Precipitation transition probabilities as a function of area size represented

Ying Zhao

School of Natural Resources and the Environment, University of Arizona,

Tucson, AZ 85719, USA

Abstract: Transition probability refers to the probabilities of rainfall occurrence on a given day following a previously wet or dry day. It is an essential parameter for many stochastic rainfall generators, which can be used in hydrological and soil erosion models. The objective of this study was to find how different spatial scales affect the calculated transition probabilities. We chose Walnut Gulch Experimental Watershed as the study area, since it has a dense network of 88 rain gages operated currently. Daily precipitation data for the summer months (July-September) from 1964 to 2013 were chosen to calculate the bi-weekly transition probabilities P(W), P(W/W), P(W/D), where P(W) is the probability of a wet day, P(W/W) is the probability of a wet day following a wet day, and P(W/D) is the probability of a wet day following a dry day. Then each transition probability was calculated at seven spatial scales (single gage, 2×2 km^2, 4×4 km^2, 6×6 km^2, 8×8 km^2, 10×10 km^2, whole watershed 149 km^2). Results showed that both P(W) and P(W/W) were greatest for July 16-31 and least for September 16-30. As the area (scale) increased, P(W) and P(W/W) increased for most half months, but the rate of increase became less as the area became larger. There was an exception for the relatively dry period September 16-30, where P(W/W) did not show a significant change with area. These findings present a challenge with regard to spatial scale in representing transition probabilities when building rainfall generators.

Keywords: transition probability, rainfall generator, soil erosion model