

Research Article

## Prediction Rainfall in 2020 in Telangana

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### Abstract

Present work uses four separate methods to arrive at the prediction value by taking the average of the results of these four. Here, the calculations are based on past 32 year history of rainfall in Telangana. The four methods are: (1) The Root Mean Square (RMS) values, (2) the Artificial Neural Network (ANN) method, (3) The Fast Fourier Transform (FFT) method, and the Time Series method. Out of these the first and the last methods involve linear regression hence the results obtained exhibit a linear curve. Here, the prediction can be made about 8 months in advance to give sufficient time for planning to the farmers or hydro-electric power generators, or the governments at different levels.

**Keywords:** Monsoon rain prediction, annual rainfall, rainfall frequency spectrum, El Nino and La Nina influence on rainfall, drought and famine, crop failure, drinking water shortage.

### 1. Depletion of water reserves and its consequences in daily lives

In India, the water reserves have gone down drastically because with increased population and industrialization human being's ability to use pumps has increased tremendously. At the same time, most of the ponds in the cities are filled up for construction of buildings. The extensive use of concrete all over, prevents water to be absorbed by ground.

In recent times due to the global warming the global warming the rainfall has become erratic. Our lives depend on the timeliness of the availability of water. In India about 60% of the agriculture is dependent annual rainfall. For example, for sowing the seeds, the ground has to be wet or soft to plough the fields. If there is a delay in the onset of monsoon then the ploughing is also delayed which results in sufficient time needed for the growth of crops.

The farmer's suicides in Telangana is recorded in (Telangana's Shocking Statistics: 350 Farmer Suicides in Five Months, <http://www.ndtv.com/article/south/telangana-s-shocking-statistics-350-farmer-suicides-in-five-months-616371>; How Telangana Farmer's Suicide, <http://www.ndtv.com/article/south/how-telangana-farmer-s-suicide-has-changed-the-world-of-his-daughter-572462>; Farmer's Suicide in Vidarbha: Everybody's Concern, <http://medind.nic.in/jaw/t09/i2/jawt09i2piii.pdf>; Farmers' Suicides in the Vidarbha Region of Maharashtra, India

A Qualitative Exploration of Their Causes, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3291283/>, Four more Maharashtra farmers commit suicide, <http://www.thehindu.com/news/national/four-more-maharashtra-farmers-commit-suicide/article6655587.ec>; Three Farmers Commit Suicide in Draught-Hit Marathwada Region, [http://zeenews.india.com/news/maharashtra/three-farmers-commit-suicide-in-draught-hit-marathwada-region\\_1508366.html](http://zeenews.india.com/news/maharashtra/three-farmers-commit-suicide-in-draught-hit-marathwada-region_1508366.html)). In many areas drinking water is supplied using trucks or even using trains (1. (India is already facing a water crisis—and it is only going to get worse, <https://thedi diplomat.com/2014/04/indias-worsening-water-crisis/>; In Gujarat's water crisis, key question: why is Narmada's level low this year, <http://indianexpress.com/article/explained/in-gujarats-water-crisis-key-question-why-is-narmadas-level-low-this-year-5113688/>; Water shortage in Gujarat's Morbi forces people to dig holes in the ground, <http://indianexpress.com/photos/india-news/gujarat-morbi-water-crisis-narmada-river-5119373/>; Gujarat staring at water crisis this summer, <http://indianexpress.com/article/india/gujarat-staring-at-water-crisis-this-summer-5042137/>; Water scarcity threat to India and South Africa - Climate News Network <https://climatenewsnetwork.net/23742-2/>; India's escalating water crisis -, <https://www.livemint.com › Politics › Policy>; India's potable water crisis is set to worsen , <https://www.livemint.com › Politics › Policy>; India's fast-growing cities face water crisis - Phys.org , <https://phys.org › Earth › Environment>; India drought: '330 million people affected', [\\*Corresponding author's ORCID ID: 0000-0003-1336-8333; FAX: \(709\) 864 - 4042, DOI: <https://doi.org/10.14741/ijcet/v.10.5.6>](http://www.bbc.com/news/world-</a></p></div><div data-bbox=)

asia-india-36089377; Drought years may become more frequent in India, says study, <http://indianexpress.com/article/india/india-news-india/maharashtra-gujarat-drought-waterless-monsoon-crisis-years-may-become-more-frequent-in-india-says-study-2826500/>; The Thirst for Power: Hydroelectricity in a Water Crisis World, <http://www.brinknews.com/the-thirst-for-power-hydroelectricity-in-a-water-crisis-world>). This is because the wells and other water reservoirs become dry due to insufficient rains in the previous years or due to the extension of the summer months caused by the delay in the onset of the monsoon. Water is used for processing in many industries.

Fig. 1 shows three areas which are located between the Eastern and Western Ghats. Due to the obstruction in the path of south west monsoon, the rainfall in these areas becomes very erratic.



**Fig 1** Locations of Marathwada, Vidarbha and Telangana between western and eastern ghats

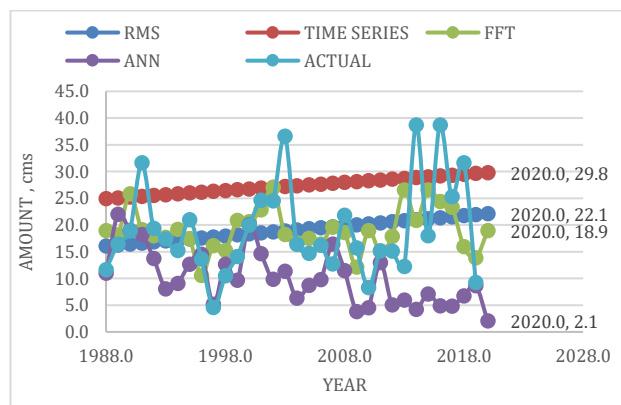
These days many dams become dry in the summer months and it causes power shortage due to decreased levels of water in reservoirs thereby affecting hydro power generation, the purpose of the present study is to improve the planning of power availability. The works of many researchers can be seen in 1. (Singh, P, and Borah, B., 2013, "Indian summer monsoon rainfall prediction using artificial neural network"; Stoch Environ Res Risk Assess Vol 27:pp. 1585–1599; Gadgil, S and Srinivasan, J, 2012, Monsoon Prediction: Are Dynamical Models Getting Better Than Statistical Models? Delsole, T. and Shukla, J. 2012. Climate Models Produce Skillful Predictions of Indian Summer Monsoon Rainfall ; Singh, K., et al, 2020, A Study on Variability in Rainfall Over India Contributed by Cyclonic Disturbances in Warming Climate Scenario; Mathur, R., AchutaRao, K., 2020, A Modelling Exploration of the Sensitivity of the India's Climate to Irrigation; Prathipati, V.K., et.al,2020, , Inconsistency in the frequency of rainfall events in the Indian summer monsoon season; 4. Rana, M., et. Al., 2019, Climate Change Impact and Response of Rice Yield; Mohanty, U.C., et. al.2029, Evaluation of performance of seasonal precipitation prediction at regional scale over India, and Prediction of rain in Bihar, India based on historical Bihar's rain data, [http://www.engr.mun.ca/~asharan/RAINBIHAR/RAIN\\_BIHAR\\_V12.pd](http://www.engr.mun.ca/~asharan/RAINBIHAR/RAIN_BIHAR_V12.pd) ).

**2. Prediction of rain amount in 2020 using various numerical calculations**

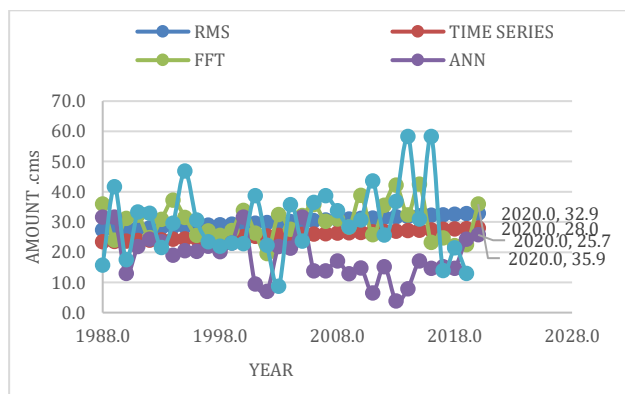
Table 1 shows the results of all calculations for the months of June to September period. Here the calculations are performed using the four methods mentioned earlier. The Time Series and RMS methods use the linear regression analysis to arrive at the trend of the rainfall.

The results starting from the month of June to September months are shown in Figs 2 to 6. In the Fig 6 the total value of rain amount is shown. The frequency diagram of the total values are shown in Fig. 7. The frequency diagram helps in determining the presence of important causes of the rainfall such as the magnitude of El Nino effect.

In Figs. 2 to 6 except 4, one can see an increasing trend. The FFT (Fast Fourier Transform method) show variations similar to the actual rain. The ANN method yields lower results except for September. The linear regression analysis results fairly well represent the actual rain values. The details about these two methods can be seen in (Rainfall projections, <http://www.imdpune.gov.in/endofseasonreport2013.pdf> ; Excel - Time Series Forecasting. <http://www.youtube.com/watch?v=gHdYEZA50KE> ; Frequency Domain Using Excel. <http://online.sfsu.edu/jtai/downloads/ENGR%20302/Excel.FFT.pdf>)



**Fig 2** Rain amount in June 2020 in Telangana



**Fig 3** Rain amount in July 2020 in Telangana

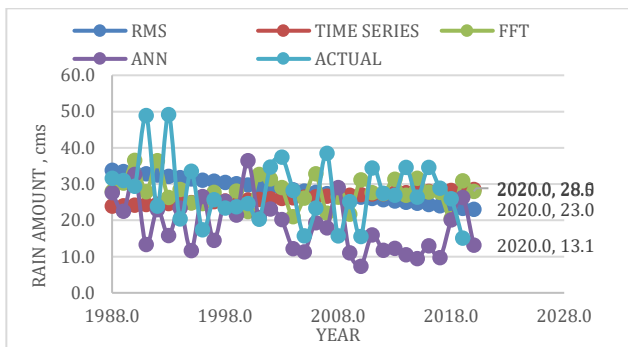


Fig 4 Rain amount in August 2020 in Telangana

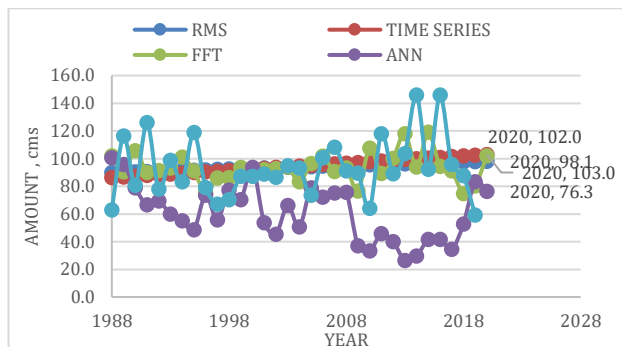


Fig 6 Total rain amount in Telangana in year 2020

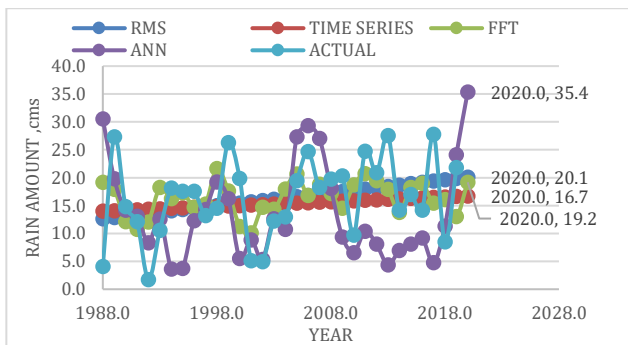


Fig 5 Rain amount in Telangana in September in year 2020

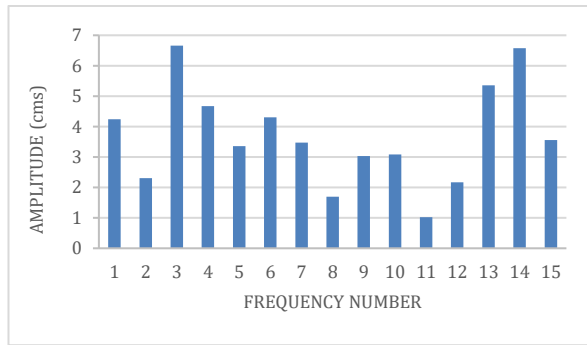


Fig 7 Amplitude versus frequency number

The picture is clearer in the Table 1 which is a summary of the results. It shows that this year there will be 10.8 % greater amount of rain than past 32 years.

The result shown in Fig 7 indicate that frequency numbers 1,3,6, 13 and 14 have magnitudes greater than 4 and cause heavier rainfall.

Table 1: Rain forecast in centimeters for Telangana during 2020 monsoon months

Method	Year	June	July	August	September	Total	Comments
Rms values	2020	21.9	32.9	23	20.1	97.9	
Time series	2020	29.6	28	28.5	16.7	102.8	
Fast fourier transform (fft)	2020	25.1	41.6	39.2	26.9	132.8	
Ann method	2020	8.6	25.7	13.1	35.4	82.8	
Predicted amount	2020	21.3	32.1	26.0	24.8	104.1	10.8% greater than 32 year average
32 year average		19.1	30.0	27.9	16.3	93.3	

Conclusions

1. The rainfall in the months of June to September except August, including the total value will be above the 32 year average.
2. This excess rain amount can build up the reserves of water.
3. There is a need to implement agriculture techniques of using less water in agriculture should be adopted as is the practice in Israel.

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