Temporal and spatial distribution of minimum groundwater runoff in the western and central part of Slovakia

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The minimum groundwater runoff values calculated from the stream discharges can be used as one of the parameters characterizing groundwater drought - lack of groundwater amounts in the rock environment. Discharges from 18 gauging stations (Biskupice, Cadca, Cierny Brod, Dolna Lehota, Holisa, Hronec, Chalmova, Handlova, Kralova Lehota, Lubochna, Myjava, Podbanske, Vychodna, Poluvsie, Stare Hory, Studienka, Sastin Straze, and Zlatno) located on surface streams of Bebrava, Kysuca, Dolny Dudvah, Vajskovsky potok, Ipel, Cierny Hron, Nitra, Handlovka, Boca, Lubochnianka, Myjava, Bela, Biely Vah, Rajcianka, Starohorsky potok, Rudava, and Hron Rivers in Slovakia were used as the study material. The catchments cover western and central part of Slovakia and differ in parameters of the catchment size, altitude, climatic, geological, and hydrogeological conditions.

Castany's method was used for groundwater runoff estimation. The method was selected because it gives the lowest estimates of groundwater runoff among the most of usually used methods. In hydrogeology, groundwater runoff values estimated by the method of Castany are considered for the minimum groundwater runoff values from a catchment and under certain conditions (low precipitation totals) they can be considered for manifestation of lack of the groundwater in the aquifer. The method is based on selection of 30 minimum daily discharges following one after another in each year and on calculation of the average value of them. Average groundwater runoff for certain time period (usually for a decade - 10 years) is calculated as a median value from the average values of all years of the assessed period. Groundwater runoff values were calculated for the period of hydrological years 1951-2005.

Annual precipitation totals were calculated for each hydrological year and for each catchment. Number of dry and humid years was determined for each decade and for the whole assessed period. Relation between the groundwater runoff values and precipitation was studied.

Amounts of the minimum groundwater runoff varied from 0.049 $m^3.s^{-1}$ in Myjava gauging station on Myjava River up to 2.106 $m^3.s^{-1}$ in Chalmova on Nitra River.

Three types of the minimum groundwater runoff seasonal pattern were distinguished. The first one can be characterized as the winter-spring pattern with occurrence of the minimum groundwater runoff in the period from December up to March. The second summer-autumn type occurs from July to October. The third pattern type is typical by occurrence of two minimum groundwater runoff periods formed by combination of the first and second pattern with one minimum in winter months (December to February) and the second one in summer-autumn months (July to October).

Some irregularities were discovered by studying the groundwater runoff-precipitation relationships. In Dolna Lehota, despite of the high precipitation totals, the runoff values are non-proportionally low. The same is valid for Handlova, Myjava, Stare Hory and Zlatno gauging stations. On the other hand, the minimum groundwater runoff in Chalmova is non-proportionally high.