Ilkogretim Online - Elementary Education Online, 2021; Vol 20 (Issue 3): pp. 3852-3864
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2021.03.399

Prediction Of Pan Evaporation Of Parbhani District Of Maharashtra By Using Artificial Neural Network

Deepshikha[1], Akash Behera, Smruti Ranjan Sahu, Dharampal Singh Kandari, Kishan Singh Rawat, Jitendra Chauhan[2]

[1]Department of Civil Engineering, Graphic Era Deemed to be University, Dehradun-248002, India , Email: ksr.kishan@gmail.com

[2]Assistant Professor, School of Management, Graphic Era Hill University, Dehradun, India.

Abstract

The relative estimation is depended on the optical differentiation i.e.; complete form of the detected and predicted organized graphs. The detected and forecasted values of pan evaporation for training years 1971-2014 using ANN models with 2 chosen networks are present in this research. According to the detected and predicted values of precipitation for monitoring years 2010-14 of ANNs are monitored. It is found that there is a nearly close acceptance between the detected and predicted pan evaporation, and complete form of the organization of predicted pan evaporation is same as the observed pan evaporation. From this research we can control the water consumption for cultivation, monitoring the condition of drought, expand the budget of water, draining of aquifer monitoring and crop estimation.

Keywords: ANN; MATLAB; PAN evaporation.

Introduction

Artificial neural networks, commonly called neural networks, are calculation systems influenced by the living neural networks that make up the brain. Artificial neural networks include 3 layers with connected nodes to replicate the human brain.From June to September, the southwest monsoon contributes over 75°c to India's annual rainfall (Singh, 2006). The rating of Indian cultivation is something that depends on the opening of the monsoon and the depth of rain during the rainy season. For prediction, there are many methods, from inexperienced methods to ION using additional methods which are human intelligence (AI); artificial neural networks (ANNs) are the best methods for predicting policies. ANN predictions collected from examples and record functional relationships between data, even if those correlations are unrecognized or hard to explain.

By the integrated process of evaporation and transpiration Evapotranspiration produced. More than 90 ° Zc of annual precipitation is lost at ET (Glenn et al., 2007). ET is the runoff of water on the earth's surface. This creates a connection between the amount of water and energy in the atmosphere (Khaldi et al. 2011).

Materials and Methods

Study area

Parbhani district situated in the Maharastra state which is foundin between 19.27°N to 76.78°E. Parbhani district was also known as “Prabhavati”. Parbhani district occupied a total of 57.61 km^2 area. It situated 347m above the MSL. The study area recorded average rainfall of 962.8 mm. 33.8c and 20.4c are the highest and lowest average temperature of the study area respectively.

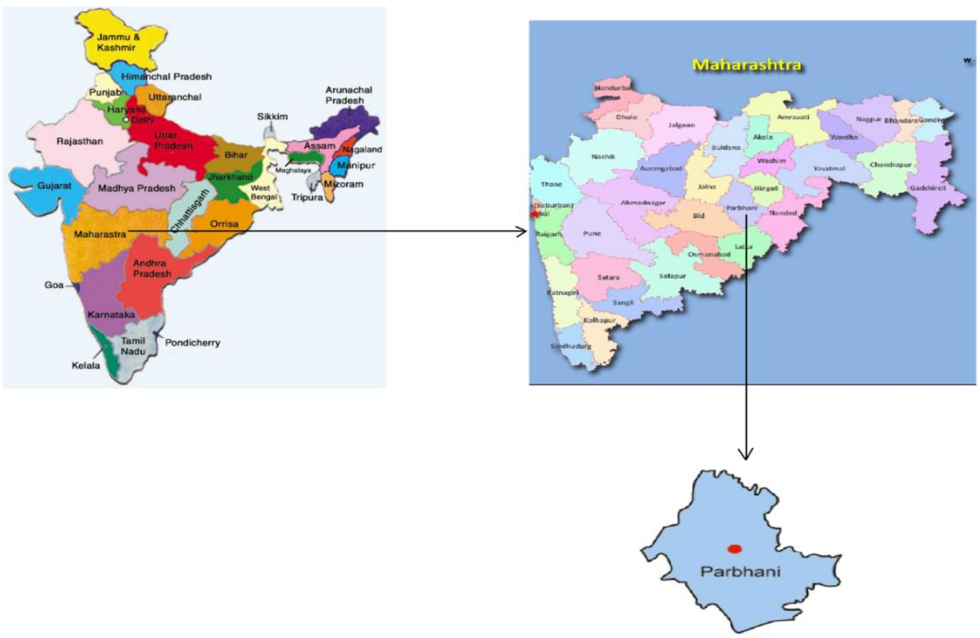

Fig. 1 Study area

Datasets

The 44-year daily weather data (1971- 2014) was obtained from the aerological survey of VasantRaoNaikMarathwadaKrishiVidyapeeth, Parbhani, in the state of Maharashtra, India. In this research the data collected for a time period of June to September 30") for the 44 years from 1971 -2014. These data include daily precipitation values, temperature (min and max); respectivehumectation (min. and max). The speed of wind is set in advance of the analysis and creation of the database. The data at 90 ° / c (1971 -20 10) is used for the design of the model and the remaining data at 10 ° / c (2011-2014) is used for validation.

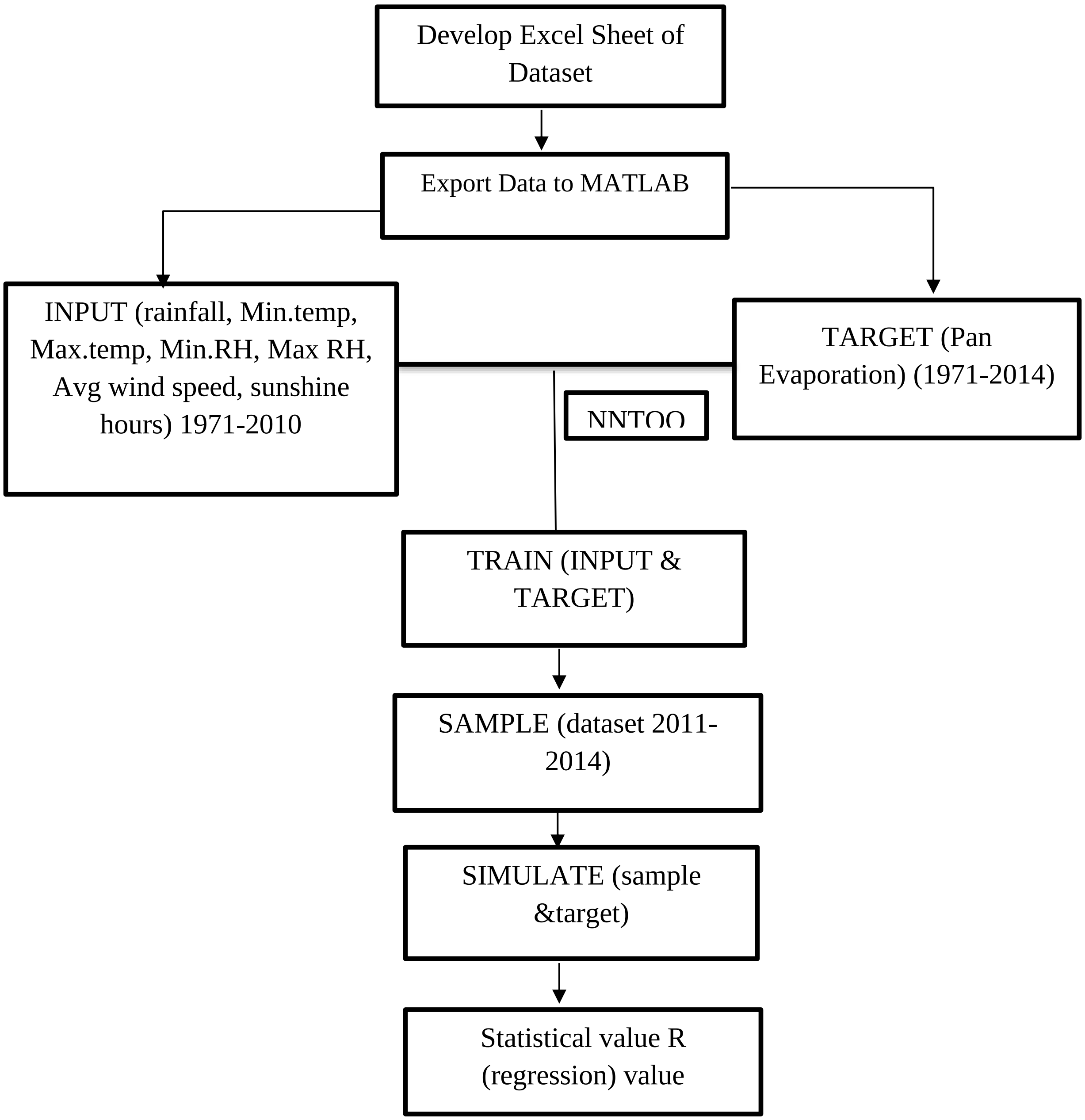

Fig. 2 Flow chart of methodology

Methodology

From figure 3(a), when we correlate pan evaporation with maximum rainfall humidity hour it shows extremely poor result.

In figure 3(b) when we correlate pan evaporation with sunshine hours it shows poor result.

In figure 3(c) it clear, when we correlate pan evaporation wit maximum temperature it also shown extremely poor result.

Same with figure 3(d) when we correlate pan evaporation with rainfall it shows poor result.

Then the conclusion comes that when we correlate pan evaporation with a single factor it gives extremely low value of R (regression coefficient). So, for preparing a model we must take all factor together to correlate with pan evaporation.

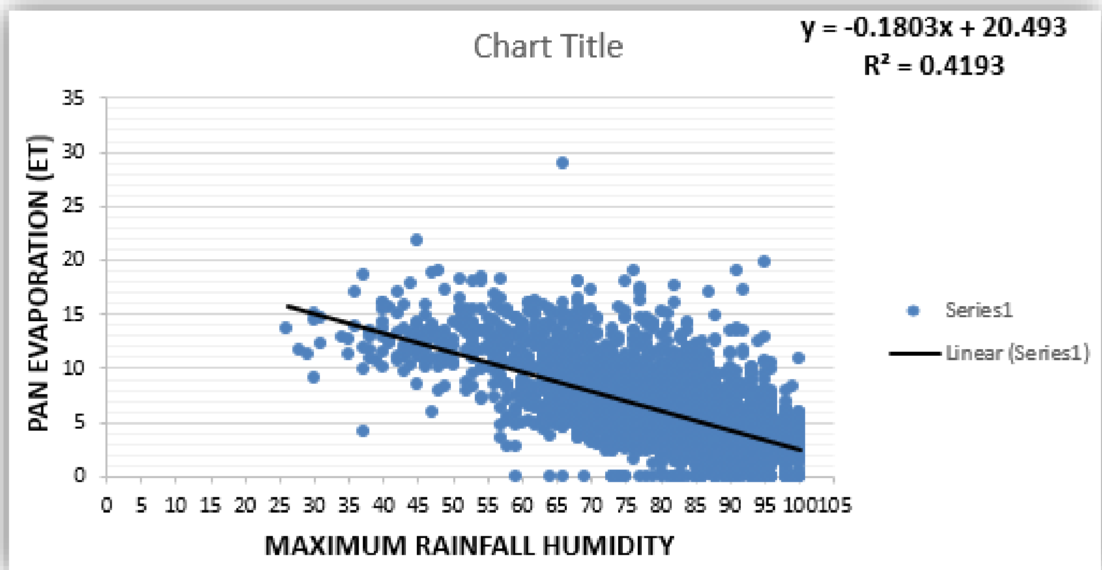

Fig. 3a Correlation between Maximum Rh and Pan Evaporation

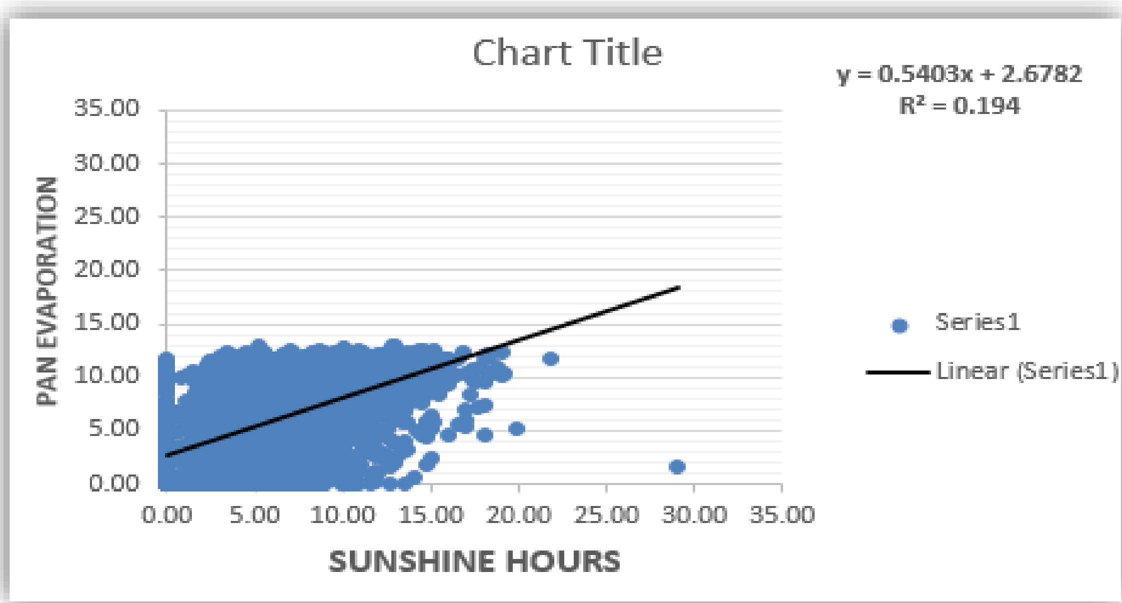

Fig. 3b Pan Evaporation and Sunshine Hours

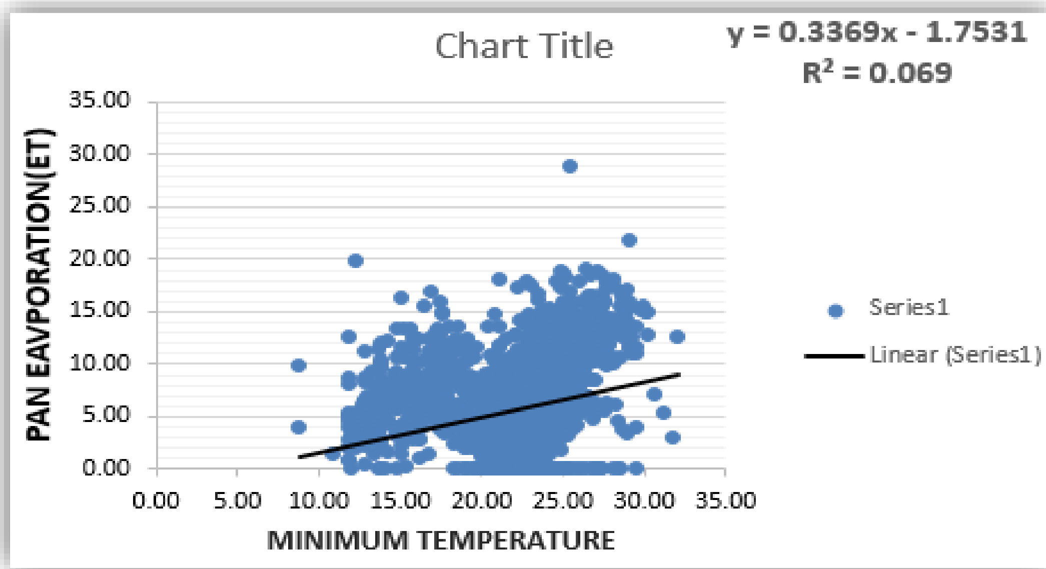

Fig. 3c Correlation between Minimum Temperature and Pan Evaporation

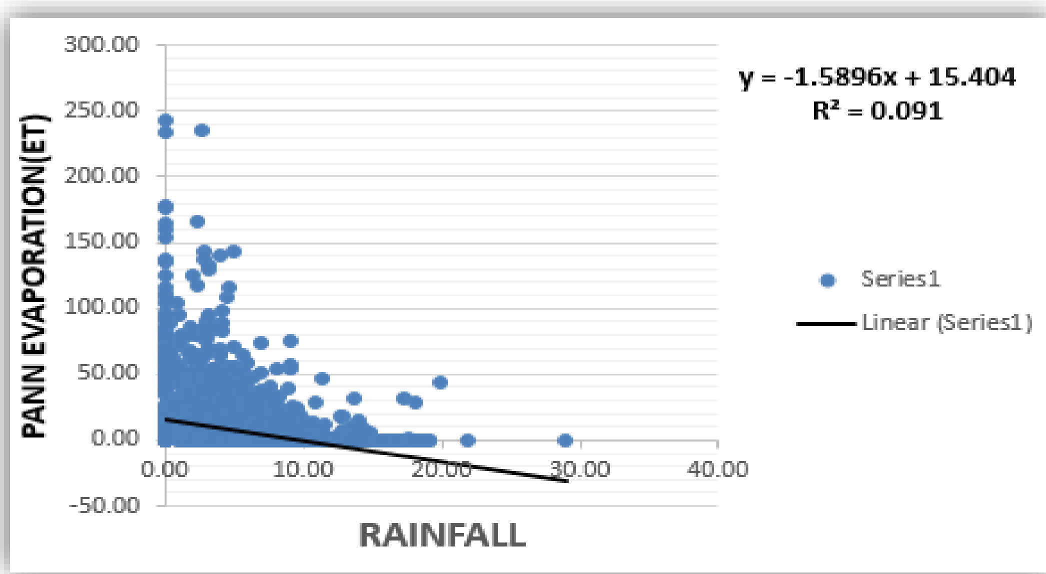

Fig. 3d Correlation between Rainfall and Pan Evapotranspiration

Results and discussions

The most important factor for the pan evaporation prediction model is rainfall because the R-value is fluctuating due to the rainfall factor.This method is best suited for the prediction of weather conditions aswell as the prediction of factors on which weatherconditions are dependent.

We can see in the figure.4a and 4b when we took all 7 factors and correlate them with pan evaporation it gives the best result. Here R-value comes to 0.82.

When R=0.82
INPUT= rainfall, Minimum temp., Maximum temp, Minimum RH, Maximum RH, Avg. wind speed, sunshine hours (Total parameter=7)

OUTPUT= Pan Evaporation

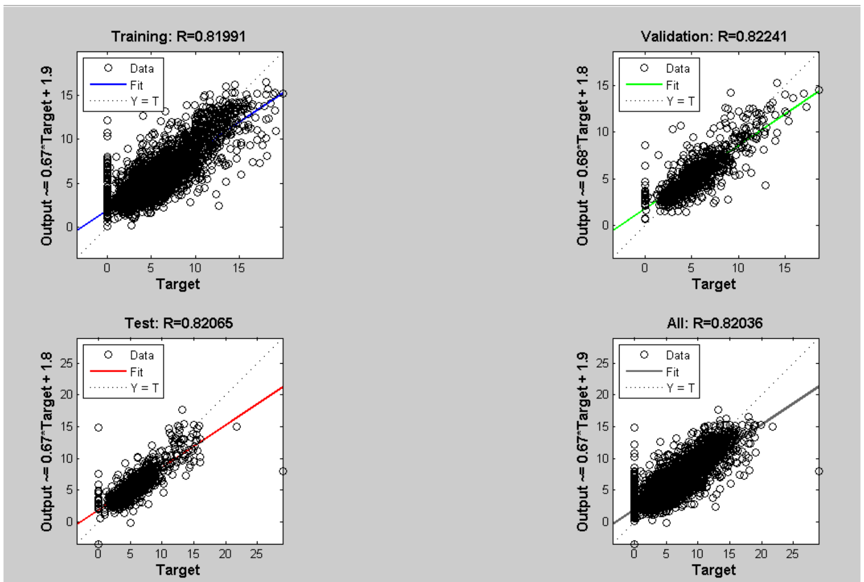

Fig. 4a Development of ANN Model when R=0.82

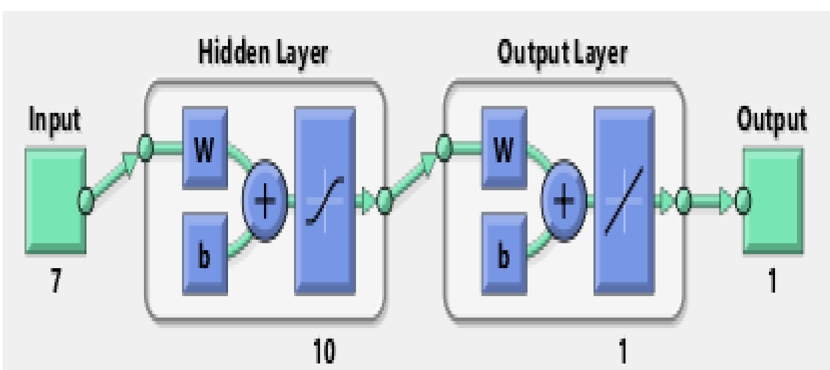

Fig. 4b Sketch diagram of ANN when R=0.82

In figure.5a and 5b states that when we remove one factor of sunshine hours and took 6 factors and correlate them with pan evaporation then R-values come to 0.81. It means pan evaporation doesn't depend on sunshine hours.

When R=0.81

INPUT= rainfall, Minimum temp., Maximum temp., Minimum RH, Maximum RH, Avg. wind speed (Total parameter=6)

OUTPUT= Pan Evaporation

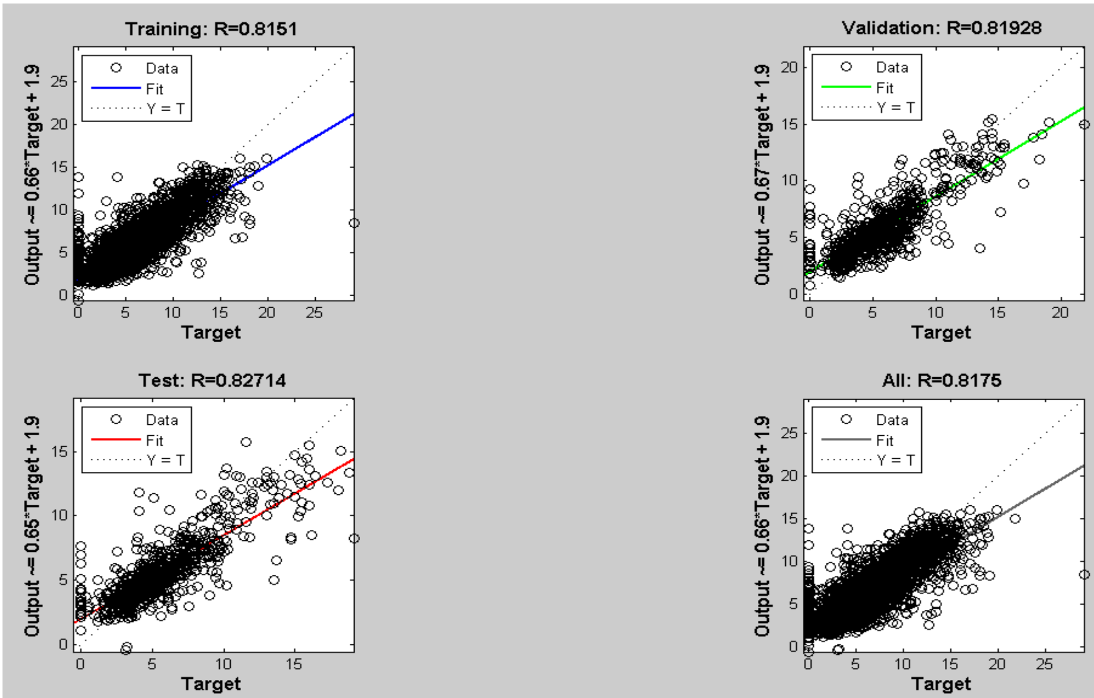

Fig. 5a Development of ANN Model when R=0.81

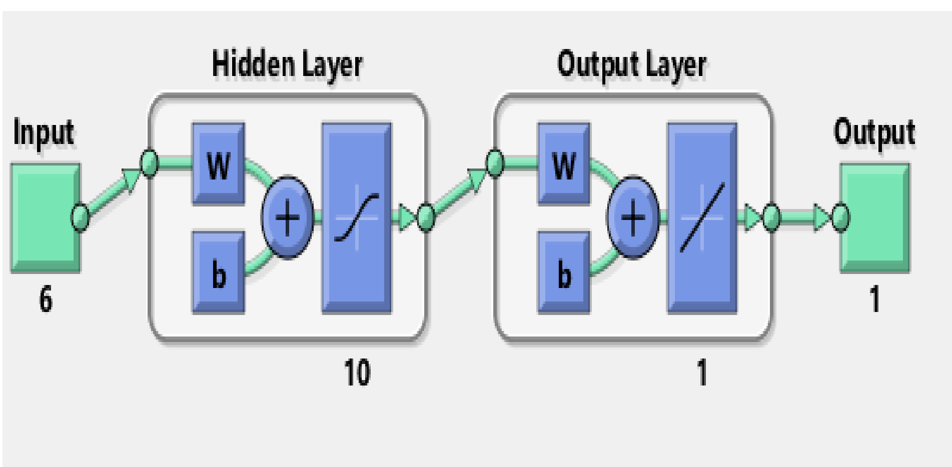

Fig. 5b Sketch diagram of ANN when R=0.81

In figure.6a and 6b it defined that when we remove two factorssunshine hours & Avg. wind speed and took 5 factors to correlate them with pan evaporation then R-values come to 0.78.

When R=0.78

INPUT= rainfall, Minimum temp., Maximum temp., Minimum RH, Maximum RH (Total parameter=5)
OUTPUT= Pan Evaporation

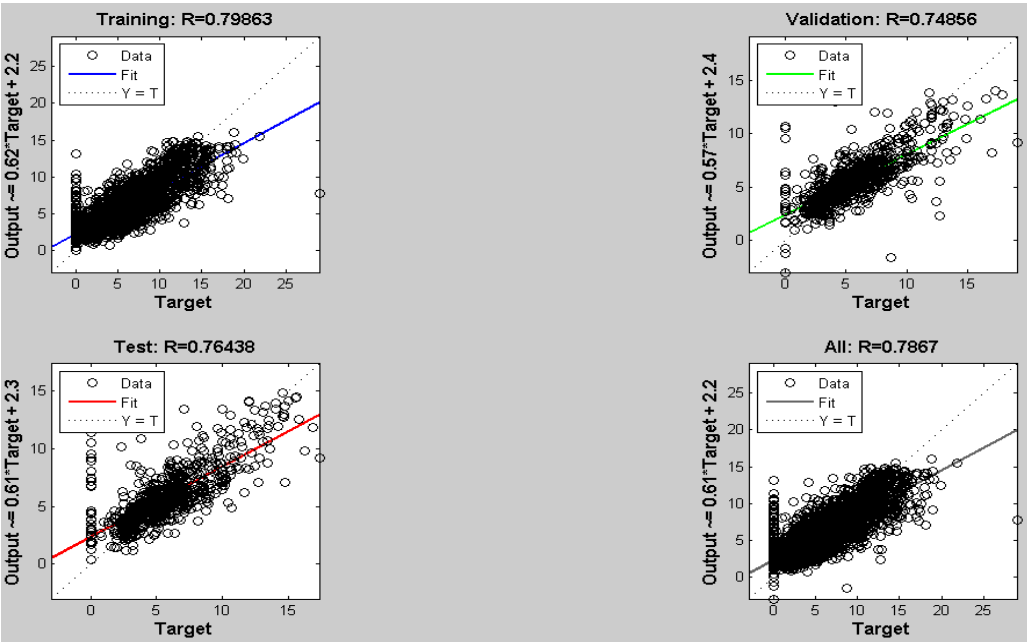

Fig. 6a Development of ANN Model when R=0.78

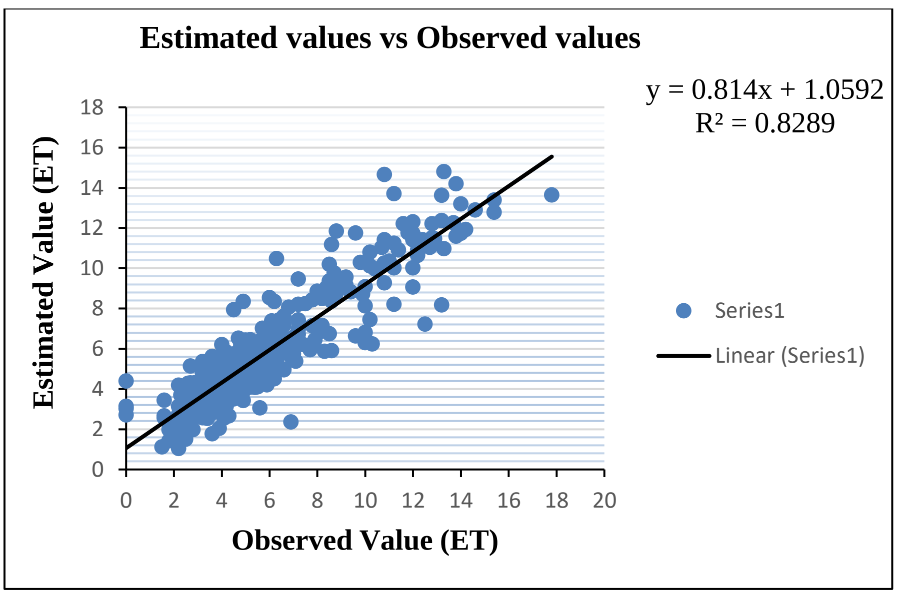

Fig. 6b validation of Model with observed data when R=0.78

In figure.7a and 7b when we remove 3 factors sunshine hours, Avg. wind speed & Max RH, and took 4 factors to correlate it with pan evaporation then R-value comes to 0.78.

When R=0.78

INPUT= rainfall, Minimum temp., Maximum temp., Maximum RH (Total parameter=4) OUTPUT= Pan Evaporation

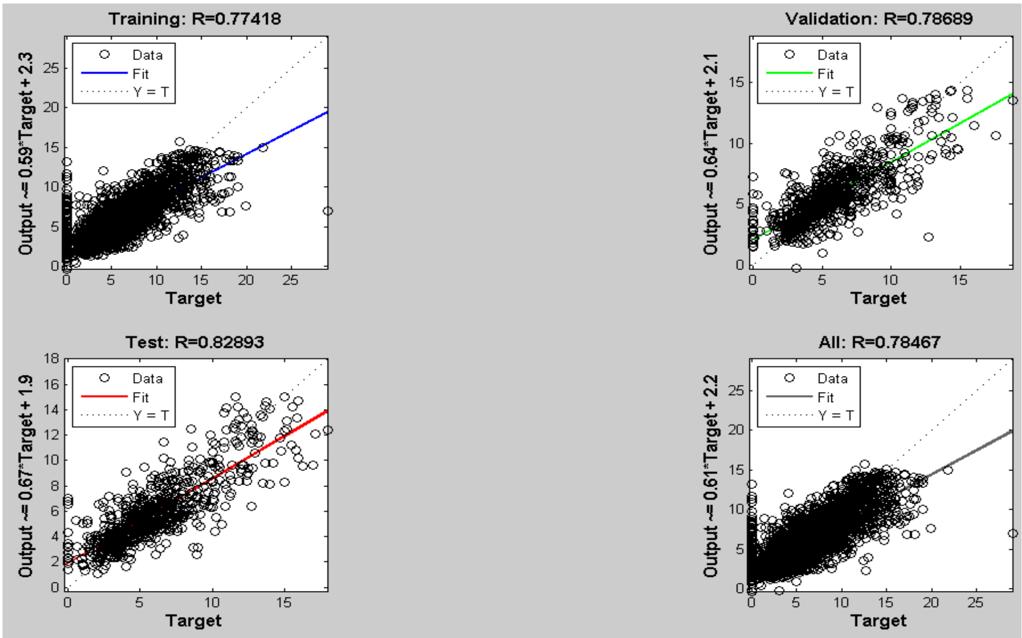

Fig. 7a Development of ANN Model when R= 0.78

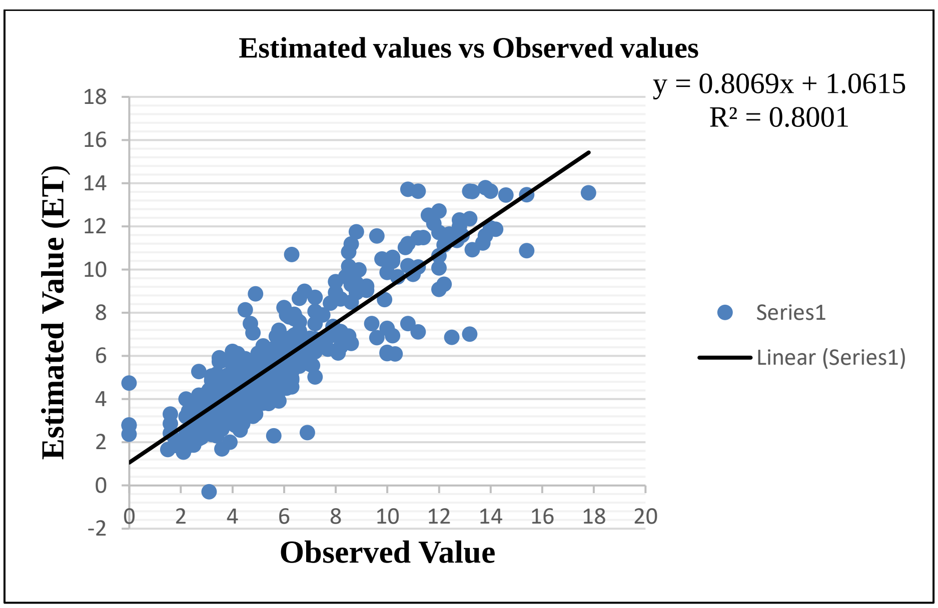

Fig. 7b validation of Model with observed data when R=0.78

Figure 8a and 8b defined that when we remove 4 factors sunshine hours, Avg.wind speed, Max. RH & Min. RH and took 3 factors to correlate it with pan evaporation then R-value come to 0.75.

When R=0.75
INPUT= rainfall, Minimum temp., Maximum temp., (Total parameter=3)
OUTPUT= Pan Evaporation

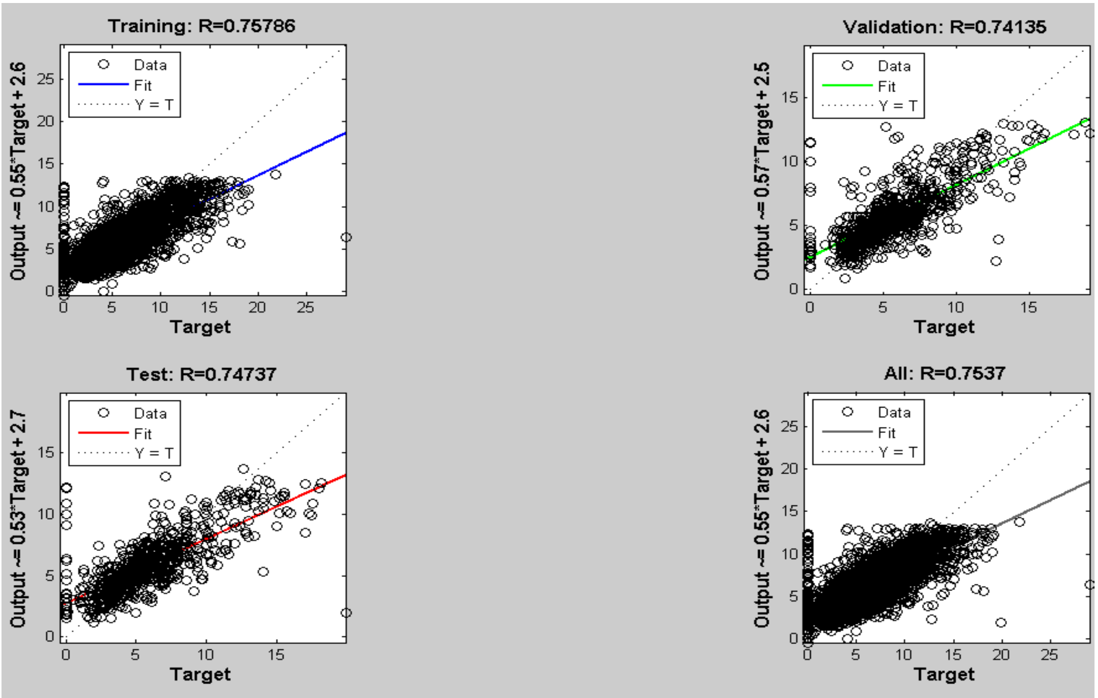

Fig. 8a Development of ANN Model when R=0.75

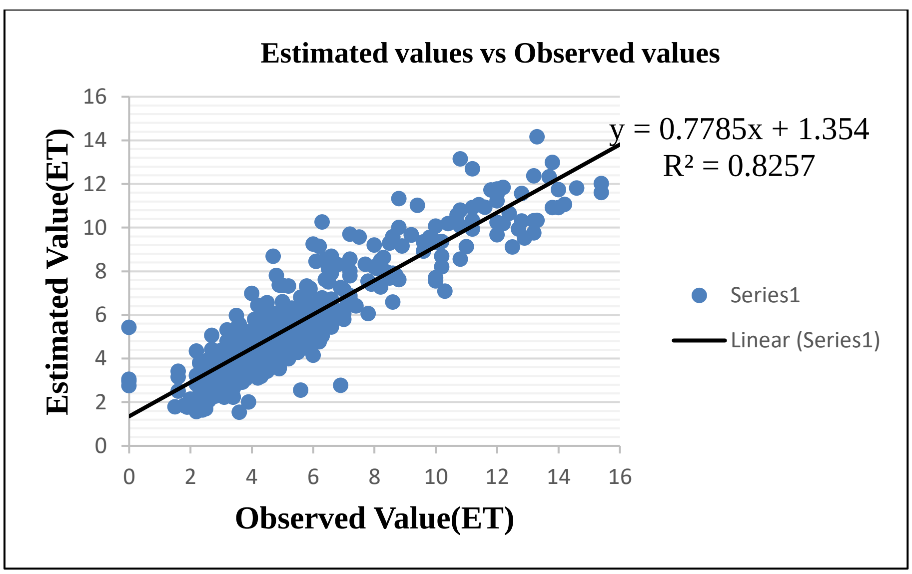

Fig. 8b validation of Model with observed data when R=0.75

When R=0.62

INPUT= rainfall, Minimum temp, Maximum temp. (Total parameter=2)

OUTPUT= Pan Evaporation

In figure.9a and 9b when we remove 5 factor sunshine hours, Avg. wind speed, Max. RH, Min. RH, Max. Temperature and took 2 factors to correlate it with pan evaporation then R-value come to 0.62. Which shows that model is failing.

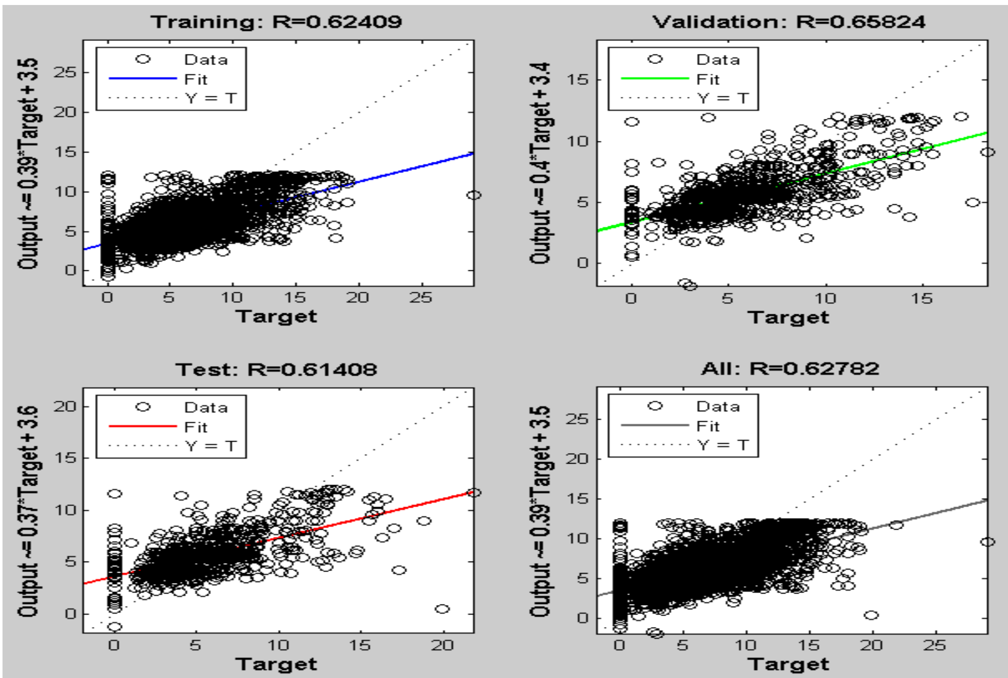

Fig.9a Development of ANN Model when R=0.62

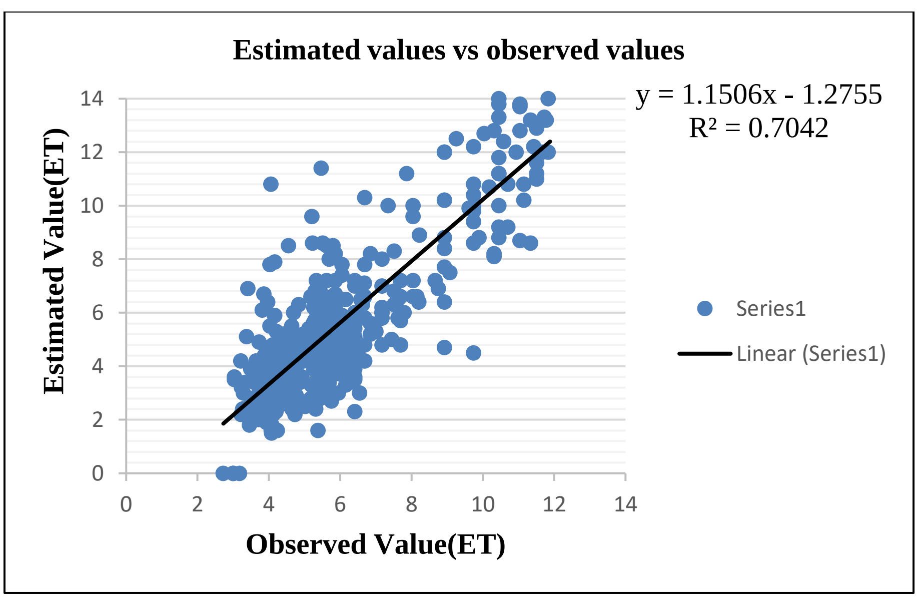

Fig. 9b validation of Model with observed data when R=0.62

Conclusion

It was found that the prediction of pan evaporation during the training years (1971-2014) using the ANN model with two nets selected. It is noticed that the retrogression line is exactly the best fit line (1:1 line), which indicates that all the models under predict the ET values for the Parbhani district of Maharashtra. From the above figures its monitored that the framework which is developed in this research show satisfactory results for the prediction of pan evaporation and it may be considered as quietly satisfactory according to the comparative estimation during testing period. Therefore, a satisfactory comparative performance foundduring the entire process.

This research gives good accuracy for the considered dataset and allows comparison between neural network model and more machine learning framework andcan easily calculate average absolute error for each model , calculate mean and standard deviation for each dataset accurately and used for weather forecast.

References

1.Dutta, S., A.A. Parsons, C. Bhattacharjee, 2010. Development of an artificial neural network model for adsorption and photocatalysis of reactive dye on TiO2 surface.Expert Systems with Applications, 37; 8634– 8638.

2. Panda, S.S., V. Garg, I. Chaubey, 2004. Artificial Neural Networks Application in Lake Water Quality Estimation Using Satellite Imagery. Journal of Environmental Informatics, 4; 65-74.

3.Palani, S., S.Y. Liong, P. Tkalich, 2008. An ANN application for water quality forecasting. Marine Pollution Bulletin, 56; 1586–1597.

4.Sahoo, G.B., C. Ray, H.F. Wade, 2005. Pesticide prediction in ground water in North Carolina domestic wells using artificial neural networks. Ecological Modelling, 183; 29–46.

5.Moosavi, V., M. Vafakhah, B. Shirmohamadi, 2013. A Wavelet-ANFIS Hybrid Model for Groundwater Level Forecasting for Different Prediction Periods. Water Resources Management, 27; 1301-1321.

6.Nourani, V., R. GoliEjlali, 2012. Quantity and Quality Modeling of Groundwater by Conjugation of ANN and Co-Kriging Approaches.Water Resources Management and Modeling.

7.Venkat Kumar, N., S. Mathew, G. Swaminathan, 2010. Analysis of Groundwater for Potability from Tiruchirappalli City Using Backpropagation ANN Model and GIS. Journal of Environmental Protection, 1; 136-142.

8. Garcia, L.A., A. Shigidi, 2006. Using neural networks for parameter estimation in ground water. Journal of Hydrology, 318; 215–231.

9. Huang, J., J. Xu, X. Liu, L. Wang, 2011. Spatial distribution pattern analysis of groundwater nitrate nitrogen pollution in Shandong intensive farming regions of China using neural network method. Mathematical and Computer Modelling, 54; 995–1004.

10. Karul, C., S. Soyupak, A.F.Cilesiz, 2000. Case studies on the use of neural networks in eutrophication modeling. Ecological Modelling, 134; 145–152.

11. Rawat K.S et al. Estimation of crop evapotranspiration through spatial distributed crop coefficient in a semi-arid environment, Agricultural Water Management, Volume 213, 2019, Pages 922-933, ISSN 0378-3774.

12. Rawat K.S et al. Retrieval and validation of soil moisture from FRS-1 data set of radar imaging satellite (RISAT-1). Arab J Geosci **10,** 445 (2017).

13. Rawat K. S et al. (2020). Parameterizing the modified water cloud model to improve soil moisture data retrieval using vegetation models. Hungarian Geographical Bulletin, 69(1), 17-26.

14. Mishra A.K and Rawat K.S (2017), Remote Sensing of Precipitation over India from combined observations of GPM and MFG, SENSED, Society for remote sensing and photogrammetry (RSPSoc), ISSN: 2319-7706.

15. Kumar R et al. (2013), Evapotranspiration mapping for agricultural water management: An overview, Journal of Applied and Natural Science, Vol. 5 (2), pp 522-534 ISSN: 097-9411.