4. It shows that the actual rainfall differs fairly high from year to year in the beginning. However, in the later period it appears to converge towards the mean value.

The rainfall amounts for September are shown in Figure 5. It shows that there will be less rain in September as compared to July or August yet, it will be more than that of June. Figure 6 shows the total rain values for the months of June to September. Here, the values obtained by various methods are closer to each other. As is shown in Table 1, the total predicted amount which is the average of the four methods, is significantly higher than the 32 year average values (see Table 1).

Figure 7 shows the frequency distribution of the total rainfall values. These are not static values. However, there are higher amplitudes present in the frequency numbers 1,3,5,8, and all higher than 12. This explains the rapid changes in the actual rain values and that there are many sources that lead to higher rain amounts. .

### III. CONCLUSIONS

1. Looking at the Table 1 one can say that this year, the rainfall will be significantly more than the average of the last 32 years.
2. The ANN method often shows higher values.
3. The presence of higher amplitudes among higher frequencies indicate high fluctuations in the time history of rain.
4. Slightly higher rain than the past 32 year average values show that the water shortages will be somewhat compensated due to excess ( higher than the average ) rain amount
5. The month-wise rain amounts vary quite a bit but the scatter in the total rain values is much less.

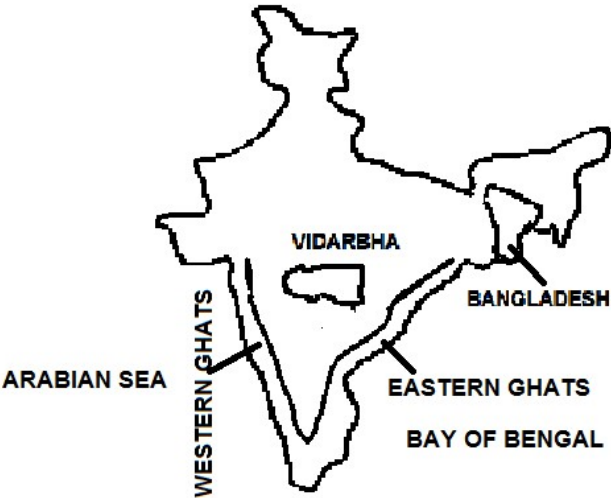
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TABLE 1: RAIN FORECAST IN CENTIMETERS FOR VIDARBHA DURING 2020 MONSOON MONTHS

METHOD	YEAR	JUNE	JULY	AUGUST	SEPTEMBER	TOTAL	COMMENTS
TIME SERIES	2021	20.7	28.9	27.2	24.6	101.5	
FFT	2021	19.4	29.0	31.2	22.0	101.6	
ANN	2021	27.8	35.6	37.2	21.6	122.2	
RMS	2021	19.5	34.7	27.3	20.8	102.3	
PREDICTED AMOUNT	2021	21.9	32.1	30.7	22.3	106.9	More than the 32 Year Average Value
32 YEAR AVERAGE		19.2	30.8	28.5	16.8	95.4	



**FIG. 1 LOCATION OF VIDARBHA BETWEEN EASTERN AND WESTERN GHATS**

