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Probability prediction of the suspended sediment concentration using copulas

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Abstract

A probability prediction using conditional distribution function derived from copula provides a great deal of flexibility in the suspended sediment concentration as well as other hydrological variable estimations, but the influencing variables of the probability prediction model capability are necessary to be investigated. The bivariate conditional distribution function of suspended sediment concentration with runoff as its only influencing variable is firstly derived to assess the sensitivity of the probability prediction to the choice of copula and marginal distribution, and the probability prediction is further extended to the trivariate conditional distribution function with runoff and precipitation as its influencing variables. The approach is exemplified using stationary mean daily precipitation, runoff and suspended sediment concentration data sets from six hydrological stations in the central Yellow River located in the Loess Plateau, which is characterized by heavy sediment transport. The results of the bivariate conditional distribution functions indicate that the probability prediction is mainly influenced by the choice of copula function, and the tail dependence of the copula function determines the shape of the estimated suspended sediment concentration curve. The comparison between the bivariate conditional distribution function, trivariate conditional distribution function, and traditional sediment rating curve demonstrates the uncertainty bands from trivariate conditional distribution function are always smallest, and those from the sediment rating curve are usually largest, while the difference between different models become larger at hydrological stations with smaller sample size.

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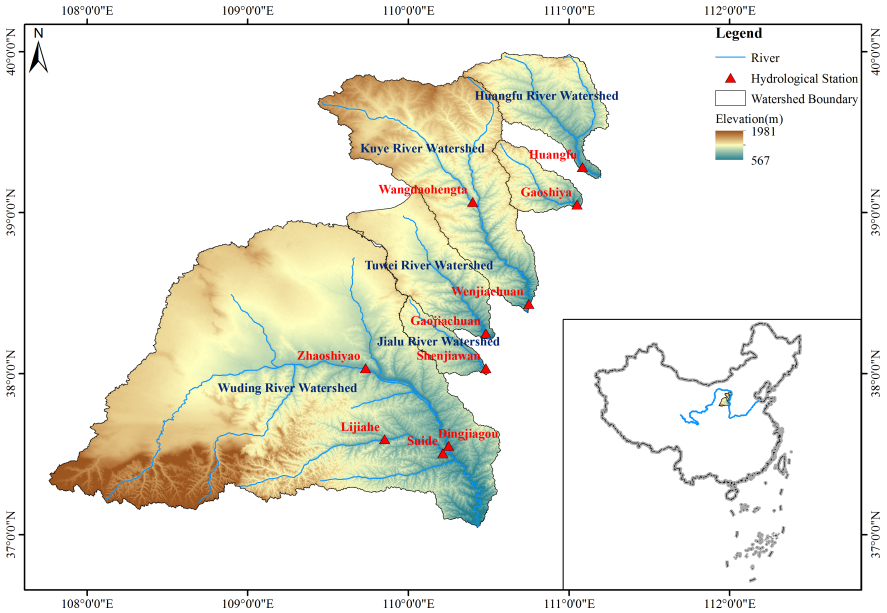

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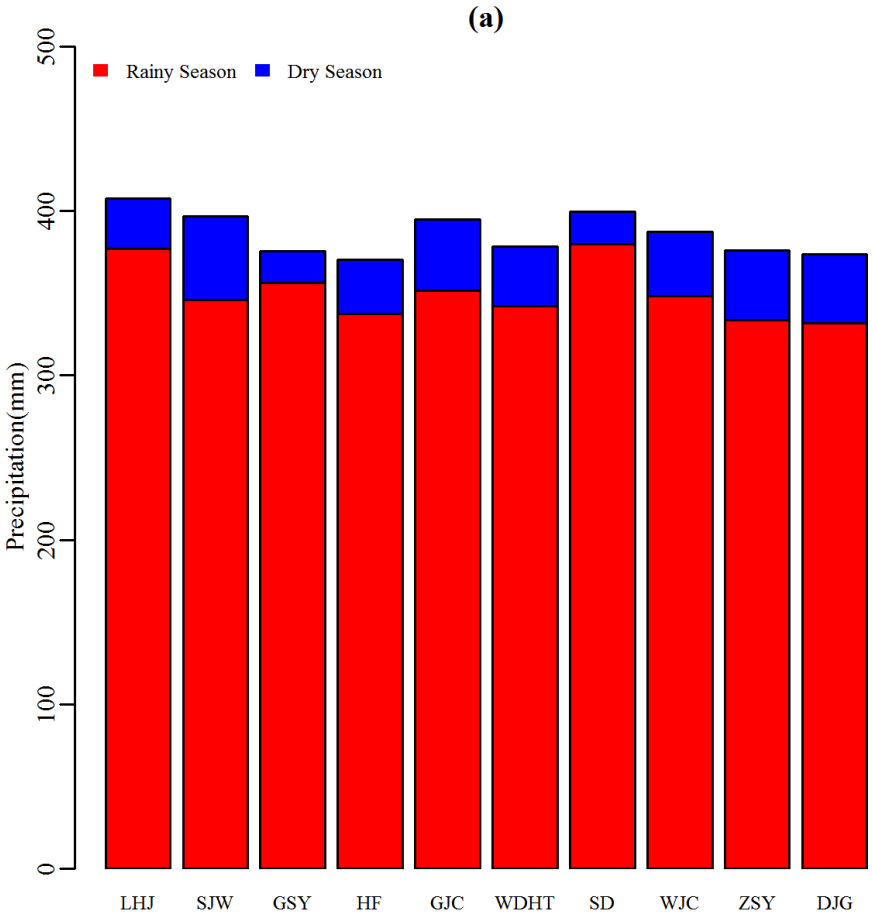

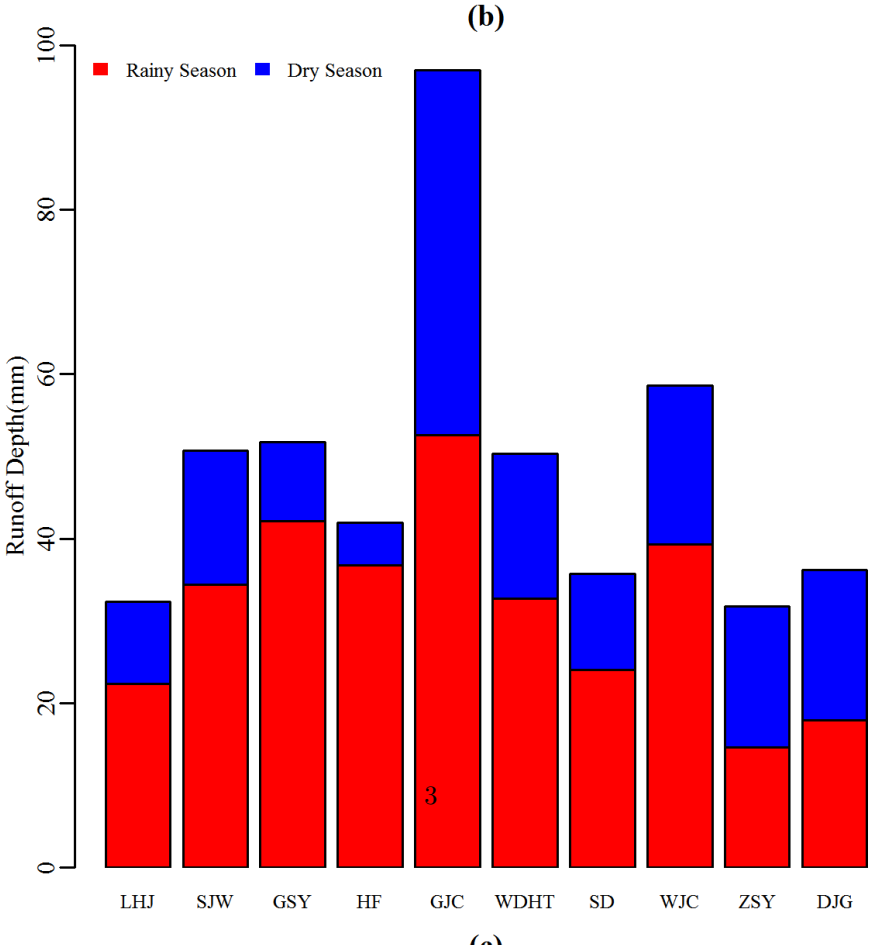

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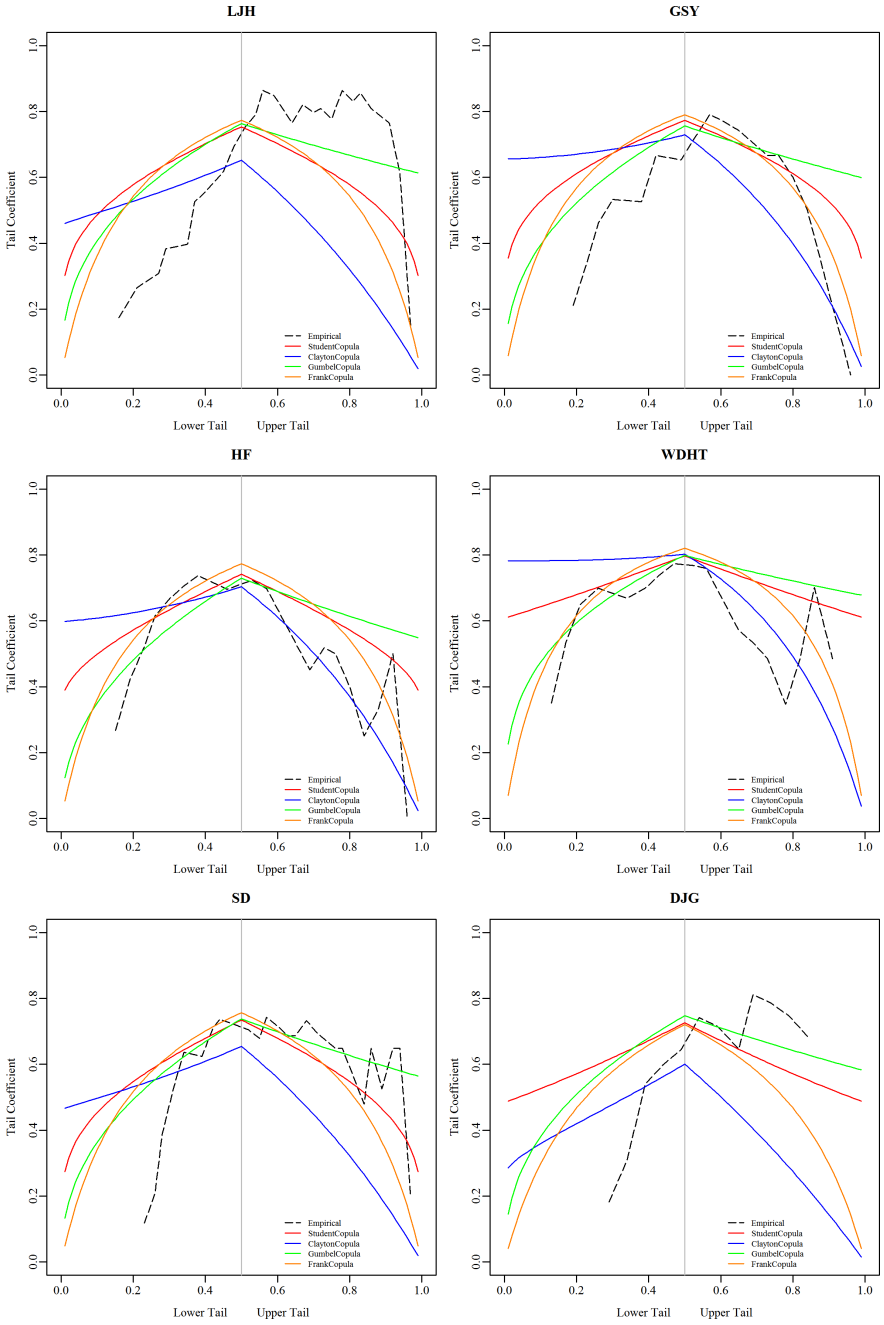

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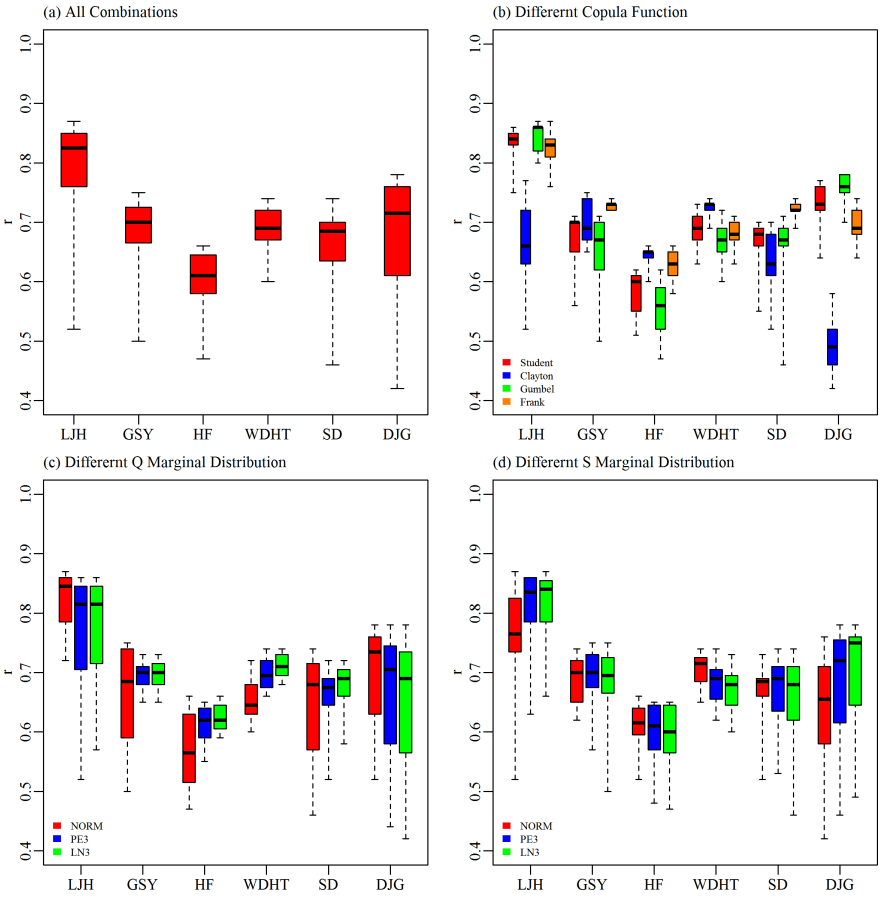

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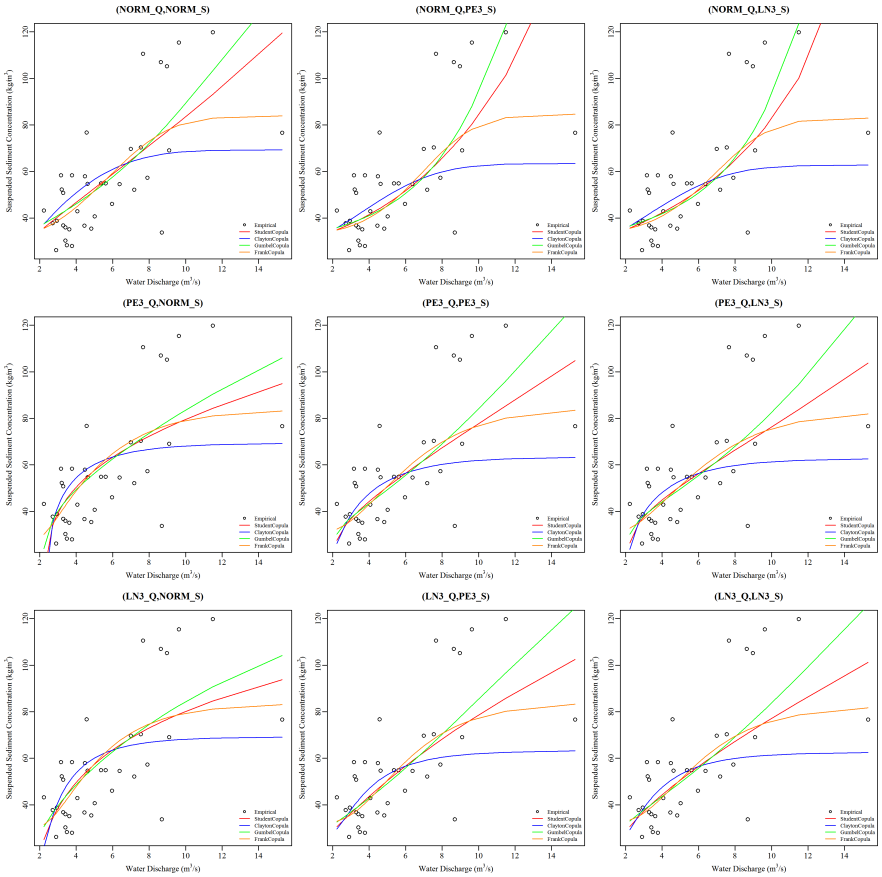

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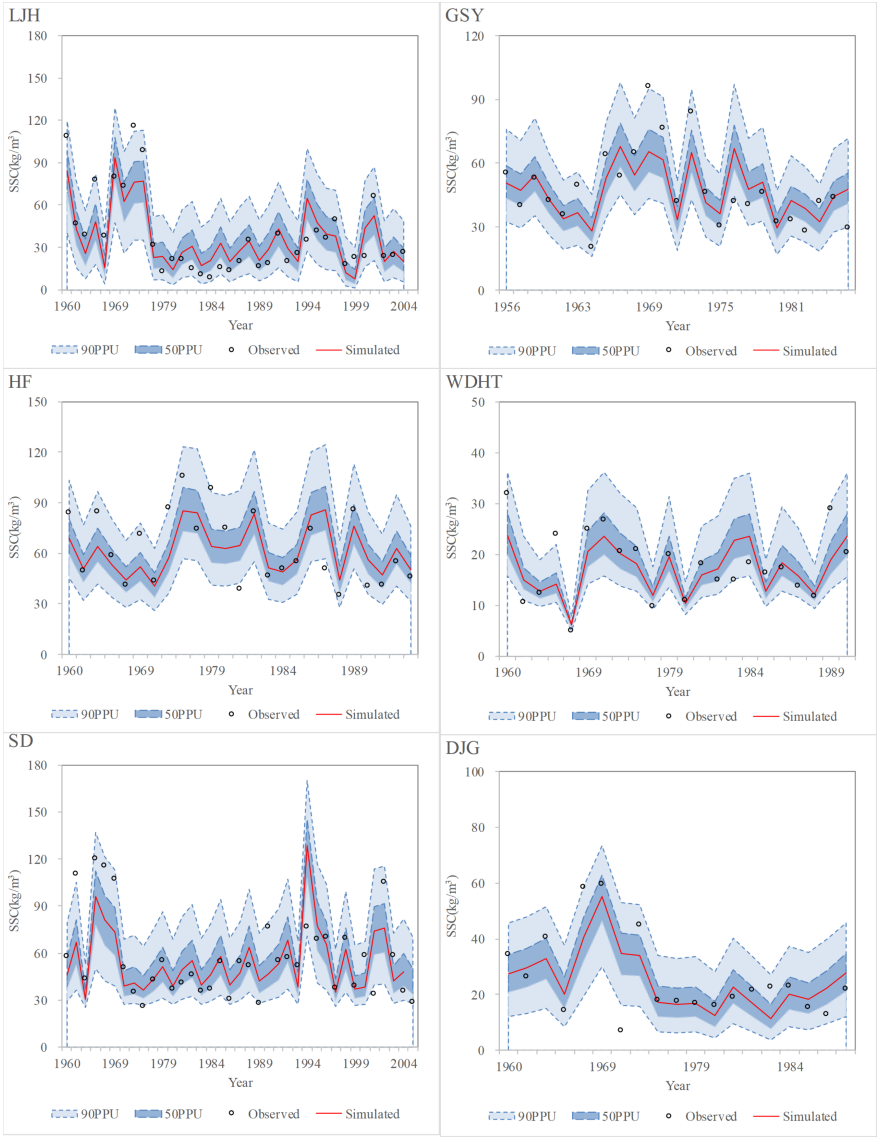

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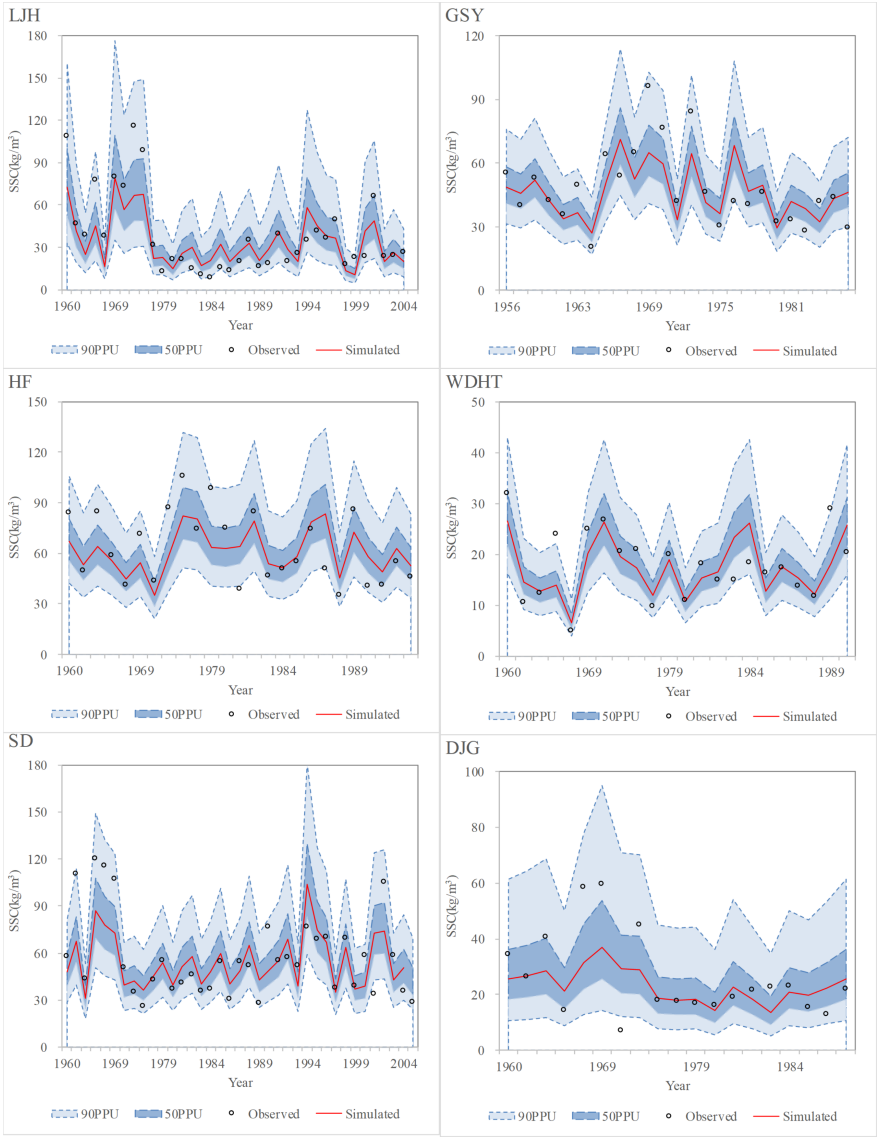

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