Estimation of instantaneous peak flow from simulated maximum daily flow using the HBV model

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Instantaneous peak flow (IPF) data are the foundation of the design of hydraulic structures and flood frequency analysis. However, the long discharge records published by hydrological agencies contain usually only average daily flows which are of little value for design in small catchments. In former research, statistical analysis using observed peak and daily flow data was carried out to explore the link between instantaneous peak flow (IPF) and maximum daily flow (MDF) where the multiple regression model is proved to have the best performance. The objective of this study is to further investigate the acceptability of the multiple regression model for post-processing simulated daily flows from hydrological modeling. The model based flood frequency analysis allows to consider change in the condition of the catchments and in climate for design. Here, the HBV model is calibrated on peak flow distributions and flow duration curves using two approaches. In a two –step approach the simulated MDF are corrected with a priory established regressions. In a one-step procedure the regression coefficients are calibrated together with the parameters of the model. For the analysis data from 18 mesoscale catchments in the Aller-Leine river basin in Northern Germany are used. The results show that: (1) the multiple regression model is capable to predict the peak flows with the simulated MDF data; (2) the calibrated hydrological model reproduces well the magnitude and frequency distribution of peak flows; (3) the one-step procedure outperforms the two-step procedure regarding the estimation of peak flows.