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Deriving N-year discharges in small catchments

Ondrej Ledvinka and Milon Bohac
Czech Hydrometeorological Institute, Prague 412, Czech Republic (ledvinka@chmi.cz, bohac@chmi.cz)

Maximum discharges with the return period of 100 years (Q_{100}) belong to basic hydrological data that are derived and provided for any profile of the river network by the Czech Hydrometeorological Institute (CHMI). However, as regards small catchments, the determination of these characteristics is largely subjective and thus it is rather performed by comparing the results of several methods.

The first approach is to extrapolate the three parameters of maximum peak discharges (average $Q_{\max}$, coefficient of variation $\mathrm{Cv}_{\max}$, Q_{100}) from water-gauging stations to selected unobserved profiles (using regression relationships and regularities at the confluence points). For this purpose, the so-called program Budsez is utilized. During this process, the physical-geographical (PG) features, rainfall data and other information about catchments are considered, based on which the parameters of theoretical distributions of N-year discharges are optimized.

For smaller catchments the relationships between the 100-year specific runoff q_{100} and the catchment area and other PG characteristics are used that are determined in a GIS environment with the extension AGPosudek. In this innovative method, besides many other PG characteristics, especially the average value of CN and N-year maximum daily precipitation are taken into account when computing Q_{100}. In the older methodologies, Q_{100} is based on the average slope of the stream and the average slope of the catchment. The values of Q_{100} are then corrected according to the percentage of forested areas and the catchment shape.

Hydrologists compare the values of Q_{100} coming from different approaches in a logarithmic graph (q_{100} against area) for the particular catchment or its analogon. The final value is determined with respect to experience and previously issued values. The remaining N-year discharges are usually assessed through the ratio Q_N/Q_{100} from the nearest water-gauging station or the closest profile where these ratios were derived by the extrapolation.

The starting project should improve the derivation of N-year discharges in small catchments and propose a certified methodology. The appropriateness of regression relationships will be tested on a set of selected water-gauging stations with a small catchment area by comparing the values of Q_{100} derived from the series of observed maximum peak discharges with those determined according to the three methods. The regression relationship with the highest coefficient of determination and fulfilling the current knowledge of the formation of the rainfall-runoff process will be recommended. This relationship will be further refined, and if it proves effective, a new regionalization in the Czech Republic will be conducted.