Non-stationary frequency analysis of rainfall events in Korea and Japan

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Abstract

Predicting extreme storm and flood events requires analysis to predict probable rainfall in target years. We present a non-stationary frequency analysis for 6 meteorological stations in Korea and Japan: *Gangneung, Kwangju, Pohang, Seoul, Kochi, Iida.* Non-stationary analysis results in higher estimated rainfall than stationary analysis for all stations. Increased probable rainfall in Korean stations was higher than in Japanese stations (i.e. Z-values of Korean stations were larger than for Japanese stations). Using rainfall data at the 6 sites with increasing trends, we estimate 3 types of probably predicted rainfall for the target years 2020, 2050 and 2070. According to the results of applicability analysis, in the case of a 100-year return period, the probable rainfall estimated by non-stationary methods has a residual of 1.6˜2.5% in Kochi, 11.98˜16.01% in Gangneung, 4.3˜4.9% in Kwangju, and 3.2˜5.3% in Seoul. This study indicates that non-stationary methods provide better results in terms of confidence than stationary methods for representing rainfall with increasing trends. The non-stationary rainfall frequency analysis provided more reasonable and well-directed estimates of probable rainfall for the target year. Results show that non-stationary methods estimate probable rainfall well over short timescales based on linear regression of observed data. Further, the probable rainfall estimator for target years reflects the increasing temporal pattern of rainfall and predicts future rainfall. Results from this study can inform the design of flood prevention approaches and effective hydraulic structures.

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