



Nonstationary frequency analysis for the trivariate flood series of the Weihe River

Cong Jiang and Lihua Xiong

State Key Laboratory of Water Resources and Hydropower Engineering Science, Wuhan University, Wuhan, China
(jc1207@whu.edu.cn)

Abstract: Some intensive human activities such as water-soil conservation can significantly alter the natural hydrological processes of rivers. In this study, the effect of the water-soil conservation on the trivariate flood series from the Weihe River located in the Northwest China is investigated. The annual maxima daily discharge, annual maxima 3-day flood volume and annual maxima 5-day flood volume are chosen as the study data and used to compose the trivariate flood series. The nonstationarities in both the individual univariate flood series and the corresponding antecedent precipitation series generating the flood events are examined by the Mann-Kendall trend test. It is found that all individual univariate flood series present significant decreasing trend, while the antecedent precipitation series can be treated as stationary. It indicates that the increase of the water-soil conservation land area has altered the rainfall-runoff relationship of the Weihe basin, and induced the nonstationarities in the three individual univariate flood series. The time-varying moments model based on the Pearson type III distribution is applied to capture the nonstationarities in the flood frequency distribution with the water-soil conservation land area introduced as the explanatory variable of the flood distribution parameters. Based on the analysis for each individual univariate flood series, the dependence structure among the three univariate flood series are investigated by the time-varying copula model also with the water-soil conservation land area as the explanatory variable of copula parameters. The results indicate that the dependence among the trivariate flood series is enhanced by the increase of water-soil conservation land area.