Geophysical Research Abstracts
Vol. 13, EGU2011-13197, 2011
EGU General Assembly 2011

Meteorological and Hydrological Processes Controlling Stormflow at the Panola Mountain Research Watershed, Georgia

Jim Freer (1) and Norman Peters (2)

(1) University of Bristol, School of Geographical Sciences, Bristol, United Kingdom (jim.freer@bristol.ac.uk, +44-(0)117-3318388), (2) University of Georgia, Department of Geology, Athens, Georgia, USA (ne_peters@mac.com)

Stormflow was evaluated for the relatively undisturbed, small (41 ha) forested Panola Mountain Research Watershed (PMRW) near Atlanta, Georgia. PMRW contains 10% bedrock outcrop in the headwaters and the remainder of the watershed is covered with a mixed deciduous/ coniferous forest consisting of hickory, oak, tulip poplar, and loblolly pine. Soils are thin (<1 m) on hillslopes and thick ($\leq$5 m) in the riparian zone. Annual precipitation averages 1,250 mm (<1 % snowfall) and runoff averages 360 mm. This presentation will report on the relative importance of hydrological processes and interrelation among meteorological and hydrological metrics for rainstorms during WY1985-WY2007 with the intent of identifying the major processes that need to be represented in modeling stormflow using high resolution 1 min data. The hydrograph characteristics were computed for the basin outlet and for a 10-ha sub-watershed (ephemeral). The meteorological and hydrological metrics were augmented with ancillary soil moisture and groundwater level characteristics (minimums and maximums). The rainfall-runoff analysis computer code (in MatLab), which generated the storm metrics was developed with the intent of applying it to multiple experimental watersheds for inter-site comparison. The contribution of stormflow to the total annual runoff was 43% ranging from 29% to 55% for individual years. The highest rainfall rates are associated with the largest storms, most of which are convective and occur during summer. Maximum streamflow during rainstorms is generally related to the maximum rate of change in rising limb streamflow. Furthermore, the driest antecedent conditions result in the lowest stormflow water yields, but also produce higher maximum rates of change in the rising limb streamflow and lower streamflow maximums than rainstorms occurring under wetter conditions. It is hypothesized that under wetter conditions the lower maximum rates of change in the rising limb streamflow and the generally higher maximum streamflow are likely caused by contributions of multiple hydrological pathways, particular in the lower part of the watershed. The rapid rise in streamflow under dry conditions is likely caused by runoff from a large bedrock outcrop in the headwaters, and direct contribution of rainfall to the stream channel. Dynamics of the riparian zone aquifer affects the timing and magnitude of the stormflow. One of the most striking results of this research however is the complexity in the responses of the catchment and the difficulty of pinning down dominant process representations and causes from a number of response characteristics. We explore the issues this complexity raises and how this impacts on us developing right models for the right reasons in terms of understanding catchment processes where detailed data is available.