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Hydrological Simulation of the Upper Hirmand Transboundary Catchment Using SWAT Model

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Abstract

One of the major challenges in water resources management is the operation of trans boundary watershed. This has been experienced in case of Helmand River between Iran and Afghanistan since the last century. For such a situation, application of a conceptual rainfall-runoff models that can simulate management scenarios is a relevant tool. The SWAT model can be a relevant option in this regard. However, the required hydro-climatic data for them is a serious obstacle. Especially, this problem gets exacerbated in the case of Afghanistan with poor infrastructures. So, application of this type of model would be more problematic. This paper aims to investigate capabilities of SWAT for the simulation of rainfall-runoff processes in such a data-scarce region and the upper catchment of Helmand River is used as the case study. For this purpose, discharge data of Dehraut station from 1969 to 1979 along with some metrological data were prepared and used to calibrate and validate the simulations. The results were acceptable and the coefficients of determinations (R^2) during calibration and validation periods were 0.76 and 0.70, respectively. Notably, with respect to snowy condition of the basin, the elevation band option of the snow module of model had a significant effect on the results, especially in the base flows. Moreover, two Landsat satellite images during February 1973 and 1977 when the basin was partly covered with snow was prepared and compared with the SWAT outputs. Similarly, the results showed good performance of the model such that R^2 were 0.87 and 0.82, respectively.

Keywords: Swat model, transboundary watershed, Snow cover area, Landsat image, Helmand River.

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