



Estimation of Design Flood under Non-stationarity Using Equivalent Reliability Method

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Abstract: Stationary hydrological frequency analysis (SHFA) has been commonly employed for estimating the design flood in most countries. Fundamental to applying SHFA is the assumption that the data series is stationary. In theory it is not applicable if the series is nonstationary. Here, we introduce the method of Equivalent Reliability (ER) to estimate the design flood under non-stationary conditions, which considers the impact of design life period of an engineering on design flood. ER implies that regardless of environmental changes, the design reliability of engineering under non-stationary conditions should be identical with the planned design reliability specified at the stage of the engineering planning. ER is expected to solve two key questions: (i) to estimate the design flood with a given return period for an engineering to be constructed, and (ii) to adjust the original design flood of an already constructed engineering to obtain a new design flood for making the engineering adapt to the changing conditions. Two experiments are provided to demonstrate how to employ ER to solve the above two questions. In addition, an example of annual peak flow series was also used to illustrate ER. Results show that the design life poses a considerable impact on the estimation of design flood and the uncertainty of parameter estimations leads to a non-negligible uncertainty on the estimation of design flood. Overall, ER can be a potential method for estimation of design flood under non-stationary conditions.