US Army Corps of Engineers®
Engineer Research and Development Center

Research Brief: Watershed Scale Sediment Model

Issue

Sediment yield from watersheds is an integral part of nonpoint source contributions to excessive sediment in receiving waters and can adversely affect Corps of Engineers water resource projects. A reliable and accurate model is needed to assess watershed sediment erosion and transport so that management practices can be evaluated and downstream problems can be diagnosed.

Objective

Produce a watershed analysis and management model that will serve as a component of the Inland Morphology Modeling System and has the ability to simulate

- Movement of water.
- Sediment and associated constituents at the watershed.
- Regional scales for long-term periods (weeks to years) and single storm events.

Research/Design

The existing comprehensive watershed hydrology model Gridded Surface Subsurface Hydrologic Analysis, or *GSSHA,* provides a prudent starting point for TMDL (total maximum daily load) analysis at the watershed/regional level because of its stability, robustness, and applicability in a variety of hydrologic regimes. While *GSSHA* currently contains empirical sediment erosion, deposition, and transport, the model requires modifications before it can be extended beyond the scope of hydrologic analysis at the watershed scale. In order to simulate sediments, *GSSHA* requires the ability to simulate sediment source/sink areas and a viable transport algorithm. To extend the capability of *GSSHA* beyond watershed analysis for a limited time period, *GSSHA*'s structure needs to be more flexible and model parameters need to reflect their known seasonal variability. The following improvements to the model will be made:

- Overland transport - Transport of sediments/constituents on the overland flow plane will be added.
- Source/Sink Terms - On the overland flow plane sediment erosion, transport and deposition will be quantified based on first principle equations.
- Seasonality of parameters - The *GSSHA* model requires a large number of parameters in order to simulate the many physical processes that determine hydrologic response and is lacking parameters for other than summer calculations.
- Restructuring for compatibility-- The model will be structured so that it can be embedded in the Inland Morphology Modeling System (created separately under RSM).

Application

The model will be used to manage water and sediment at the watershed and regional scales by varying the model grid size, and combining a number of watershed models to create a single regional model. Because the model is physics/process based, the model is not application/scale specific and can work in any type of hydrologic regime. This feature allows the model to be extrapolated to assess future conditions such as application of best management practices. Because the model will provide both overland and in-stream sediment flows, TMDLs and effects of management practices can be evaluated for both the overland and in streams and rivers. Compatibility with data from various geographic information system applications as well will allow Corps engineers and scientists to use the model for hands-on and management projects.

Products

Links and information will be posted here. View online at http://www.wes.army.mil/rsm/.

Research Team

Charles W. Downer, Ph.D., PE, Principal Investigator, CEERD-HC-HW, U.S. Army Engineer Research and Development Center, 3909 Halls Ferry Rd., Vicksburg, MS 39180-6199, phone 601-634-2473.