Geophysical Research Abstracts, Vol. 7, 05695, 2005
SRef-ID: 1607-7962/gra/EGU05-A-05695

Streamflow generation at the Panola Mountain Research Watershed, Georgia, USA — Inferences derived from model results with varying time scales

N.E. Peters (1), J. Freer (2), H.G. Tromp-van Meerveld (3), K.J. Beven (2), and J.J. McDonnell, (4)

(1) US Geological Survey, 3039 Amwiler Rd., Suite 130 Atlanta, GA, 30360¬2824, USA, (2) Dept. of Environmental Science, I.E.N.S, Lancaster University, Bailrigg, Lancaster, LANCS, LA1 4YQ, UK, (3) EPFL, Civil and Environmental Engineering, CH 1015 Lausanne, Switzerland, (4) Oregon State University, Department of Forest Engineering, Corvallis, OR, 97331, USA (nepeters@usgs.gov)

The conceptualization of streamflow generation at the 41-ha forested Panola Mountain Research Watershed (PMRW) has been refined through hydrologic modeling and data analysis of long-term hydrometric and hydrochemical data. Runoff at PMRW is controlled primarily by two processes, runoff from a 3.6-ha bedrock outcrop and groundwater discharge from a ∼5-m thick riparian zone aquifer. The timing and delivery mechanisms of water from hillslopes, storage and leakage in the bedrock, and evapotranspiration are other major factors affecting the hydrological response of the watershed. For example, the timing of runoff is sensitive to antecedent watershed wetness; wetting fronts takes as much as 1 hour from the time of peak rainfall to the time of peak stormflow during dry antecedent conditions and less than 10 minutes during wet antecedent conditions. This paper compares results of dynamic TOPMODEL and a transfer-function model for different fixed time intervals ranging from 1 minute to 1 day to explore the mechanisms of streamflow generation. The results of the transfer-function model of bedrock runoff significantly improved with the addition of a leaky storage component. Although saturated flow on bedrock occurs on hillslopes during large rainstorms, a tracer experiment showed that flow occurs through the bedrock on the hillslopes during lower intensity but similar magnitude simulated rainfall. Streamflow predictions from these models are compared with the timing of changes in hydrological characteristics in the watershed including soil-moisture content, evapotran-

spiration derived from sapflow measurements, groundwater levels, and a calculated antecedent precipitation index.