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Estimation of instantaneous peak flow from maximum daily flow-a comparison of methods

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Estimation of flood frequency based on instantaneous peak flow (IPF) is important for the design of hydraulic structures. However, observed flow data with high temporal resolution are scarce, especially regarding the limited length of the available flow time series. Here, three different methods are developed and compared to estimate the IPF based on maximum daily flow (MDF), which is available usually at more gauges and for longer time periods. In the first approach, simple linear regressions with non-intercept of probability weighted moments (PWM) or quantile values between IPF and MDF data are employed. Secondly, stepwise multiple linear regressions is used to generate regression equations describing the relationship between easily obtained catchment attributes and MDF predictors and the IPF as target variable. With the third method, the temporal scaling properties of IPF series based on the hypothesis of piece wise simple scaling are investigated for 3 different flow gauges with 15 min data and then utilized to estimate the IPF for all gauges in the area. The study region is the Aller-Leine river basin in northern Germany with 45 stream flow gauges. Cross validation results from the three presented models show good performance in reproducing the peak flow and the potential to be used in other catchment. The simple regressions are the easiest to apply given enough peak flow data, the scaling method is the most efficient one among these three models but stepwise multiple linear regressions gives the best results compared with the other two methods.