

Application of FAO 56-PM for estimation of evapotranspiration from forest and rice field in Itoshima peninsula area

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This paper represents an application of Penman-Monteith equation standardized by the Food and Agriculture Organization (FAO56-PM) simultaneously with crop coefficient approach (single crop coefficient) for the estimation values of reference evapotranspiration (ET_o) and crop evapotranspiration under standard conditions (ET_c) from forest and rice field. Seven year daily meteorological data from Jan 1996 to Dec 2002 derived from Maebaru AMeDAS station and Fukuoka local meteorological station was used in Itoshima peninsula, western region of Fukuoka City, Japan. The reference crop that used in calculating ET_o was considered as a hypothetical crop with an assumed height of 0.12 m having a surface resistance of 70 s m⁻¹ and an albedo of 0.23. The standard conditions refer to crops grown in large fields under excellent agronomic and soil water conditions. The aim is to introduce an effective water resources management for Itoshima area regarding that it will have a future change in land use due to the construction of the new campus (Ito campus) of Kyushu University.

In the study area, the average annual precipitation during 7 years (1996-2002) is 1646 mm/year, approximately, more than 50% of which occurs in June to August. Air temperature ranges from 19.2C - 31.1C in summer and 1.7C - 15.4C in winter months. Daily mean temperature in summer is 23.3C and 9.6C in winter. On the other hand, daily mean minimum and maximum relative humidity are 35% and 95% with annual average of 67% respectively. The daily average of wind speed is 2.1 m/s. The elevation of the ground surface ranges from 0.2 m. at the lowest point to about 400 m. a. s. l. The lowland area is used for agriculture such as greenhouse farming and paddy fields.

In the present study the FAO56-PM method was applied to compute the daily ET_o values from daily meteorological data and then to estimate the ET_c values for forest and rice field from there crop coefficients by means of crop coefficient approach. In the crop coefficient approach ET_c is calculated by multiplying ET_o by a crop coefficient (K_c).

The daily average value of ET_o for 7 years is 2.79 [mm/day]. The calculation procedure for ET_c consists of:

1. Identifying the crop growth stages, and selecting the corresponding K_c coefficients.
2. Adjusting the selected K_c coefficients for frequency of wetting or climatic conditions during the stage.
3. Constructing the crop coefficient curve; and
4. Calculating ET_c as the product of ET_o and K_c.

The calculated result of the daily average value of ET_c from rice field is 4.3 [mm/day], and from forest is 2.37[mm/day]. The ET_c calculated in the present study is the crop evapotranspiration under the standard field conditions where the conditions encountered in the field differ from the standard conditions, the strong need for local calibration of K_c under given climatic conditions is required. K_c should be adjusted to the field conditions under the environmental effects. The present study was designed in order to be as a key factor in computing the regional water budget and also as a key element of managing water resources.