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Regional analysis for frequency estimation of annual flood peaks in ungauged basins of Spain

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Flood frequency regionalization makes possible to estimate the T-year flood flow at ungauged sites and improves the estimations in gauged basins, mainly for higher return periods. Multiple linear regression technique achieves equations to predict the values of flood characteristics from basin characteristics. Generalized least squares (GLS) regressions provide optimal estimates, taking into account the accuracy of estimates by the length of the records and the variance of the estimations and the possible cross-correlation among concurrent records at the various gauged sites.

A regional analysis by regression of T-year flood event estimates on basin characteristics has been developed in the Tagus River basin as a show case in Spain. Annual maximum series (AMS) of 69 gauging stations with more than 20 years of record length have been selected. Monte Carlo simulations carried out over different probability distributions have shown that regional AMS follow the Generalized Extreme Values (GEV) distribution and the most robust method for parameter estimation for this distribution is L-moments. Ordinary least squares (OLS) regression of the at-site100-year event estimate on the drainage area has shown that the sign of estimation errors clearly follow a spatial pattern in which two different zones have been identified: eastern region shows higher flood events than western region. Drainage area, T-year rainfall and mean basin elevation have been identified as the most important variables from an analysis based on the quantification of the coefficient of determination, the standard error of prediction, the Mallow's statistic and Predicted Residual Sum of Squares (PRESS) statistic for the regressions derived from all possible combinations among the twelve variables considered.

GLS regressions between these three catchment variables and T-year estimates have

been realized for the two identified regions. Regression equations for 10, 25, 100 and 500 years show good accuracy with high values of the adjusted coefficient of determination and moderate values of the standard error of estimate. Regression equations have been used to predict T-year flood quantiles in ungauged basins and to improve the accuracy of estimates in gauged basins by an estimator that combines at-site and regional information both weighted by the inverse of the variance of each estimation.