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Modified Flood Frequency Analysis Using Natural Flow Index to Estimate Flood Quantiles in Ungauged Watersheds for Flood Damage Analysis

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This study presents a practical flood frequency analysis to estimate flood quantiles in ungauged watersheds through adjusting the estimated flood quantiles from the designed rainfall-runoff analysis (DRRA) method using natural flow index. First, we present the differences between the flood quantiles estimated by the flood frequency analysis (FFA) and the DRRA. For several gauged watersheds in South Korea, the DRRA overestimated the flood quantiles by approximately 52% than the FFA. Due to the lack of observed flood data, the DRRA is usually used to estimate design floods in practice throughout the world. Therefore, this study suggested a modified flood frequency analysis to reduce the differences between the FFA and DRRA and the investigated the applicability for ungauged watersheds. After investigating the relationship between natural flow quantiles and watershed characteristics, we proposed three types of modified flood frequency analysis that can be applied to ungauged watersheds. Then, we performed the Leave-One-Out Cross-Validation with skill score to validate the proposed methods. The overall results indicated that the modified method increased the accuracy by 23.2% compared to the DRRA. We expect that the modified flood frequency analysis suggested in this study can be extended to investigate the flood risk in the future according to the climate change scenarios.

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