Implications of hillslope connectivity for runoff at catchment scales

Mike Kirkby

University of Leeds, Geography, Leeds, United Kingdom (m.j.kirkby@leeds.ac.uk, 0044 113 3436758)

Modelling on the hillslope scale suggests that the connectivity between rainfall and runoff for a semi-arid area may be summarised in a generalised runoff coefficient, and that much of the variability can be encapsulated in a single runoff threshold, which decreases with both slope length and gradient, for given soil characteristics. Runoff response to rainfall is then a highly non-linear function of the runoff threshold, asymptotically tending to 100% rainfall in extreme events. Realistic runoff responses depend on the frequency with which storm rainfalls exceed the runoff threshold.

Scaling up to the catchment, storm response depends on the distribution of runoff thresholds around the catchment, and catchment runoff is a balance between runoff generated and channel infiltration losses.

On decadal time scales, changes in slope morphology and drainage density will adjust runoff threshold to roughly match dominant storm sizes, so that we may expect higher drainage densities where slopes are steep and soils less permeable and, conversely, we may attempt to estimate runoff thresholds from observed slope morphologies and rainfall statistics.