Physical, Mechanistic Hillslope Hydrology Model: Development and Applications

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Abstract. In this paper we show improvements to, and applications for, an ongoing hillslope modeling project. A previously developed overland flow model that implements the full hydrodynamic equations has been improved to include a one-dimensional implementation of Richard’s equation for infiltration. The new model (HYDROR) allows, before impossible, investigations into the impact of fine scale variability, length scale $O(10^{-2}) [m]$, of many hillslope physical characteristics (e.g., soil moisture, erosivity) on distributed hillslope rainfall-runoff characteristics and morphology.

Experimental studies of hillslope rainfall – water and sediment runoff have become invaluable to scientists for lumped and distributed water and erosion model calibration. These experimental studies are often done by separating hillslopes into plots, applying known rainfall and measuring the water and sediment runoff. However we predict that this systematically under predicts runoff and sediment removal because run on and interactive infiltration are not allowed. We use HYDROR to examine how plot size and rainfall event length affect the influence of slope separation on rainfall / runoff response.