Simulating Channel Geomorphic Change in Semi-Arid Watersheds

Darius J. Semmens, David C. Goodrich, Waite R. Osterkamp

Abstract

An event-based distributed simulation model for geomorphic change in semi-arid watersheds has been developed for use on intermediate-scale watersheds. The model incorporates the general KINEROS design, including rainfall, infiltration, erosion, and sediment transport, with a new variable parameter Muskingum diffusion model for stream channel routing, and a geomorphic model for computing changes in channel geometry using the concept of stream power minimization. The model is also been adapted to run continuously, and track cumulative geomorphic change resulting from a series of rainfall-runoff events. Testing of the geomorphic model has been carried out on the Walnut Gulch Experimental Watershed in southeastern Arizona. Detailed rainfall records and repeat measurements of channel geometry were used to develop several multiple-year input data sets for separate calibration and validation of the model. The model is designed to address the need for evaluating distributed management impacts on sediment fluxes through and within large ephemeral channel networks typical of semi-arid environments. It thereby permits the assessment of local impacts as they relate to the larger watershed system, as well as cumulative regional impacts on the channel network. The model is also useful for the assessment of channel stability, and the classification of watersheds in terms of their susceptibility to channel destabilization, riparian habitat degradation, and increased sediment yields. These new assessment capabilities are currently in the process of being added to the Automated Geospatial Watershed Assessment Tool (AGWA).

Keywords: geomorphic, modeling, channel networks

Semmens and Goodrich are with the USDA-ARS, Southwest Watershed Research Center, Tucson, AZ 85719. E-mail: dsemmens@tucson.ars.ag.gov. Osterkamp is with the U.S. Geological Service, Desert Laboratory, Tucson, AZ 85745.