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Surface runoff simulation to mitigate the impact of soil erosion, case study of Třebsín (Czech Republic)

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The relation between soil erosion and its redistribution on land strictly depends on the process of surface runoff formation during intensive rainfall. Therefore, interrupting and reducing continuous surface runoff, using adequate conservation measures, may be implemented in order to reduce the shear stress of flowing water. This paper describes the outcomes of the KINFIL model simulation in assessing the runoff from extreme rainfall on hill slopes. The model is a physically based and parameter distributed 3D model that was applied at the Třebsín experimental station in the Czech Republic. This model was used for the first time to simulate the impact of surface runoff caused by natural or sprinkler-made intensive rains on four of the seven different experimental plots. The plots involved in the analysis contain a variety of soils which are covered with different field crops. At this stage, the model parameters comprise saturated hydraulic conductivity, field capacity, sorptivity, plot geometry and surface roughness reflecting the Třebsín experimental plots. These parameters were verified on observed data. All seven plots had the same slope angle, but two of them were vulnerable to surface runoff due to their soil hydraulic parameters. There were rapidly increasing depths and velocities which consequently caused a higher shear stress for splashing soil particles downstream. The paper provides further information and data concerning the relationships between the depth of water and its velocity on the slopes of certain roughness. It also provides information concerning shear stress and shear velocity values, compared with their critical values depending on the soil particle distribution. This approach is more physically based than the traditional method of Universal Soil Loss Equation (USLE).

Keywords:

hydrological model; shear stress; shear velocity; soil loss

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