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Developing a new geomorphological distributed model. Application in Goodwin Creek experimental catchment.

J. Montoya (1), F. Francés (1), P. Julien (2)

(1) Department of Hydraulic Engineering and Environmental, Universidad Politécnica de Valencia, Spain. (2) Engineering Research Center, Colorado State University, USA.

TETIS is a conceptual distributed hydrological model created to simulate the hydrological process involved during a storm event. Is a complex model that represents a catchment as a cell arrangement interconnected by the topographic configuration, derived from a Digital Elevation Model. At each cell of the catchment, the model made a water balance in a bucket type conceptualization. With this conceptual approach it is possible to simulate the three main runoff components: direct runoff (produced by Hortonian and saturation runoff), interflow and base flow. The hydraulic approach used in the TETIS model is based in an approximation of the Kinematic Wave; it's assumed a fixed bed in each cell in which is applied a balance equation. The hydraulic characteristics are estimated using "at station" and "downstream" river morphological equations by Leopold and Maddock. This approach is named "Geomorphologic Kinematic Wave".

TETIS has been improved with the incorporation of erosion, sediment transport and deposition processes follow the approach used in the CASC2D-SED model. CASC2D-SED model has been developed to determine the runoff hydrograph generated from any temporally-spatially varied rainfall event. When using the erosion/sedimentation module, sediment rates can be predicted at any location as well. The CASC2D-SED adopts the Green & Ampt infiltration equation and uses the Hortonian overland flow process. When the precipitation rate exceeds the infiltration rate, the excess rainfall will accumulate as surface water and begin to flow.

In the new geomorphological model, called TETIS-SED, the erosion/sedimentation rates are calculated as a function of the hydraulic properties of the flow, the physical

properties of the soil and the surface characteristics. The modified Kilinc-Richardson equation is used to determine the upland sediment transport by grain size (silt, clay, and sand) from one cell into the next one. Sediment by size fraction is routed in the channels using the Engelund and Hansen equation in one dimension. This formulation depends on hydraulic parameters (hydraulic radius, flow velocity and friction slope) and particle characteristics (specific gravity and particle diameter).

TETIS-SED model had been tested in the Goodwin Creek experimental catchment, located in Panola County, Mississippi, USA. The catchment had an area of 21 km2. The catchment is operated by the National Sedimentation Laboratory (NSL), and it is organized and instrumented for conducting extensive research on upstream erosion, instream sediment transport, and catchment hydrology. The model performance was judged to be quite reasonable. In the calibration event, the average relative percent difference between simulated and observed total volume of sediment was -0.33%. The differences between CASC2D-SED and TETIS-SED in the hydrological approach makes it necessary to consider a correction factor in the sediment and erosion processes in TETIS-SED model, specifically in the modified Kilinc-Richardson equation. In the spatial and temporal validation events, the range of average relative percent difference between simulated and observed total volume of sediment was between +89 % and -85 %.