

VALIDITY OF QUASI-3D HILLSLOPE HYDROLOGICAL MODELS

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Hillslope response to precipitation remains a central problem in catchment hydrology. For hydrological modelling, 3D models are often applied. Since these models often have large computation times, lowering it would offer the possibility of using novel data to calibrate and validate. This gives rise to a renewed interest for quasi-3D and analytical models. In this study we compare the results from different types of quasi-3D analytical hydrological models with the results of a distributed, physically-based 3D Richard's equation model. The focus is mainly on modelling hillslope subsurface flow. The purpose is to determine under which conditions the quasi-3D models are valid. The three analytical models that are investigated are models based on the kinematic wave approximation, the linearized Boussinesq equation and the non-linear Boussinesq equation. Simulations are carried out for different precipitation intensities, varying from none to intense precipitation, for different hillslopes and hillslope angles. We define nine characteristic hillslopes by combining three plan and three profile curvatures (viz. concave, convex or straight). The results of the 3D model will be used to determine the performance of the analytical models. Comparison of the quasi-3D with the full 3D model shows the performance of the former under different circumstances and by this the applicability.