

Topographic uncertainty and catchment-based models

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ABSTRACT

Topographic attributes are key parameters in numerous models to assess sediment or nutrient input into surface waters. A broad range of digital elevation models (DEM) and algorithms bring, however, uncertainty to topographic interpretations. This may raise the question whether empirical, semi-distributed models can cope with such uncertainty. In this study, primary and complex topographic attributes related to soil loss and distributed sediment delivery were computed from DEM with cell widths between 10 and 1,000 m. Correlation and regression analyses were conducted with average values of the catchments of 138 German gauges spanning different terrain. Two slope, single-flow routing and slope-length algorithms were also included to evaluate their effects. Although either choice mostly induces significant changes of catchment means of slope, flow length, slope-length factor and sediment delivery ratio (SDR), Spearman's rank correlation coefficients are generally above 0.9. It is suggested from the data that linear or slightly curved functions are suitable to adapt average topographic attributes computed from differently resolved DEM or by different methods. Empirical catchment-based models can thus cope with topographic uncertainty and model users may implement these equations to compare model outputs. However, the catchment delineation and stream definition may constrain their application.

Keywords: Algorithm; Correlation; Digital elevation model; Resolution; Topographic attribute
