"Estimation and Comparison of Evaporation Losses by different Empirical methods"

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Abstract - *Water is precious gifts of god. The use of water by man, plants and animals is universal. Without it, there can be no life. Every living thing requires water. So water is life. Now a day the use of water is increasing rapidly with our growing population. Already there are acute shortages of both surface and under-ground waters in many parts of the country. Carless pollution and contamination of the streams, like, reservoir, wells, and other under-ground source has greatly impaired the quality of available water. This pollution results because of improper disposal of waste water both domestic as well as industrial.*

Evaporation is the process by which water is converted into gaseous state. Evaporation is an important process in the hydrologic cycle preceding precipitation. It is the process by which water in the liquid form transforms into vapour through the transfer of energy. When water is converted from solid state to vapour state without passing through liquid state then it is called sublimation.

Key Words: **Evaporation, Empirical Methods, Pan Evaporation**

1. INTRODUCTION

- Estimation of evaporation using different methods and its comparison with Pan Evaporation.

- Selection of the suitable method that provides the possibility of the realistic/accurate estimate of evaporation from the free water surface of the reservoir.

- Suggestion of coefficient of the different methods and finding out the suitable method amongst it in comparison with pan evaporation rate.

1.1 Study area

Dantiwada Dam is situated at Dantiwada Village of Banaskantha District. Dantiwada Dam is a mud and masonry dam on the West Banas River near Dantiwada, Banaskantha district of northern Gujarat in India. Constructed in 1965, the dam is meant for irrigation and flood control. The Dantiwada dam is Situated at 24°45'N latitude and 71°03'E longitude.It has a length of 6km and a mean width of 0.50 km covering the area of 3.24 sq km.
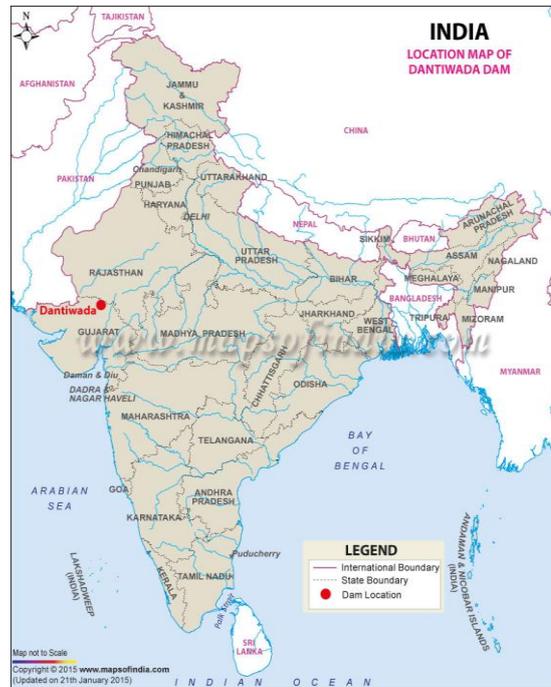

Figure: 1 Map of India showing location of Dantiwada dam in Gujarat

1.2 Data used in the study

- Meteorological data: Minimum and Maximum Temperature, Relative humidity, Wind speed, Sunshine hours.

- Climatic and Meteorological data are collected from The Meteorological Department of C. P. Collage of Agricultural, S. D. Agricultural University, Dantiwada.

- Reservoir data are collected from executive engineer posted on dam site.

	Mayer's	Rohwer's	Thronthwait	Blaney-Criddle	Papadakis
Winter (Nov to Feb)	7.17	7.09	1.51	4.72	4.27
Summer (Mar to Jun)	14.55	16.01	5.24	8.17	5.80
Monsoon (Jul to Oct)	10.33	13.60	4.40	4.86	3.67

1.3 Methodology

- Evaporation rate is obtained by Meyer, Rohwer, Blaney-Criddle, Papadakis, & Thornthwait methods (Empirical methods).

- Comparing evaporation rate by pan values (mm/day) to the evaporation rate obtained by above mentioned methods.

- To obtain correction factor by comparison.

- Statistical Analysis

- Conclusion (which method should be more precise)

2. Result and Analysis

By using the collected data, computation of monthly evaporation is carried out using Meyers's formula, Rohwer's formula, Papadakis formula, Thornthwaite formula, BlaneyCriddle formula, Panmen formula and compared with Pan Evaporation Value.

Pan evaporation values obtained from the calculation were ranging from 2.02 mm/day to 13.95 mm/day with an average of 6.78 mm/day. According to values obtained from the previous calculation the best suited method in comparison with the Pan Evaporation value is Blaney-Criddle Method. While using Blaney-Criddle method evaporation values obtained from the calculation were ranging from 0.63 mm/day to 11.99 mm/day with an average of 5.92 mm/day. These values are near to the Pan Evaporation values. The results that were obtained by various different methods carry out wide variations due to the methods which depend upon various factors.

The average values of estimated evaporation rate for all the methods and pan evaporation rate are given below:

Values of evaporation computed by different method are compared with the rate of evaporation obtain by pan methods. In order to get the better estimation of evaporation by various method, Correction factor are suggested. To find out the acceptable value of Evaporation rate (mm/day), the correction factor were been calculated dividing the year into three seasons i.e., winter season (November to February), summer season (March to June) & Monsoon season (July to October). Accordingly various methods are modified.

The average values of Modified evaporation rate for all the methods and pan evaporation rate are given below:

	Mayer's	Rohwer's	Thronthwait	Blaney-Criddle	Papadakis
Winter (Nov to Feb)	4.45	4.46	4.91	4.48	4.48
Summer (Mar to Jun)	10.48	10.73	10.80	10.21	10.21
Monsoon (Jul to Oct)	5.87	5.99	5.82	7.05	6.05

3. CONCLUSIONS

Evaporation rates are estimated using the five different methods i.e., Meyer's method, Rohwer's method, Thornthwaite method, BlaneyCriddle method, and Papadakis method, the computed values of evaporation are compared with the values of evaporation measured by Pan. On the basis of their comparison the Evaporation value of the Blaney-Criddle method were nearly similar to that of the Pan Evaporation value, whereas, the other four methods including Meyer's method, Rohwer's method, Thornthwaite and Papadakis method were over estimated. So, on the basis of the calculation, Blanley-Criddle method showed a good Evaporation rate compared to others.

	Mayer's	Rohwer's	Thronthwait	Blaney-Criddle	Papadakis
Winter (Nov to Feb)	0.62	0.63	3.25	0.95	1.05
Summer (Mar to Jun)	0.72	0.67	2.06	1.25	1.76
Monsoon (Jul to Oct)	0.46	0.44	1.32	1.45	1.65

In season wise computation, before modification, Papadakis method is suggested for estimation evaporation rate as the average rate is 4.27 mm/day which is nearly equal to 4.31 mm/day for winter season. Blaney-Criddle method is suggested for estimation evaporation rate as the average rate is 8.17 mm/day which is nearly equal to 10.10 mm/day for summer season. Blaney-Criddle method is also suggested for estimation evaporation rate as the average rate is 4.48 mm/day which is nearly equal to 5.78 mm/day for Monsoon season.

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