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Development and application of SWAT to paddy rice district at watershed scale

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Abstract: In irrigation district, especially in paddy rice fields, agricultural irrigation water use has a great influence on the natural water cycle process at watershed scale. In this study, SWAT model was modified to simulate irrigation water demand and quantify the irrigation return flow coefficient and the irrigation impact coefficient in paddy rice fields. Due to the lack of irrigation observed data, a multi-water source module was add to SWAT to build several feasible extraction scenarios, and a new algorithm of automatic irrigation application was implemented too. According to the simulation accuracy, the optimal scenario was selected to use in the new SWAT model, and then was applied to Changge Irrigation District in Hulan River Basin, northeast China. Comparisons between the enhanced model and old one were conducted at outlet cite, sifangtai. The results showed that the proposed SWAT has higher precision during calibration and validation periods, Nash coefficient of the simulated monthly flow was from 0.74 and 0.69 to 0.88 and 0.80 respectively. in addition, the annual averaged irrigation water and return water were 78 million m3 and 41 million m3, the irrigation return flow coefficient was 0.52, average consumption of irrigation water accounted for 10% of the total runoff. In general, the developed model had been greatly improved as compared to original model.

Keywords: SWAT model, hydrological modeling, rice, irrigation return flow coefficient, irrigation impact coefficient