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Runoff generation in shallow hillslope soils at watersheds with different forest cover

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Our study evaluates the water regime and focuses specifically on runoff generation for a shallow hillslope soil and on the possible impact of the type of vegetation covering the watershed. Using numerical models, the water regime of the shallow hillslope soils is evaluated in relation to precipitation in summer seasons during which extreme hydrological conditions were observed. Shallow subsurface flow is considered to be an important component of the studied watershed response to intensive rainfall. Flow in a hillslope soil is modeled as superposition of two components: one-dimensional vertical flow in two communicating flow domains: the soil matrix domain and the preferential flow domain, and one-dimensional downhill saturated flow along the impervious or less permeable soil-bedrock interface. The S1D DUAL code, designed to simulate flow and transport in dual continuum systems, is applied to data observed at the experimental watersheds with different forest cover to simulate vertical flow. Subsequently, model HYPO solving one-dimensional Boussinesq equation is used for simulating shallow saturated subsurface flow. To evaluate the process of runoff generation, simulated fluxes at the boundaries are compared with the observed specific discharge rates. Using simulated pressure head, the water regime of the soils at the watersheds with different forest cover is examined. For extreme rainfall-runoff events, the measurements as well as model responses indicate that the retention and accumulation of water at all studied watersheds are quite limited independently of vegetation cover. The shallow subsurface runoff seems to be one of the dominating processes which determine the response of the studied upland watersheds to intense rainfall. So far, no transparent evidence was found that the difference in water regime of the studied watersheds is caused by a particular vegetation cover. This research has been supported by research grants GACR 205/05/2312 and AVCR AV0Z20600510.