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# Development of the surface runoff-erosion model SMODERP2D

Petr Kavka, Jakub Jerabek, Karel Vlasak, and David Zumr

Czech Technical University in Prague, Faculty of Civil Engineering, Department of irrigation, drainage and landscape engineering, Prague 6, Czech Republic (petr.kavka@fsv.cvut.cz)

Model SMODERP2D is an spatial distributed physically based event model designed to calculate and predict soil erosion and runoff from small catchments. The basic processes included in the model are: infiltration (Phillips equation), surface runoff (kinematic wave based equation), surface retention, and surface roughness and vegetation impact on runoff and erosion. In SMODERP2D is included explicit solution of rill erosion and flow, which is often solved only implicitly. Although the rill geometry and formation is still simplified, it remains to be a challenging task. The main application of SMODERP2D is a design of technical soil conservation measure at a single plot or at a small catchment scale. SMODERP2D is therefore capable of calculating a flow in ditches, brooks and small streams in order to quantify the impact of such features on the erosion and water runoff from an area. Scientific applications in an erosion research are however also possible. SMODERP2D was developed as a tool for widespread GIS software ArcGIS. The physical relations were implemented through Python scripts. These scripts use ArcGIS system tools for input rasters and vectors processing. Direction of surface flow is calculated by steepest descent algorithm in the presented version of 2D model. Parameters of surface runoff equation were calibrated on the set of measurements performed on the laboratory rainfall simulator for five different soil textures. For modelling of the rills a specific submodel was created. This submodel uses Manning formula for flow estimation. Numerical stability of the model is solved by Courant criterion. Stream flow submodel was added for calculation and design of channel and stream characteristics. We also present how the input data can be obtained based on available resources (soil maps and data, land use, terrain models, field research, etc.) and how can the model be used in the assessment of a soil erosion risk and in designing of erosion control measures. Case study on five different types of catchment is presented. Goal of this case study was sensitivity analyses of the model with different parameter sets. An usage of the SMODERP2D model for hill-slope to stream and within the hill-slope stream connectivity is presented besides the case study.
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