

## Short Research Article

# Estimation of Potential Reference Evapotranspiration in Bhavanisagar Block of Tamil Nadu using FAO ETo Calculator

### ABSTRACT

The FAO Penman-Monteith equation is used by the ETo calculator [software](#) to calculate [reference evapotranspiration](#) ETo from meteorological data [Raes and Munoz \(2009\)](#). FAO chose this technique as the standard because it is physically based, roughly approximates grass ETo in the studied region, and explicitly considers both physiological and aerodynamic aspects. The application can handle climate data on a daily, ten-day, and monthly basis [\(López et al., 2009\)](#). The data may be supplied in a variety of units, and it can be analyzed using regularly used meteorological parameters. In this study, ETo calculator version 3.2 is used to estimate the [Potential Evapotranspiration ETo](#) in Bhavanisagar. The results revealed that, [it is possible to estimate ETo by using the ETo calculator version 3.2 is found be estimating the Potential evapotranspiration](#). The concept of the reference evapotranspiration was introduced in this study and the result obtained are used further to estimate the evaporative demand of the atmosphere independently of crop type, crop development and management practices.

**Keywords:** [ETo Calculator](#); [Potential Evapotranspiration](#); [South West Monsoon](#); [North East Monsoon](#).

### 1. INTRODUCTION

The FAO's Land and Water Division created the ETo calculator [software programme](#). Its main purpose is to compute FAO-recommended reference evapotranspiration (ETo) [\[1\]\(Allen et al., 1998\)](#). ETo is the evapotranspiration rate from a non-water-scarce reference surface. The reference surface is a huge, homogeneous grass field that is used all throughout the world. The reference crop is kept short, properly hydrated, and actively developing under ideal agronomic circumstances [\[2\]\(Valle et al., 2021\)](#). The FAO Penman-Monteith equation is used by the ETo calculator to calculate ETo from meteorological data [\[3\]\(Raes and Munoz \(2009\)\)](#). FAO chose this technique as the standard because it is physically based, roughly approximates grass ETo in the studied region, and explicitly considers both physiological and aerodynamic aspects. The application can handle climate data on a daily, ten-day, and monthly basis [\[4\]\(López et al., 2009\)](#). The data may be supplied in a variety of units, and it can be analyzed using regularly used meteorological parameters. When data for some meteorological variables is absent, processes are utilised to estimate missing climatic data using temperature data or specified climatic circumstances, as detailed in the Irrigation and Drainage Paper No. 56: "Crop Evapotranspiration" [\[1\]\(Allen et al., 1998\)](#). Even if the information just provides maximum and lowest air temperatures, credible estimates for ten-day or monthly ETo can be obtained (Eilerse et al., 2007). The FAO-ETo calculator version 3.1 was used to estimate reference evapotranspiration in the Bhavanisagar block in this study.

### 2. MATERIALS AND METHODS

#### 2.1 Study Area

Bhavanisagar is a revenue block in the Erode district of Tamil Nadu, India. Bhavani River, a major tributary of the Kaveri River originates from Nilgiri hills of the Western Ghats flows through this block and forms the major source of irrigation in this area. Bhavanisagar dam is located on the river Bhavani and the dam is used to divert water to the lower Bhavani Project for irrigating dry parts of the district (Fig. 1).

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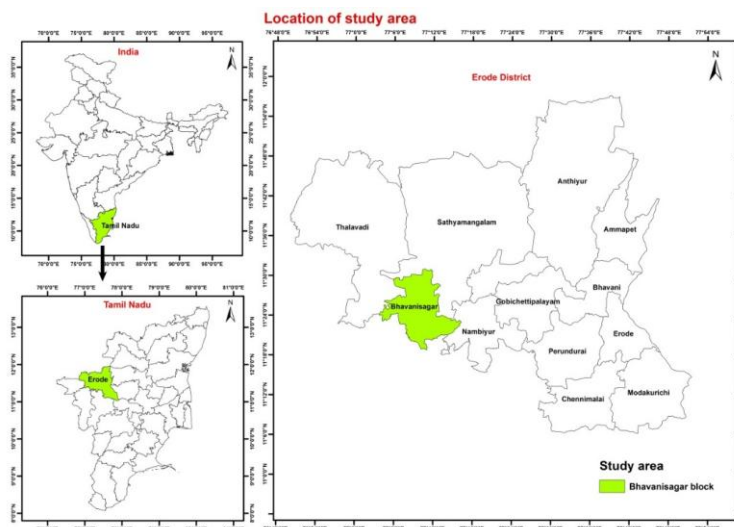


Fig 1. Study area of Bhavanisagar block

## 2.2 Weather Data and Estimation of Reference Evapotranspiration

Indian Meteorological Department (IMD) data from 1980 to 2020 was used in this study

## 2.3 Potential evapotranspiration

The Penman - Monteith equation is used widely for computing the  $ET_o$ , recommended by the FAO in 1998. Many studies found that the Penman-Monteith is more appropriate for many regions (Alexandris *et al.*, 2008). In PAP basin, total potential evapotranspiration ( $ET_o$ ) was estimated through built in FAO Penman – Monteith equation as shown below using  $ET_o$  calculator version 3.2 developed by the FAO (Jabloun and Sahli, 2008).

$$ET_o = \frac{0.408\Delta(R_n - G) + \gamma \frac{900}{T+273} U_2 (e_s - e_a)}{\Delta + \gamma(1 + 0.34U_2)}$$

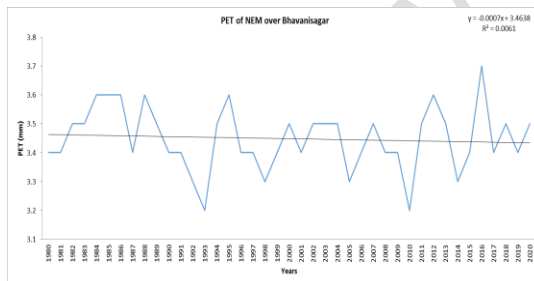
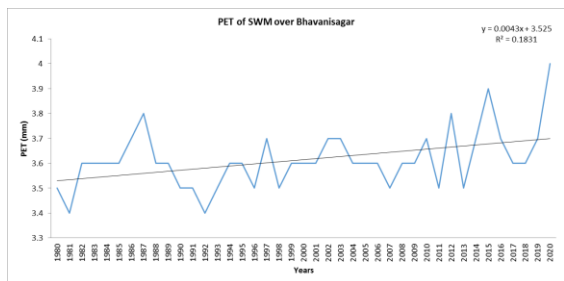
Where,

$ET_o$  is the potential reference evapotranspiration rate ( $\text{mm}\cdot\text{day}^{-1}$ );  $G$  is the soil heat flux density ( $\text{MJ}\cdot\text{m}^{-2}\cdot\text{day}^{-1}$ );  $T$  is the mean daily air temperature at 2 m height ( $^{\circ}\text{C}$ );  $U_2$  is the wind speed at 2 m height ( $\text{m}\cdot\text{s}^{-1}$ );  $e_s$  is the saturation vapour pressure (KPa);  $e_a$  is the actual vapour pressure (KPa);  $\Delta$  is slope of vapour pressure curve ( $\text{KPa}\cdot^{\circ}\text{C}^{-1}$ );  $\gamma$  is the psychrometric constant ( $\text{KPa}\cdot^{\circ}\text{C}^{-1}$ );  $R_n$  is the net radiation at the crop surface ( $\text{MJ}\cdot\text{m}^{-2}\cdot\text{day}^{-1}$ ).

## 3. RESULTS AND DISCUSSION

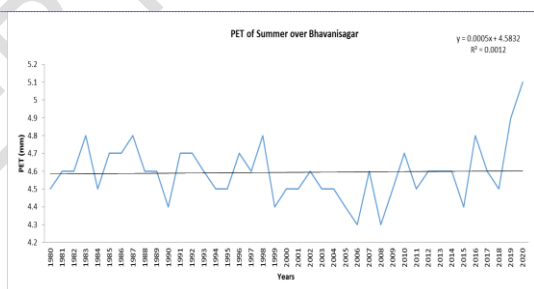
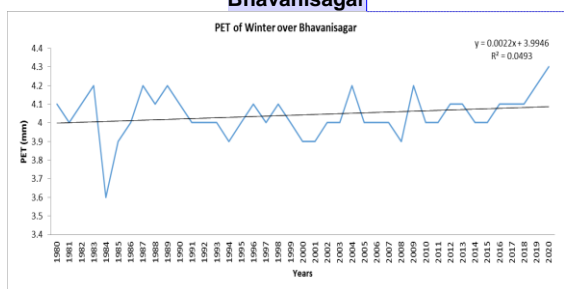
The average annual  $PET_o$  of Bhavanisagar was  $3.9 \text{ mm}/\text{day}^{-1}$ . The  $PET_o$  values per day ranged between  $3.8$  to  $4.4 \text{ mm}/\text{day}^{-1}$  respectively. While analyzing the seasonal  $PET_o$  variations over Bhavanisagar, the average  $PET_o$  value of southwest monsoon season (Figure 2) was  $3.6 \text{ mm}/\text{day}^{-1}$ , and the  $PET_o$  values varied between  $3.4$  to  $4 \text{ mm}/\text{day}^{-1}$ . In northeast monsoon season (Figure 3), the average  $PET_o$  value was  $3.4 \text{ mm}/\text{day}^{-1}$ , and it is varied between  $3.2$  to  $3.7 \text{ mm}/\text{day}^{-1}$ , whereas in winter season (Figure 4) the average  $PET_o$  value was  $4.0 \text{ mm}/\text{day}^{-1}$  and varied between  $3.6$  to  $4.3$

mm/day<sup>-1</sup>. During the summer season (Figure 5), the average PET<sub>o</sub> was 4.6 mm/day<sup>-1</sup>, and it was varied between 4.3 to 5.1 mm/day<sup>-1</sup> respectively. While comparing to all the four seasons, the PET<sub>o</sub> was higher during Summer season, it is due to increased temperature during this season, followed by winter season it may due to the diurnal variation prevailed in the area, followed by Southwest monsoon season. The Northeast monsoon season had least PET<sub>o</sub> in the Bhavanaisagar, it may due to the rainfall effect, while northeast monsoon (NEM) is considered to be the major rainfall season in Bhavanaisagar.



**Fig 2. Reference evapotranspiration PET in the southwest monsoon season of SWM over Bhavanaisagar**

**Fig 3. PET of NEM over Bhavanaisagar**



**Fig 4. PET of Winter Season over Bhavanaisagar**

**Fig 5. PET of Summer Season over Bhavanaisagar**

#### 4. CONCLUSION

The results revealed that EToC calculator version 3.2 is found to be estimating the Potential evapotranspiration. The concept of the reference evapotranspiration was introduced in this study and the result obtained are used further to estimate the evaporative demand of the atmosphere independently of crop type, crop development and management practices.

#### REFERENCES

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**Comment [U5]:** Adjust as suggested in the abstract.

**Comment [U6]:** References need to be revised. Consult the last published issue of this Journal.

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