



Utilization of the local minimum method for assessment of groundwater runoff development and drought occurrence in Topla and Ondava River catchments, Eastern Slovakia

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The paper contains results of groundwater runoff temporal development and analysis of drought periods occurrence in two catchments: Topla River catchment, profile Hanusovce nad Toplou and Ondava River catchment, profile Svidnik for period 1962 – 2007.

Two methods were used for groundwater runoff calculation - the local minimum method and the original version of the method of Kille (Kille, 1970). The local minimum method used in BFI model (Institute of Hydrology, 1980) enables to calculate the baseflow values in a daily time step. The original BFI model was re-programmed by Gregor (2008) into BFI +2 program, which enables to choose the length of N-day periods used for turning points estimation and different values of the test factor f . Results of calculation using N equal to 5, 10 and 30 days, and f equal to 0.9 – 0.5 were compared with the groundwater runoff estimates calculated by the original version of the method of Kille. The method works in a monthly step and enables to estimate the long-term average groundwater runoff values for ten-year periods. The threshold level value of BF90 estimated from the baseflow duration curves. The classification of the year wetness proposed by Majercakova et al. (2007) was applied.

It has been showed, that the values estimated by the local minimum method using 5-days time step, as it was built in the original version of the BFI model (Institute of Hydrology, 1980) were two-times higher than the results obtained using the method of Kille. The values obtained from both methods closest to each other were obtained when the 30-days time step was applied in the local minimum method.

The groundwater runoff values obtained by the local minimum method with the 30-days time step varied from 0.37 m³.s⁻¹ (profile Svidnik) to 2.62 m³.s⁻¹ (profile Hanusovce nad Toplou). The specific groundwater runoff values varied from 2.21 l.s⁻¹.km⁻² (profile Svidnik) to 2.50 l.s⁻¹.km⁻² (profile Hanusovce nad Toplou).

The results for the period 1962 – 2007 has been compared with period 1962 – 2000, which falls within reference period 1961 – 2000. The distinct decrease of groundwater runoff in both catchments was found in 1962 – 1964 period, where in Topla River catchment the groundwater runoff values reached only 48 – 77 % of the long-term groundwater runoff values of the reference period and in Ondava catchment it was 47 – 86 %. This period was classified as extremely to medium dry in groundwater runoff. Another low groundwater runoff period lasted from 1968 to the beginning hydrological year 1970 what represented the decrease of about 33 % (Topla catchment) and 48 % (Ondava catchment). The next drought followed from 1972 to the beginning of the year 1974 with the decrease of about 42 % in Ondava catchment. In 1993 – 1994 the groundwater runoff reached about 70 % of the reference period average values in both catchments. The last long-term decrease of groundwater runoff occurred in Topla catchment in 2002 – 2004, reaching about 65 % of the long-term groundwater runoff. In the Ondava catchment the drought started already in 2000 reaching 78 % of the long-term value. The decrease of groundwater runoff was probably influenced by ongoing development of climatic conditions and low precipitation amounts in 1982, 1993, 2000, 2002 and 2003. The results of the trend analyses for discharges and groundwater runoff showed decreasing trend for 1962 – 2007 periods and the small increasing trend for precipitation amounts for 1982 – 2007 periods in both evaluated catchments.

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