Geophysical Research Abstracts,
Vol. 11, EGU2009-10076-2, 2009
EGU General Assembly 2009

Parameter Changes from Upscaling of a Local Scale, Process-Based Erosion Model

S. Jomaa (1), D. A. Barry (1), G. C. Sander (2), and P. Heng (2)

(1) Ecological Engineering Laboratory, École Polytechnique Fédérale de Lausanne, Switzerland (seifeddine.jomaa@epfl.ch, andrew.barry@epfl.ch), (2) Department of Civil and Building Engineering, Loughborough University, UK (g.sander@lboro.ac.uk, b.c.p.heng@lboro.ac.uk)

Soil erosion affects agricultural productivity, the natural environment and infrastructure security. Soil loss and its associated impacts are important environmental problems. Consequently, model-based predictions of erosion are beneficial for a variety of applications. Process-based erosion models are used to forecast sediment transport concentration as it varies temporally and spatially. Of these, the one-dimensional Hairsine-Rose model describes multiple particle size classes, rainfall detachment, flow-driven entrainment and deposition. This model has been evaluated for different experiments, and has been shown to reliably explain experimental data in a consistent manner.

It is common on both the hillslope and laboratory scales to apply one-dimensional erosion models even though the overland flow and sediment transport is two-dimensional. One-dimensional parameter determinations, which are based typically on outflow data, implicitly average the two-dimensional flow. Here we compare experimentally and numerically this averaging process for the Hairsine-Rose model. For this purpose, laboratory experiments were performed using different configurations of the 2 m $\times$ 6 m EPFL erosion flume. The flume was divided into 4 smaller flumes, with widths of 1 m, 0.5 m, and 2 $\times$ 0.25 m, but otherwise identical. A series of experiments was to provide data sets for analysis by the Hairsine-Rose model. After running the experiments, the amount of the eroded sediment in each subplot was assessed by comparing the temporal variation of eroded mass to evaluate the effect of, and sensitivity to, transverse width on erosion dynamics. The surface elevation changes due to erosion were examined to provide further understanding of the erosion data. A high resolution laser scanner provided details of the soil surface in the form of digital terrain maps before and after the experiment. This method presents a promising way for identification of spatial distribution pattern of eroded soil.

In addition, we ran simulations using a fully two dimensional implementation of the Hairsine-Rose model for erosive flows with varying topography with spatially dependent flow and erosion input parameters to produce both outflow hydrographs and suspended sediment graphs. The data were integrated transversely and, as for the experimental data, the one-dimensional Hairsine-Rose model was used to fit the integrated data and so provide parameter estimates to compare with the two-dimensional input values.