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A Development of Nonstationary Regional Frequency Analysis Model with Large-scale Climate Information: Its Application to Korean Watershed

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The existing regional frequency analysis has disadvantages in that it is difficult to consider geographical characteristics in estimating areal rainfall. In this regard, this study aims to develop a hierarchical Bayesian model based nonstationary regional frequency analysis in that spatial patterns of the design rainfall with geographical information (e.g. latitude, longitude and altitude) are explicitly incorporated. This study assumes that the parameters of Gumbel (or GEV distribution) are a function of geographical characteristics within a general linear regression framework. Posterior distribution of the regression parameters are estimated by Bayesian Markov Chain Monte Carlo (MCMC) method, and the identified functional relationship is used to spatially interpolate the parameters of the distributions by using digital elevation models (DEM) as inputs. The proposed model is applied to derive design rainfalls over the entire Han-river watershed. It was found that the proposed Bayesian regional frequency analysis model showed similar results compared to L-moment based regional frequency analysis. In addition, the model showed an advantage in terms of quantifying uncertainty of the design rainfall and estimating the area rainfall considering geographical information. Finally, comprehensive discussion on design rainfall in the context of nonstationary will be presented.

KEYWORDS: Regional frequency analysis, Nonstationary, Spatial information, Bayesian

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