



Comparing Empirical Methods in Evapotranspiration Estimation based on Lysimeter Data: A Case Study of Kashan plain

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Extended Abstract

Introduction: Estimation of evapotranspiration at a regional level is an important element in efficient management of water resources. Evapotranspiration includes the evaporation from the surface of soil and water and also, the transpiration by the plant that is very important in arid and semi-arid areas. There are many empirical methods for evapotranspiration estimation of reference plants, but these methods don't produce the same results for all areas. Lysimeter studies are carried out to determine the most suitable method in each area.

Material and Methods: The study area in this research is located in Kashan University, based in the center of Kashan plain with geographical coordinates of $^{\circ} 45' 21''$ east longitude and $^{\circ} 18' 00'' 34$ northern latitudes. Then, to measure the evapotranspiration of the reference grass plant, three drained lysimeters of the grass plant and one control lysimeter were made and used in the research site for 6 months within the statistical year of

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2012-2013. Moreover, empirical methods of evapotranspiration estimation and evaporation pan were compared based on lysimeter data.

Results: Using lysimeter in the project area, the estimation results for monthly evapotranspiration were reported as being 24.49, 38.39, 51.52, 73.87, 119.77, and 180 mm in January, February, March, April, May, and June, respectively. Moreover, from among the methods investigated, Thornthwaite turned out to be the most accurate ones with $R^2 = 0.95$, $R=0.97$, $NSC= 0.986$, $RMSE=4.29$, and $MBE= -1.15$, being considered as the most suitable method for evapotranspiration estimation in the study area. After that, modified Jensen Hayes, Blaney –Criddle, Jensen-Hayes, Hargreaves-Samani, evaporation pan, and FAO-Penman-Monteith were considered as other useful methods in that regard though with lower accuracy. Finally, the Penman method with $R^2 = 0.58$ was found to have the least accuracy from among the relevant methods considered.

Discussion and Conclusion: Kashan is one of Iran's arid regions which faced a severe shortage of water resources. Therefore, careful planning and efficient management of water resources is required to avoid any serious problem in providing water for different purposes. The evapotranspiration parameter is considered as an important criterion in determining the extent of drought in different areas. Experimental methods for estimating evapotranspiration including the Penman and FAO-Penman-Monteith require many meteorological parameters. Penman method has been introduced for humid climates of England and is not suitable for the arid and semi-arid conditions of Kashan. As it considers a large number of climatic parameters in its calculation of evapotranspiration, this method has acceptable accuracy, but as all the required information is not calculated, it cannot provide a good estimate. In this study, the appropriate evapotranspiration method for the Kashan region was obtained, using the data gathered over six months in the statistical year of 2012-2013. Therefore, to ensure the accuracy of the results obtained, it is recommended that this research continues for at least the next two or three years. On the other hand, due to a possible error in the drainage lysimeter when calculating the actual evapotranspiration, it is recommended that the research get conducted in the region via accurate weight lysimeters so that it could identify the most appropriate method of estimating evapotranspiration in Kashan more accurately.

Keywords: Evaporation pan, Experimental methods, Thornthwaite, Grass reference plant, Drainage lysimeter.