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New methodology to develop high-resolution rainfall data using weather radar for watershed-scale water quality model

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ABSTRACT

Watershed-scale water quality models are often used for interpreting changes in complex environmental systems. Precipitation is a primary control affecting the output of watershed-scale water quality model, and higher resolution of precipitation data is highly desirable. The objective of this study was to investigate whether the radar rainfall estimates can improve the accuracy of stream flow, TSS load, and TP load simulations with the soil and water assessment tool for high- and low-flow conditions. Yeongsan River watershed (YRW) was selected for this study. This watershed, located south-west of Korean Peninsula, has an area of about 2,938 km^2, and is divided into 25 sub-watersheds. The simulations were conducted under different rainfall datasets: (1) rainfall observations from nine ground rain gauges (GR), (2) 25 corrected radar rainfall estimates (RR), and (3) a combination of nine ground rain gauges and 16 corrected radar rainfall estimates that represent the 16 ungauged sub-watersheds in YRW (GARR). Simulation results under different the rainfall datasets were compared using the Nash–Sutcliffe efficiency coefficient and percentage bias. The prediction of both high and low stream flows using GARR was better than using GR and RR data. The model performance for predicting TSS load was significantly better under GARR data than under GR and RR data. In case of TP, the model performances using RR and GARR data were significantly better than that using GR data. Overall, combining gauge rainfall and corrected radar rainfall led to an improvement in the prediction accuracy for the watershed-scale water quality model.

Keywords: Radar rainfall image; Soil and water assessment tool; Watershed-scale water quality model; Bias correction; Stream flow; TSS load; TP load

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