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Using L-moments to Statistically Determine High and Extreme Flows in Slovenia

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In Slovenia, for the statistical analysis of high flows usually the Log-Pearson III method with central moments is used. It is known that for higher return periods this method gives unrealistically high values. The main reason of the study was to compare the usage of L-moments (Hosking and Wallis, 1997), as proposed in the Flood Estimation Handbook (FEH), with the existing statistical methods in use in Slovenia for single-site analysis. For this reason, we compared the Pearson III distribution with L-moments with the Pearson III distribution and the Log-Pearson III distribution using central moments. As the data set (a series of annual maximum discharges Q_{max}) we used available data from the Slovenian hydrological network of nearly 300 stations. Even though the WINFAP-FEH as a software platform for this purpose is available on the market, it was found to be inconvenient to use it for the whole Slovenian network (there is no direct support for the Slovenian data). That is why we developed a program in the Excel and Visual Basic environment, supporting different two- and three-parameter statistical frequency distributions using the L-moments and the central moments, and directly using the available files created in the Environmental Agency of the Republic of Slovenia. The output files of this newly created software can be easily used in the Windows Office environment.

The results obtained using the L-moments were compared for three return periods (50, 500, and 5000 years) with the other two applied methods using central moments in terms of average values, absolute differences, catchment area of the measuring station, and the size of the data set. After all these criteria the new method with the L-moments proved stable, and the results ranged in-between the results yielded by the other two methods using central moments. The results using the L-moments are on average 8 % to 13 % lower when compared to Log-Pearson III, and 4 % to 10 % higher when com-

pared to the Pearson III method. The differences between the methods increase with longer return periods. For the 50-year return period 85 % of all stations are in the $\pm$ 10 % interval, but with the 5000-year return period the number of such stations drops to only 50 %. The study also revealed that the differences between the methods were on average somewhat larger for smaller rivers, irrespective of the return period. For shorter return periods and the stations with less observations the differences between the methods are smaller when compared to the stations with more observations; with longer return periods the situation is the opposite, the differences are somewhat larger for the stations with less data.