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Research Paper :

Comparison of several reference evapotranspiration methods for hot and humid regions in Maharashtra

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ABSTRACT

The accurate estimation of reference crop evapotranspiration (ETo) in the water balance or irrigation scheduling allows us to improve the crop water management practices. The present study was planned to estimate the reference crop evapotranspiration (ETo) with four different evapotranspiration estimation methods *viz.*, Pan Evaporation, Blaney-Criddle, Hargreaves- Samani and Priestly-Taylor. These methods were then compared with FAO Penman - Monteith (FAO-56) to test capabilities to predict daily ETo under the given climatic conditions of southern hot and humid region of *Konkan* platue in Maharashtra state. Daily weather data of Shindhudurg region for 15 years was used for the analysis. The estimated ETo and statistical parameters based on coefficient of regression, root mean square error and average deviation indicated that Blaney-Criddle is the most reliable and accurate methods for estimation of ETo for Konkan region of Maharashtra. Under the unavailability of data on all weather parameters the preference for ETo estimation method for Konkan region should be Blaney-Criddle, Hargreaves-Samani, Pan evaporation and Pristley-Taylor.

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Being an agricultural based country, agriculture sector plays a dominating role in Indian economy. Major source of water for agriculture in the country is the rainfall, which receives mostly from South West monsoon during the period from June to September. However, uneven and erratic nature of rainfall necessitates the use of irrigation water more efficiently to avoid the loss of crop yields. Evapotranspiration is one of the major hydrological components for water resource assessment and budgeting. Hence reliable and consistent estimate of evapotranspiration is necessary in the context of many issues, for example, crop production, efficient management of water resources, scheduling of irrigation, evaluation of the effects of changing land use on water resources and environmental assessments. Similarly efficient irrigation management requires exact quantification of evapotranspiration

Reference crop evapotranspiration (ETo) is defined by several workers (Jensen *et al.*, 1990; Smith *et al.*, 1992) as the rate of evapotranspiration from an extensive surface of green grass cover of uniform height, actively growing, completely shading the ground and not short of water. Since, direct measurement of ETo for short grass is difficult, time consuming and costly, the most practical approach would be to estimate ETo from climatic variables, such as solar radiation, air temperature, relative humidity and wind speed. Several methods were developed to estimate reference crop evapotranspiration from climatological data involving equations ranging from the most complex energy balance methods requiring detailed climatological data (Allen *et al.*, 1989) to simpler methods requiring less data (Hargreaves and Samani, 1982; Samani, 1985). Some of these methods need several weather parameters as input while others need fewer. Among the methods of evapotranspiration estimation some techniques have been developed partly in response to the availability of data (Lee *et al.*, 2004).

FAO Penman-Monteith (F-PM) method is preferred as the standard and accurate method for daily ETo estimation (Jensen *et al.*, 1990; Allen *et al.*, 1998). However, the major constraint of this method is the requirement of extensive weather data such as air temperature, relative humidity, wind speed and solar radiation which could not be easily available at many places. In addition to the use of complicated unit conversions and lengthy calculations, the reliable quality data and difficulties in data collection present another serious limitation for this method.

In contrast, there are other methods requiring data on only one or two weather parameters and give comparatively better ETo estimates such as Thornthwaite requiring monthly average air temperature and