OPTIMAL COMPARISON OF EMPIRICAL EQUATIONS FOR ESTIMATING POTENTIAL EVAPOTRANSPIRATION IN TAIWAN

JIN-FA CHEN[1] HSIN-FU YEH[2] CHENG-HAW LEE[3] and WEI-CHENG LO[4]

[1]Assistant Professor, Department of Information Management,
Kao Yuan Institute of Technology, Kaohsiung 821, Taiwan, ROC.
(Tel: +886-7-6077777-2400, Fax: +886-7-6077097, e-mail: jinfa@cc.kyit.edu.tw)
[2] Doctoral Student, Department of Resources Engineering, National Cheng Kung University, Tainan 701, Taiwan, ROC.
(Tel: +886-6-2757575-62840-31, Fax: +886-6-2380421,
e-mail: n4893105@ccmail.ncku.edu.tw)
[3]Professor, Department of Resources Engineering,
National Cheng Kung University, Tainan 701, Taiwan, ROC.
(Tel: +886-6-2757575-62833, Fax: +886-6-2380421, e-mail: leech@mail.ncku.edu.tw)
[4] Assistant Professor, Department of Hydraulic and Ocean Engineering, National Cheng Kung University, Tainan 701, Taiwan, ROC.
(Tel: +886-6-2757575-66364, Fax: +886-6-2741463, e-mail: lowc@mail.ncku.edu.tw)

Evapotranspiration is an important component of the hydrosphere and atmosphere, as well as plays an active role in the hydrological cycle. According to Kite (2000) about 65% of the precipitation on the earth surface evaporates back into the atmosphere. Evapotranspiration is attributed to two sources: one is the direct evaporation of water from the surface; the other is the exchange of water vapour that occurs at the leaves of plants as a consequence of water extraction from the soil by the root system. Evapotranspiration is notoriously difficult to measure, because of complex interaction between water and energy fluxes subject to a variety of atmospheric, soil and vegetable conditions. The concept of potential evapotranspiration is an attempt to characterize the micrometeorological environment in terms of an evaporative power or demand, that is in terms of the maximal evaporation rate that the atmosphere is capable of exacting from an area of given surface properties (Hillel, 1998). There are a number of methods to estimate potential evapotranspiration, which are (a) the Penman-Monteith combination, (b)temperature-based, (c) radiation-based, (d) mass-transfer, (e) water budget, respectively (Xu and Singh, 2002). The problem of estimating potential evapotranspiration has been studied by many researchers, among which the Penman-Monteith equation is especially excellent. Jensen et al. (1990) indicated that Penman-Monteith combination showed excellent performance in both arid and humid climates. This study provides an overview of the results of six different methods of estimating potential evapotranspiration that are compared with the Penman-Monteith equation result in Taiwan. Finally, three statistical criterions are used to establish the optimal parameter suitable to the local hydrological condition of Taiwan.

This study provides a comparison of the results using six different equations in estimating potential evapotranspiration occurred in Taiwan with the Penman-Monteith equation. Three statistical criterions are applied to establish the optimal parameter in the native country. We conclude that it is much simple to estimate the potential evapotranspiration when the recalibrates are in original parameter values. The rate of change of potential evapotranspiration in different seasons ranges between 2.0 mm/day and 6.0mm/day in Taiwan. Our study also indicates that potential evapotranspiration is relatively high in summer and relatively low in winter. A comparative study also shows that the Hargreaves-Samani equation and the Priestley-Taylor equation overestimate the 5-year (1998-2002) potential evapotranspiration, but the Blaney-Criddle equation, the Kharrufa equation, the Makkink equation and the Hargreaves equation underestimate. It is evident that a better result for parameter estimation can be obtained through recalibration with the Penman-Monteith equation. Thus, the parameters we determined for six selected models will indeed prove useful information for estimating potential evapotranspiration in Taiwan.

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