Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11983, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11983
EGU General Assembly 2008

A runoff generation process tool developed for a tropical headwater catchment with scarce data

C. Birkel (1,2) and D. Salas Gonzalez (2)

(1) The Macaulay Institute, Craigiebuckler, Aberdeen, AB15 8QH, UK (c.birkel@macaulay.ac.uk) (2) Geography School, University of Costa Rica, San Jose, Costa Rica

Runoff generation processes have been subjectively studied by observations in a tropical headwater catchment in the Costa Rican central volcanic mountains to empirically derive a hydrological response unit (HRU) map, which is considered the adequate tool to improve hydrological modelling approaches implementing maximum process knowledge with a minimum of data and measurement input at the ungauged or data scarce site. GIS methods, remote sensing and extensive fieldwork were utilized to develop an automized process transfer tool to compute the HRU map connecting physiographical characteristics with the subjective process knowledge and the results of a semi-distributed conceptual model applied to the study basin.

This transfer tool might be regionalized to other application sites taking into account typical process indicators. In a tropical environment such as Costa Rica, among these can be mentioned the highly variable topography (slopes), tropical cloud forests as a particularity of land use, deep volcanic soils and aquifer systems and a typical geomorphology characterized by differently scaled landslides, which can be associated to fast, delayed and slow hydrological process patterns. These parameters were derived by photointerpretation, field control and model output, classified after its process affiliation and computed by a weighting superposition procedure to finally obtain a process transfer tool, which can be translated to a runoff generation routine in a distributed hydrological modelling approach and therefore, offers the opportunity for regionalization to other drainage basins and even to other climatic regions across the world.

Slopes over 30 % were categorized to produce fast superficial flow (includes Hortonian overland flow and saturation excess), which was studied by semi-randomly installed overland flow detectors (OFD). This low cost methodology qualitatively identified fast runoff generation zones associated to land use and hydrogeology. Furthermore, the different processes could be distinguished due to infiltration measurements and soil properties analyzed in the laboratory, and by air photo interpretation to detect macro and micro morphodynamic processes. The slope category from 15 - 30 % is considered to consist of fast runoff generation zones, primarily according to land use (urban and mixed use), and of delayed flow due to soil properties. Moderate slopes ($<$ 15 %) produce delayed and slow runoff reactions triggered by hydrogeology and soils with low influence from land use. The application of the conceptual semi-distributed model confirms the importance of quickly moved and concentrated fast runoff components for stormflow generation and delayed and slow runoff generation for streamflow recession.