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Flood frequency from maximum daily vs. instantaneous peak flows

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Flood frequency analysis (FFA) has long been the standard procedure for obtaining design floods for all kinds of purposes. Ideally, the data at the basis of the statistical operations have a high temporal resolution, in order to facilitate a full account of the observed flood peaks and hence a precise model fitting and flood quantile estimation.

Unfortunately, high-resolution flows are rarely disposable. Often, average daily flows pose the only available/sufficiently long base for flood frequency analysis. This averaging naturally causes a significant smoothing of the flood wave, such that the “instantaneous” peak can no longer be observed. As a possible consequence, design floods derived from these data may be severely underrated.

How strongly the original peaks are flattened and how this influences the design flood estimation depends on a variety of factors and varies from gauge to gauge. In this study we are looking at a range of errors arising from the use of daily instead of instantaneous flow data. These include differences in the observed individual flood peaks and mean annual maximum floods, as well as the estimated distribution parameters and flood quantiles. The aim is to identify catchment specific factors that influence the magnitude of these errors, and ultimately to provide a means for error assessment on the mere basis of local hydrological conditions, specifically where no high-resolution data is available.

The analyses are carried out on an all-German dataset of discharge gauges, for which high-resolution data is available for at least 30 years. The classical FFA approach of fitting distributions to annual maximum series is utilized for error assessment. For identification of influencing factors, both the discharge series themselves and a catalogue of climatic and physiographic catchment descriptors are screened.