Implications of input spatial aggregation on a watershed model

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Abstract. This paper presents a computational framework for quantifying the impacts of watershed delineation on the complexity, performance, and identifiability of sediment processes in a watershed model. Sediment yields from a watershed have important implications for water quality and water resources. Water quality issues arise because sediments serve as carriers for various pollutants, such as nutrients, pathogens, and toxic substances. Watershed models are often used to model sediment transport through the watershed and provide information on abatement strategies and their location for pollutant control. Accurately representing sediment processes in a watershed model is reliant upon a reasonable hydrologic network representation. Currently, watershed delineation and extraction of stream networks are accomplished with GIS databases of digital elevation models (DEMs). The most common method for extracting channel networks entails the a-priori specification of a critical source area that is required for channel initiation. There are no established guidelines on how to select the critical source area, and the nature of the channel network is very sensitive to this value. As a result, the channel network can be viewed at multiple scales within the same watershed. Thus, for the same watershed and DEM data, users may obtain markedly different channel networks, and subsequently the watershed model results and nonpoint source control strategies could be affected as well. The proposed computational analysis, comprised of multivariate and tree regression analyses, is linked with the Soil and Water Assessment Tool (SWAT) to determine the optimum channel network extent that provides the best model performance. The tradeoff between computation time, performance and complexity of SWAT will be investigated using ten different water configurations.

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