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A study of the effect of moving storms on hillslope hydrology using laboratory experiments

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Hillslope geometry and storm movements have a marked influence on flow and erosion. Modeling of hillslope hydrology normally assumes that rainfall storms are stationary, i.e. a storm upon arrival over a hillslope remains stationary during the rainfall event and then disappears instantaneously. Further, many studies assume average values for valley flank slopes, meaning that curved surfaces are modelled as straight ones. These assumptions introduce errors in hillslope response models. The objective of this study therefore is to investigate the effect of storm movement and surface geometry on the hydrologic response of hillslopes.

Using an electrically driven rainfall simulator and a 3-segment articulated soil flume, laboratory experiments were carried out to simulate the effect of storm movement and different hillslope geometries on runoff and erosion response. Both static and moving storms were simulated by moving the rainfall simulator downstream and upstream. Hillslope geometries that were investigated included convex, straight, concave, concave-convex and convex-concave.

The laboratory experiments showed that storm movement and hillslope geometries were important factors determining soil loss and overland flow. Runoff peaks and erosion were higher for downstream moving storms than for upstream moving and stationary storms. Likewise, convex slopes produced more sediment yield than did concave and straightline slopes.