Short Research Article

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

ABSTRACT

The FAO Penman-Monteith equation is used by the ETo calculator to calculate 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 analysed using regularly used meteorological parameters. In this study ETo calculator version 3.2 is used to estimate the Potential Evapotranspiration in Bhavanisagar. The results revealed that 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 programme. Its main purpose is to compute FAO-recommended reference evapotranspiration (ETo) (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 (Valle *et al*., 2021). The FAO Penman-Monteith equation is used by the ETo calculator to calculate 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 analysed 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"(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 (Eilers *et al*., 2007). The FAO-ETo calculator version 3.1 was utilised 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).

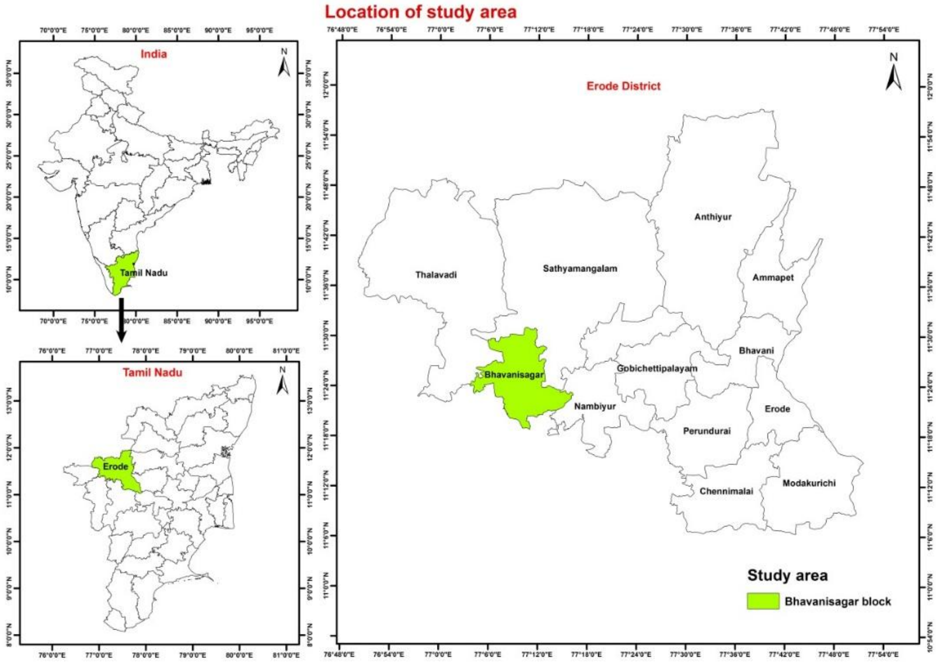

Fig 1. Study area of Bhavanisagar block

2.2 Weather data

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_0) 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).

$$ET_0 = \frac{0.408\Delta(R_n - G) + \gamma \frac{900}{T+273} U_2(es - ea)}{\Delta + \gamma(1 + 0.34U_2)}$$

Where,

ET_0 is the potential evapotranspiration rate ($mm.d^{-1}$), G is the soil heat flux density ($MJ.m^{-2}.day^{-1}$) ; T is the mean daily air temperature at 2 m height (^oC); U_2 is the wind speed at 2 m height ($m.s^{-1}$); ed is the saturation vapour pressure (KPa); ea is the actual vapour pressure (KPa); Δ is slope of vapour pressure curve ($KPa.^0C^{-1}$); γ is the psychrometric constant (KPa, $^0C^{-1}$); Rn is the net radiation at the crop surface ($MJ.m^{-2}.day^{-1}$).

3. RESULTS AND DISCUSSION

The average annual PET of Bhavanisagar is 3.9 mm/day. The PET values per day ranged between 3.8 to 4.4 mm/day respectively. While analyzing the seasonal PET variations over Bhavanisagar, the average PET value of South west monsoon season (Figure 2) was 3.6 mm/day and the PET values varied between 3.4 to 4 mm/day. In North east monsoon season (Figure 3), the average PET value was 3.4 mm/day and it is varied between 3.2 to 3.7 mm/day, whereas in winter season (Figure 4) the average PET value was 4.0 mm/day and varied between 3.6 to 4.3 mm/day During the summer season (Figure 5) the average PET was 4.6 mm/day and it was varied between 4.3 to 5.1 mm/day respectively. While Comparing to all the four seasons the PET 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 South West monsoon season. The North east monsoon season had least PET in the Bhavanaisagar, it may due to the rainfall effect, while NEM is considered to the major rainfall season in Bhavanaisagar.

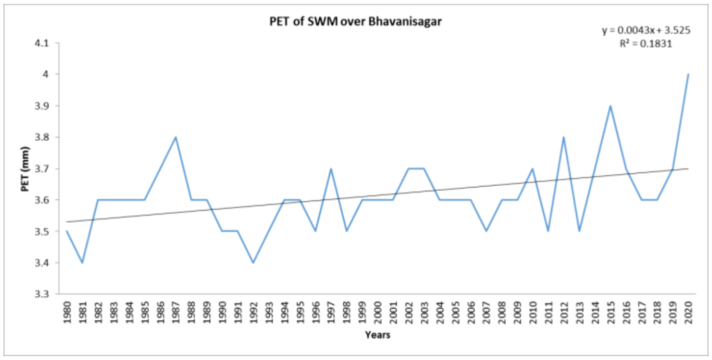

Fig 2. PET of SWM over Bhavanisagar

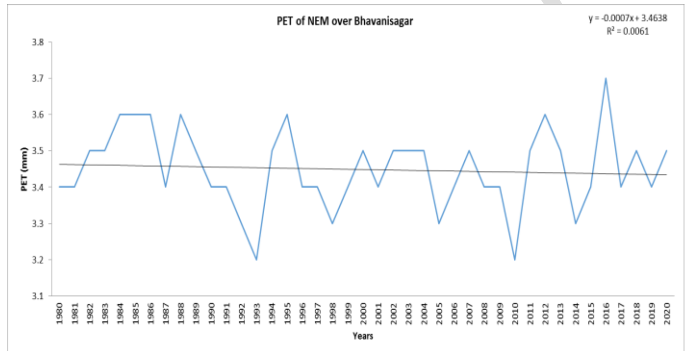

Fig 3. PET of NEM over Bhavanisagar

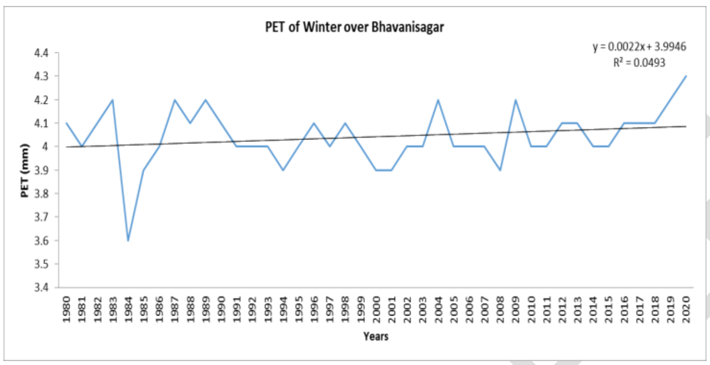

Fig 4. PET of Winter Season over Bhavanisagar

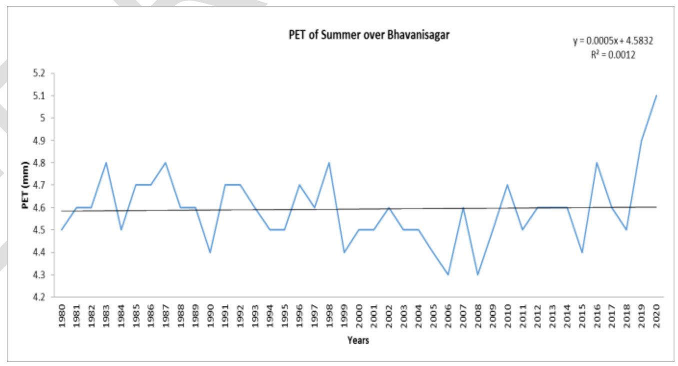

Fig 5. PET of Summer Season over Bhavanisagar

4. CONCLUSION

The results revealed that 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.

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