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Design flood hydrographs from the relationship between flood peak and volume

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Abstract. Hydrological frequency analyses are usually focused on flood peaks. Flood volumes and durations have not been studied as extensively although there are many practical situations, such as when design dam, in which the full hydrograph is of interest. A flood hydrograph described by a multivariate function of the peak, volume and duration. Standard bivariate and trivariate functions do not produce univariate parameter functions as marginal distributions, however, three-parameter functions are required to fit highly skewed data, such as flood peak and flood volume series. In this paper, the relationship between flood peak and hydrograph volume is analysed to overcome this problem. A Monte Carlo experiment was conducted to generate an ensemble of hydrographs that maintain the statistical properties of marginal distributions of the peak, volumes and durations. This ensemble can be applied to determine the Design Flood Hydrograph (DFH) for a reservoir, which is not a unique hydrograph, but rather a curve in the peak-volume space. All hydrographs on that curve have the same return period, which can be understood as the inverse of the probability to exceed a certain water level in the reservoir in any given year. The procedure can also be applied to calculate the length of the spillway crest in terms of the risk of exceeding a certain water level in the reservoir.

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