

Forecasting of Monsoon Rain Amount in Jharkhand in the Year 2022

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Abstract— Water is an absolutely essential commodity which is mainly obtained from the monsoon rains. To estimate of rainfall amount four methods are used in this work. These methods are: (1) Artificial Neural Network (ANN) method, (2) Fast Fourier Transform (FFT) method, (3) the Time Series method, and (4) the Root Mean Square (RMS) method using linear regression. The amount predicted equals the average of results obtained by these four methods.

Index Terms— Monsoon rain prediction, annual rainfall, rainfall frequency spectrum, El Nino and La Nina influence on rainfall, drought and famine, crop failure.

I. INTRODUCTION AND OBJECTIVE OF RESEARCH

India is fortunate that it has one of the largest area in the world which is suitable for cultivation and where crops can be planted round the year. Unfortunately fact is that about two third of this area is entirely dependent upon monsoon rain and without any other irrigation facilities [1-5].

It is also a fact that the farmers have to borrow money at high interest from banks and money lenders whereas the others involved in agriculture such as fertilizer suppliers or seed suppliers collect the money in advance thereby have no risk if the crop fails due to lack of rain.

The south-west monsoon rains arrive in the month of June and the four months starting with this month are considered as monsoon months. Monsoon rains adversely affect the water supply of the entire country if there is lack of sufficient rain. It affects water availability from rivers, dams and reservoirs, wells etc.

The effect of lack of rain in Tamilnadu and Jharkhand are discussed in [6-8].

In India, the agricultural output affects the corporate world. Failed crop results in the lack of demand for various goods in the market [9].

Recently, the state of California in United States of America (USA) went through a six-year drought period. As a result of this, the hydroelectric power stations had to be stopped many times.

The effect of rainfall deficit in fields such as agriculture, city supply, and hydropower has been discussed in [10]. Jharkhand has shortage of reservoirs.

These days, quite often many dams become dry or have low levels in the reservoirs which results in shutting down of the

power generation. It is quite common to see the power generation decrease in summer months due to lower availability of water [11-12]. Many other areas of India also have been feeling extreme water shortages [13-29]. Lack of rain also affects hydropower generation is discussed in [30]. Regarding the studies on monsoon rains one can refer to the work of various other researchers [31-41]. Moreover, the rainfall predictions by Indian Meteorological Department (IMD) can be seen in [42].

The location of Jharkhand in India is shown in in Fig. 1. The present study has been undertaken for forecasting the water availability for hydroelectric power generation as well as for agriculture.

II. RESULTS AND DISCUSSIONS

Fig. 2 shows the results of calculations using the Time Series method, the artificial neural network method (ANN), the Fast Fourier Transform method (FFT), The Root Mean Square (RMS) method and the actual rainfall record for the month of June. One can see the details about these methods in [43-45]. The actual rainfall varies very rapidly and the variations are over very wide range.

The Time Series and the RMS variations are based on linear regression and are straight lines. Both show a decreasing trend. The other two methods results vary closely with each other and the final values are quite close to each other.

The Table 1 shows the summary of results for all the months including the total values. The predicted amount value is the average of results obtained by these four methods. The Time Series method shows the lowest values whereas the ANN method results are the highest.

In Fig. 3, the actual results vary over wide range. Unlike results obtained by the Time Series method and the RMS method results show opposite trend – one increasing and the other –decreasing. .

In Fig. 4, the actual rain values show wide variation whereas all others stay within a narrow range.

In Fig. 5, the results of all methods show small variation range whereas the actual rainfall amount shows sharp changes.

The total value of rain is shown in Fig. 6. All results are closer to each other.

The Fig. 7 shows the amplitude versus frequency number plot. Here, frequency numbers 1, 6, 8, and 10 are significant frequencies having amplitudes greater than 4 cms, which is quite high.

The Table 1 shows that this year the rainfall amount will be less than the 32 year average in each of the months. This will result in about 7.8 % lower rain amount than the average of 32 years value.

III. CONCLUSIONS

In this work, the calculations of the rainfall were carried out using ANN method, the Time Series method, the FFT method, and the RMS method.

The following conclusions can be drawn from this work:

1. The actual rainfall pattern is quite erratic.
2. The Time Series method, and the RMS method results are linear as a result of linear regression used to determine these curves.
3. The FFT method results are approximations of the actual curve using harmonic functions.
4. India needs to spend additional resources for storing water. The rain amounts are actually not that low but the shortages are due to lack of storage capacity.

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TABLE 1: RAIN FORECAST IN CENTIMETERS FOR JHARKHAND DURING 2022 MONSOON MONTHS

METHOD	YEAR	JUNE	JULY	AUGUST	SEPTEMBER	TOTAL	COMMENTS
RMS	2022	12.2	33.7	28.1	18.2	92.2	
TIME SERIES	2022	21.3	21.2	21.2	21.1	84.8	
FFT	2022	16.1	31.7	27.5	22.9	98.2	
ANN	2022	25.3	30.9	39.0	13.8	109.0	7.8 % LESS THAN 32 YEAR AVERAGE
PREDICTED AVERAGE	2022	18.725	29.375	28.95	19	96.05	
32 YEAR AVERAGE	2022	19.6	32.8	29.8	21.8	104.1	



FIG 1 LOCATION OF JHARKHAND, IN INDIA





