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# Estimation of aquifer parameters from the recession of spring hydrographs - Influence of flow geometry

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The recession of spring hydrographs can be used to infer information about hydraulic aquifer properties, such as hydraulic conductivity and storage coefficient, at the catchment scale . Frequently, the approach by Rorabaugh (IAHS Publ. 63, 432–441, 1964) is employed for this purpose. Since this approach was derived for parallel flow from the aquifer to a stream, Sahuquillo and Gomez-Hernandez (Water Resour. Res. 39(6), 2003) questioned its applicability to springs with radial flow geometry. The objective of this work is to assess the influence of the flow geometry on the parameter estimates resulting from the evaluation of recession hydrographs. To this end, the radial flow equation is solved using a finite-difference model and the resulting recession curves are compared to the analytical solution by Rorabaugh. We found that the hydrograph of a homogeneous spring catchment with radial flow approaches the long-term exponential recession much more rapidly than that with parallel flow. But even more important, the recession coefficient itself strongly depends on the flow geometry: In case of radial flow the recession is significantly slower and thus the recession coefficient is lower than that predicted by the parallel flow model. As a consequence, the application of the parallel flow model to observed recession curves results in an underestimation of the hydraulic conductivity (given a constant storage) by an order of magnitude if flow to the spring is actually radial. However, the assumption of a homogeneous radial flow domain may be inappropriate at least in the case of karst catchments where the spring is fed by highly conductive karst conduits: Results from karst evolution models (e.g. Liedl et al., Water Resour. Res. 39(3), 2003) suggest that the hydraulic conductivity of the conduit system increases towards the spring. An increase inversely proportional to the distance from the spring compensates the effect of the decrease in flow cross-section towards the spring. In this case, the recession coefficient is similar to that of a homogeneous model with parallel flow geometry. Thus, the parallel flow approach by Rorabaugh indeed might be suitable for obtaining rough estimates of the hydraulic conductivity of karst aquifers at catchment scale.