A physically-based method for channel extraction in a watershed model

Emily L. Boyd[1] and Mazdak Arabi
Department of Civil and Environmental Engineering, Colorado State University

Abstract. This paper presents a physically-based method for extracting thresholds for channel initiation for use in watershed models. Sediment yields from a watershed have important implications for water resources and water quality when various pollutants, such as nutrients, pathogens, and toxic substances, are carried by sediments into streams. Watershed models are often used to model this 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 representation of the hydrologic network. Currently, watershed delineation and extraction of stream networks are accomplished with GIS databases of digital elevation models (DEMs). A user specification of a critical source area that is required for channel initiation is the most common method for extracting channel networks. There are no established guidelines on how to select the critical source area, upon which the nature of the channel network is very sensitive. Thus, the channel network can be viewed at multiple scales within the same watershed and DEM data. As a result, users may obtain markedly different channel networks, and, subsequently, the model results and nonpoint source control strategies could be affected as well. The proposed method is comprised of a slope-area relationship and compared with National Hydrography Datasets to determine physically-based guidelines for choosing a critical source area in watershed modeling. The analysis provides a better understanding of the spatial scale at which channel initiation occurs in a watershed.

[1] Tel: (970) 492-2838; e-mail: Emily.Boyd@colostate.edu