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Extreme value analysis in the lower Danube basin discharge time series in the 20 -th century

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The daily discharge time series in the lower Danube basin have been considered for the period 1900-2002. The Orsova station situated in the south-western part of Romania was considered as representative in this analysis. The extreme value theory is applied for studying daily maximum discharges incorporating some covariates. Two methods are applied for fitting the data to an extreme - value distribution: block maxima and peaks over thresholds (POT). Using block maxima approach associated with the use of the generalised extreme value (GEV) distribution have been applied to study the annual and spring (March, April, May and June) maxima of daily discharge for 1900-2000, as well as for monthly maxima of daily discharge for the period 1963-2000. For performing parameter estimation the Maximum Likelihood Estimation (MLE) method was used. From the three possible types of GEV distribution, a Weibull distribution fits very well both annual and spring maxima and monthly maxima of the daily discharges. The MLE allows one to easily incorporate covariate information into parameter estimates. The following variables have been introduced as covariates: the North Atlantic Oscillation (NAO), the first three principal components (PC) of the decomposition in Multivariate Empirical Orthogonal Functions (MEOF) of three atmospheric fields (1000 hPa, 500hPa and 1000-500 hPa thickness) over the Atlantic-European region, the first principal component of EOF decomposition of the sea surface temperature anomaly (SSTA) in the tropical Atlantic. For the annual and spring maxima of the daily discharges from Orsova in the period 1900-2002, the winter (the average of December, January, February and March) NAO index values (http://www.cgd.ucar.edu/cas/jhurrell/indices.html) have been considered as covariate. The NAO contribution was tested in location, scale and shape parameters of GEV distribution. An improvement over the model without covariate is found in-

corporating NAO as covariate in location parameter, especially for the spring maxima. For the monthly maxima of daily discharges (456 values in the period 1963-2000), from the five covariates (PC1, PC2, PC3 of MEOF, PC1 of SSTA and NAO), which have been tested, the best result was obtained incorporating PCs of MEOF, especially PC2, that emphasis the atmospheric circulation at regional scale. Regarding POT approach associated with Generalized Pareto Distribution (GPD), different thresholds have been tested. In all cases the maxima are fitted by a bounded (or beta) distribution. This statistical modeling of the extremes behavior, leads to useful diagnostic and predictive information as return period estimation, changes in frequency of extremes or findings of the predictor variables. For instant, this study revealed that NAO in winter is a good predictor for behaviour of maxima of discharge in the lower Danube in the spring and early summer or that the atmospheric circulation over Europe, filtered by MEOF, improves our knowledge about monthly maxima discharge fluctuation.