



Differences in rating curve and hydrograph uncertainty due to streamflow dynamics and number of discharge measurements

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The uncertainty related to the use of rating curves for hydrograph estimation is strongly affected if changes in cross-sectional geometry or friction properties occur, especially if the changes are abrupt. In lowland moderately sized streams in temperate regions, such flow changes are often associated with seasonal weed growth. The gradual increase in channel bed roughness caused by weed growth is commonly accounted for by a likewise gradual shift of the rating curve according to monthly discharge measurements. However, this measurement approach is sensitive to abrupt changes in flow, which occur for instance in dynamic streams exhibiting a large difference between maximum and minimum flow or during high summer flows or winter flooding. Hence, the purpose of this study is to investigate the role that dynamic versus stable streams play in terms of uncertainty of establishing rating curves and calculating hydrographs with the traditional stage-discharge approach. Such an analysis is highly valuable in terms of addressing the possibility of adapting hydrograph estimation procedures to the specific streamflow dynamics, thereby quantifying and potentially lowering the uncertainty of hydrograph estimates.

Based on results from the Danish national rainfall-runoff model, ratios between yearly median maximum and median minimum stream discharge were calculated for 15 km² sub-catchments for the entire country. Based on these values, ten gauging stations were selected, located to cover the range of flow regimes represented by the calculated max/min discharge ratios. The selected gauging stations were all stations that had at least three consecutive years with historical data series where direct stream discharge had been measured twenty or more times each year. Based on these data series, new sub-series were created by continuously thinning out the number of discharge measurements. Then, for each of these constructed data series a rating curve and a hydrograph were established according to the Danish standard procedure. After this, a statistical analysis was conducted to evaluate the influence of both flow regime and the number of direct discharge measurements on the deviations and uncertainties of the hydrographs.