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Decadal flood frequency analyses: Case study of station Litija on the Sava river

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The objective of the study was (1) to perform decadal flood frequency analyses for the nine 30 years long data series, (2) to compare some commonly used distribution functions, (3) to compare the method of moments and the method of L-moments, and (4) to evaluate changes in the Q-T curves for the different hydrological periods.

Decadal flood frequency analyses can be useful in climate changes or climate variability assessment. Investigation of the influence of the selected period for flood frequency analyses is important for the observation of changes in the discharge data. To reach the optimal flood frequency analyses results one should choose the best fitting distribution function and appropriate parameter estimation technique.

The hydrological station Litija on the river Sava is one of the oldest gauging stations in Slovenia. 116 years of the daily discharge data were used for decadal flood frequency analyses. Data was separated in nine parts, each part contained 30 years of annual maximums. The normal, log-normal, Pearson 3, log-Pearson 3, Gumbel, generalized extreme value (GEV) and generalized logistic (GL) distributions were used for flood frequency analyses. The method of moments and the method of L-moments were used for parameters estimation. The root mean square error (RMSE), mean absolute error (MAE), Probability plot correlation coefficient (PPCC), Kolmogorov-Smirnov (K-S), Anderson-Darling (A-D) and AIC (Akaike information criterion) tests were used to compare distribution functions and different data samples. The L-moments ratio diagram was also used to assess differences between distribution functions.

The GEV, Pearson 3 and log-Pearson 3 distributions gave better results as the normal, log-normal, Gumbel and GL distributions. The Gumbel and log-normal distributions had larger dispersion of tests results as other considered distributions. When distribution parameters were estimated with the method of L-moments test results were better as in case of the method of moments. The highest estimated discharge values were characteristic of sample 1981-2010. Difference between the estimated discharge values for the sample 1981-2010 and the second largest sample (1953-2010 for the LP3 and 1971-2000 for the GEV) for the return period of 100 years was about 600 m3/s (25 %) for the LP3 distribution and approximately 300 m3/s (13 %) for the generalized extreme value distribution. The data sample 1941-1970 gave the smallest estimated discharge values for both chosen distribution functions (LP3 and GEV). A positive trend of number of the extreme events in the last decades is the reason for the highest estimated discharge values in the period 1981-2010.