Simulating sediment transport with GIS

Holger Schäuble
Institute of Applied Geosciences, Technical University of Darmstadt
Email: holger.schaeuble@gmx.de

How do climate, relief, lithology, soils, vegetation and other geo-factors influence suspended sediment fluxes in a river catchment? And which is the most important one? Questions like these become more and more important in geomorphology, sedimentology and environmental protection. Up to now however it was not possible to quantify the sediment fluxes in large river basins in an accurate way. Small-scale erosion models like the well-known (R)USLE or WEPP are not appropriate because they were made to calculate hillslope erosion by surface runoff only. Large-scale sediment yield models like those of Syvitski et al. (2005), Harrison (2000), Ludwig & Probst (1998) or Ahnert (1970) are not appropriate as well. They have been created by multiple regression analysis and do not consider the spatial-temporal variability of controlling factors and the sediment retention by man-made sinks (dams and reservoirs). To overcome this situation the new GIS-based concept AGISY (= Advanced GIS-based Sediment Yield Modelling) has been developed (Schäuble, 2005). AGISY optimizes large-scale sediment yield models by an iterative routing algorithm. During that task, the temporal and spatial variability of controlling factors are considered as well as the sediment retention by dams and reservoirs. AGISY has been implemented in STools (= Sediment Yield Tools), an ArcView 3.x add-in. The applicability has been proven for all geozones located in the USA. US-specific sediment yield models created with AGISY achieve a coefficient of determination (r^2) which is raised up to 80% compared to models without AGISY. Similar improvements are expected for other geozones as soon as important datasets will be available, e.g. comprehensive database about the trap-efficiency of dams or high-resolution datasets about precipitation. In this presentation the most fundamental principles of AGISY and STools will be demonstrated. The software STools can be downloaded free of charge from: www.terracs.com.

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