

---

Attila Kovács

## The use of hydrograph analysis for the characterisation and modelling of karst systems

Karst aquifers are complex hydrogeological systems with strong heterogeneity originating from the presence of dissolution channel networks. Heterogeneity manifests in the duality (diffuse and concentrated nature) of the hydraulic processes taking place in karst, including recharge, groundwater flow and discharge.

The quantitative characterisation and numerical modelling of karst hydrogeological systems requires the definition of realistic hydraulic and geometric parameters. For this reason, equivalent medium modelling approaches have limited applicability in karst hydrogeology. Direct information on conduit network geometry is rarely available, and classical geological, geophysical and hydrogeological methods provide only limited information on the spatial configuration of hydraulically active conduit networks.

However, in most cases spring and/or well hydrograph data, together with well test results are available, or relatively easily obtainable.

Hydrograph analytical methods include time series analysis and single event analysis. While time series analytical methods are usually used for forecasting, data completion, and correlation analysis, single event methods based on analytical solutions can provide quantitative information on hydraulic and geometric characteristics of karst systems.

Novel analytical methods establish links between aquifer properties and hydrograph characteristics. Both spring and well hydrographs contain important information about the hydraulic functioning of karst systems. A conceptual model with two permeability classes adequately describes the hydrodynamic behaviour of karst.

Generally, spring hydrograph analytical techniques can provide information on the characteristic hydraulic parameters and conduit spacing of a karstic catchment, while well hydrograph analysis usually provides information on the hydraulic and geometric characteristics of individual matrix blocks. The combination of spring and well hydrograph analytical techniques provides a powerful tool for the characterization of the structure and hydraulic functioning of karst systems, as demonstrated on various test sites. Parameters estimated through hydrograph analysis can be fed into numerical groundwater models. Strongly heterogeneous hydrogeological systems can be quantitatively classified based on hydrograph analysis.