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Estimation of Soil Erosion and Sediment Yield in Karso Catchment Using ANSWERS model

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ABSTRACT

Quantitative assessments of runoff and soil erosion are needed for proper management of land and water resources. Four basic factors influence runoff and soil erosion by water: climate, soil properties, topography and landuse practices. It a common knowledge that these factors show large spatial variability and any effort to simulate runoff and soil erosion must take this fact into consideration. The distributed parameter models could be used to take spatial heterogeneity of a watershed into consideration. The mapping and management of such spatial information require use of new technologies such as satellite remote sensing and Geographical Information System.(GIS)

In this study, a spatially distributed model, the Areal Nonpoint Source Watershed Environmental Response Simulation (ANSWERS) has been used to simulate surface runoff and erosion in Karso watershed in Bihar, India. The model divides catchment into square elements (grid cells) and uses the connectivity of the cells (derived from slope aspect values) and the continuity equation to route flow to the catchment outlet. Three erosion processes are considered: detachment of soil particles by raindrop impact, detachment of soil particles by overland flow, and transport of soil particles by overland flow. The quantity of erosion or deposition occurring within each cell is estimated based on the erodibility of the soil and land cover type of the cell, the rate of flow passing through the cell, and the quantity of sediment in the flow passing through the cell. A series of topographic (elevation, slope, aspect), soil (porosity, moisture content, field capacity, infiltration capacity, USLE K factor), land cover (percent cover, interception, USLE CP factor, surface roughness, retention), channel (width, roughness), and rainfall inputs are required for each element.

The GIS techniques have been utilised to spatial discretization of the Karso catchment in to grids. Model input parameters such as land forms, drainage, soil, landuse/land cover were derived from digital analysis of Landsat Thematic Mapper data with limited ground truth. Information about slope and aspect were generated in a GIS from Survey of India Toposheets. The model predicted hydrographs and sediment graphs within acceptable limits. Besides temporal variation of soil erosion, the model also predicted spatial distribution of soil erosion in the watershed. Based on spatial predictions of the model, the sources of soil erosion have been identified in the watershed.