Recession curve analysis for groundwater levels: case study in Latvia

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Recession curve analysis is powerful and effective analysis technique in many research areas related with hydrogeology where observations have to be made, such as water filtration and absorption of moisture, irrigation and drainage, planning of hydroelectric power production and chemical leaching (elution of chemical substances) as well as in other areas.

The analysis of the surface runoff hydrograph's recession curves, which is performed to conceive the after-effects of interaction of precipitation and surface runoff, has approved in practice. The same method for analysis of hydrograph's recession curves can be applied for the observations of the groundwater levels.

There are manually prepared hydrograph for analysis of recession curves for observation wells (MG2, BG2 and AG1) in agricultural monitoring sites in Latvia. Within this study from the available monitoring data of groundwater levels were extracted data of declining periods, splitted by month. The drop-down curves were manually (by changing the date) moved together, until to find the best match, thereby obtaining monthly drop-down curves, representing each month separately. Monthly curves were combined and manually joined, for obtaining characterizing drop-down curves of the year for each well.

Within the process of decreased recession curve analysis, from the initial curve was cut out upward areas, leaving only the drops of the curve, consequently, the curve is transformed more closely to the groundwater flow, trying to take out the impact of rain or drought periods from the curve. Respectively, the drop-down curve is part of the data, collected with hydrograph, where data with the discharge dominates, without considering impact of precipitation.

Using the recession curve analysis theory, ready tool "A Visual Basic Spreadsheet Macro for Recession Curve Analysis" was used for selection of data and logarithmic functions matching (K. Posavec et.al., GROUND WATER 44, no. 5: 764–767, 2006), as well as functions were developed by manual processing of data. For displaying data the mathematical model of data equalization was used, finding the corresponding or closest logarithmic function of the recession for the graph. Obtained recession curves were similar but not identical.

With full knowledge of the fluctuations of ground water level, it is possible to indirectly (without taking soil samples) determine the filtration coefficient: more rapid decline in the recession curve correspond for the better filtration conditions. This research could be very useful in construction planning, road constructions, agriculture etc.