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(In the Field of Irrigation & Drainage)

The Application of Satellite Data, Field and Simulation Models to Manage Water Supply and Demand in Sistan Plain Irrigation System

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Abstract

Optimal use of water through review of water resources allocation and proper supply and demand management in the management of irrigation and drainage networks, is necessary. Evaluation of irrigation networks is possible using various tools including simulation models and satellite techniques. Simulation models are able to simulate the components of water balance and water and solute transport in soil with high time accuracy. On the other hand, by using satellite techniques, the surface phenomena of the earth can be estimated with high accuracy. Therefore, in this study, according to the advantages of satellite information and simulation models, a combination of satellite, farm and simulation information was used to study and improve irrigation planning and management in Sistan plain farms. For this purpose, the actual evapotranspiration rate was estimated using SEBAL algorithm and Landsat۸ satellite images with high temporal and spatial resolution. Then, taking into account the current situation of exploitation of water resources, different irrigation water committees and utilization of field information, SWAP simulation model was calibrated and validated. To determine the irrigation schedule (time and depth), water production functions applied to wheat crop were used. The cultivated lands of the study area are approximately ٦٠,٠٠٠ hectares per year, of which more than ٩٠٪ are cultivated wheat. For this purpose, the required information of SWAP model was measured in ١٢ wheat fields under different quantitative, qualitative and water management conditions. The amount of evapotranspiration of the selected fields was estimated using LANDSAT۸ satellite images and SEBAL algorithm and was considered as the actual evapotranspiration in the field. After measuring the required data from the monitoring farms, the SWAP model was calibrated and validated to estimate product performance. R۲, RMSE, CRM and MAE indices were used for quantitative comparison of results. These indices in the SWAP model were ٧٧٪, ١٣٠ kg / ha, ٠ and ١١١ kg / ha in validation, respectively. To improve the irrigation calendar in the region, irrigation planning scenarios based on daily allowable stress and irrigation planning based on allowable drainage of easy water defined in the SWAP model were used. In order to improve irrigation planning in the region, a total of ٢٦ scenarios were examined in five sections. In general, the results showed the best results of the model in terms of water efficiency in the scenarios of the fourth section (irrigation depth, number and dates of variable irrigation), especially scenario ١٤ (soil water + sixteen irrigations with a depth of ٤٠ mm in the proposed dates of the model) Was seen. However, if there is no water restriction in the area, in other words, it is flooded, other scenarios can be used, including Scenario ٢١ (ratio of actual transpiration to potential ٥٠٪ with irrigation depth of ٨٠ mm). Also, in case of water shortage and drought, scenario ٦ can be used (٢٠٪ reduction of irrigation depth in the current conditions and water removal for the second time).

Keywords: Irrigation planning, SWAP Model, Irrigation Management, LANDSAT۸ Satellite Images, SEBAL Algorithm