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Estimation of Evapotranspiration using the Modified Hargreaves Equation by Genetic Algorithm

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In this study, the Hargreaves monthly correction factor is presented to estimate the reference evapotranspiration. For the analysis, I used daily weather data from 1989 to 2018, at 67 meteorological stations located throughout the Korean peninsula.

A large number of more or less empirical methods have been developed over the last 50 years by numerous scientists and specialists worldwide to estimate evapotranspiration from different climatic variables. The FAO Penman-Monteith method is recommended as the sole ETo method for determining reference evapotranspiration. However, the Penman-Monteith method has the disadvantage of inputting a lot of weather data. In addition, there is a lack of meteorological data when using old historical data or as a test bed for developing countries.

In the case of the Hargreaves method, the reference evapotranspiration can be estimated only if the latitude, maximum and minimum temperatures of the meteorological station are known. However, the accuracy of the results is not as good as that of the Penman-monteith method. Thus, using the genetic algorithm method suggested the monthly correction factor of the Hargreaves method each station. The reference evapotranspiration amount calculated by Penman-Monteith was set as the true value, and the learning period of genetic algorithm was set from 1989 to 2013, and the validation period was set from 2014 to 2018.

In order to verify the model efficiency, the root mean square error decreased and the correlation coefficient increased when the monthly correction coefficient was applied to the reference evapotranspiration calculated by the Hargreaves method.

It is very important to estimate the reference evapotranspiration amount in order to develop the water long-term plan.

With the development of measuring equipment and technological capabilities, it is now possible to simulate the state of nature as if it were real, but many problems arise when using historical data or analyzing developing countries.

If the monthly correction coefficient suggested in this study is applied, it is possible to estimate the standard evaporation amount with a more approximate value.

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