



Hillslope rainfall-runoff thresholds: Macroscale process behavior and catchment similarity metric?

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Many streamflow-regime indicators exist for regionalization of hydrological information. However, few provide event-based process criteria to be used for catchment grouping and classification. Here we explore the physical meaning of widely-observed hillslope rainfall-runoff thresholds and their potential use as a macroscale descriptor and similarity metric. We describe a combined field-modeling study at the Maimai experimental hillslope, South Island, New Zealand. We present a simple reservoir-based model that captures the dominant subsurface flow behavior at the site resulting in the whole-slope threshold mechanism. We then calibrate and evaluate the model with multiple objective criteria from various field campaigns at the site, including hydrograph, tracer and internal state response data. A series of virtual experiments using the calibrated model are presented to examine the relative controls on the threshold amount of rainfall necessary to induce flow and the slope of the rainfall-runoff line following threshold flow initiation. Catchment-scale data from the Maimai 208 catchment and four catchments at the HJ Andrews Experimental Forest in Oregon, USA are used as proof-of-concept of our proposed catchment similarity metric.