Improved model for studying hydrological process in the field-to-filed irrigation system

Arash Ebadi[1], Omid Raja[1], Hamed Ebrahimian[1], Mohammad Reza Yazdani[2], and Vahid Rezaverdinejad [3]

[1]University of Tehran
[2]Rice Research Institute of Iran
[3]Urmia University

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Abstract

One of the common irrigation systems in the paddy fields is field-to-field irrigation. The management of these irrigation systems is difficult and essential because of the water scarcity. Estimating the parameters affecting the water balance in paddy fields is necessary by considering the irrigation requirements of downstream fields. The objective of this study is to develop a computational model for calculating the water balance components including the irrigation return flows in paddy fields. The irrigation return flow is considered the main factor of water supply in downstream fields. The developed model is able to calculate the crop evapotranspiration, deep percolation, surface water storage, soil moisture, irrigation return flow, and irrigation efficiency. Field data including the outflow discharge and ponding water depth from the paddy fields during the growing season was used to evaluate the model. Five fields were investigated, which the upstream field was being irrigated continuously, and the return flows were transferred into the downstream fields. The model's water balance error was about 0.5 %. The Root Mean Square Error (RMSE), Nash-Sutcliffe Efficiency (NSE), and coefficient of determination (R2) for simulation of outflow discharge were 0.124 L/s, 0.827, and 0.893, respectively. These indices were 9.6 mm, 0.884, and 0.909 for simulation of ponding water depth on paddy fields, respectively. The results showed that the model performed well to simulate outflow discharge and ponding water depth. Hence, the management of the water balance components in paddy fields would be much easier through the modelling water flow to increase the irrigation efficiency.

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