Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05543, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05543
EGU General Assembly 2008

A quantitative approach to spring hydrograph decomposition

A. Kovacs, P. Perrochet
Golder Associates Hungary Ltd. (attila.kovacs@unine.ch)

A combined analytical-numerical study for the characterization of spring hydrographs has been developed. Two-dimensional analytical solutions for diffusive flux from rectangular blocks of arbitrary shape facilitate a quantitative characterization of exponential hydrograph components. Together with analytical solutions for block discharge, a systematic analysis of numerically simulated spring hydrographs of synthetic karst systems provides an insight into karst hydrodynamics. Analytical solutions suggest that different hydrograph components do not represent different classes of rock permeability. Hydrographs of individual homogeneous blocks can be decomposed into several exponential components. Discharge hydrographs of symmetric rectangular blocks can be reconstructed by the sum of only three exponential components. Increasing block asymmetry results in an increasing number of exponential components contributing significantly to total discharge. A systematic analysis of numerically simulated spring discharges facilitated the extension of the analytical formulae to entire karst systems. When no infiltration is present, the entire recession process is controlled by the recession of individual blocks. Consequently, the hydraulic properties of a karst conduit system have no influence on spring discharge, and spring hydrographs can be simulated by summing individual block discharges. In the case of both concentrated and diffuse recharges into an aquifer, the spring hydrograph can be reconstructed as a sum of individual block discharges and the discharge originating from the conduit network. In the case of temporarily varying recharge, the end of the influence of conduit flow on a hydrograph manifests as an inflection point on the recession limb. Beyond this point, a hydrograph can be decomposed in a similar manner to that of an individual homogeneous block. The present method provides an insight into the hydraulic

behavior of karst hydrogeological systems and enables the estimation of hydraulic parameters and conduit network geometry of karst aquifers by means of spring hydrograph analysis.