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Assessment of NEXRAD and Rain Gauge Precipitation Data for Hydrological Response Predictions in the St Joseph River Watershed, USA

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Precipitation is a major driving force variable behind all hydrologic processes needed for watershed modeling studies. The use of point-scale rain gauge data in watershed hydrologic models may not effectively capture the spatial distribution of rainfall; thereby, directly affecting the water balance and introducing large uncertainty in the modeling outcome. Rain gauges typically measure the depth of precipitation within a 100 cm2 sampling area (i.e., tipping bucket). Although they usually provide high quality data, a dense rain gauge network must be established to capture the spatial variability of precipitation in an area. Spatially distributed precipitation, such as radar precipitation products from the Next Generation Weather Radar (NEXRAD) of the U.S. National Weather Service, should provide better estimates of the rainfall distribution over large watershed areas. However, NEXRAD estimates may introduce errors due to drop size distributions of rainfall and properties inherent in the radar measurement system. Consequently, there is a need to evaluate NEXRAD Stage III precipitation data against rain gauge precipitation data that are not included in the processing algorithm, as they become available before being used in hydrologic studies. Thus, the objective of this study was to examine the possible sources of error in the Stage III product through radar-gauge intercomparisons using a 3-yr record (2005-2007) of precipitation data from the Agricultural Research Service, National Soil Erosion Laboratory in northeastern Indiana, USA. The results show that the Stage III system estimated an average of 1035.5 mm of precipitation over the rain gauge network area while rain gauges recorded an average of 955.1 mm. The differences in total precipitation depth and percent bias between the Stage III and rain gauge data were 80.4 mm and 8.4 percent, respectively. Stage III overestimation was observed at four out the five rain gauges. Modeling results of watershed hydrologic response using NEXRAD and/or rain gauge precipitation data as input are provided.