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Development of future rainfall scenario under climate change for Korean Peninsula

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We propose a method for generating future hourly rainfall scenario considering climate change. The method has the following sequence: (1) rainfall statistics that are known to have hydrologic significance (mean, variance, covariance, and probability of dryness) of a given calendar month are generated based on the statistical information obtained from observed rainfall; (2) the generated rainfall statistics is corrected for the future period using the correction factor obtained by analyzing the HadGEM2-ES global circulation model output; (3) the hourly rainfall time series is generated using the Modified Bartlett-Lewis Rectangular Pulse (MBLRP) model based on the rainfall statistics obtained in Step 2; (4) Step 1 through Step 3 are repeated for all 12 calendar months to generate the hourly rainfall scenario of a given future year. The methodology was applied for the 28 rainfall observation locations and for the future period of 2019 - 2093 in Korean Peninsula. The suggested approach was validated for the validation period during which both observed and the rainfall scenario exists (1984-2004). The result of the validation indicates that (1) the approach of this study accurately reproduce the mean, variance, covariance, and the probability of dryness of the observed rainfall between hourly and daily scale; (2) the approach of this study has the improved fitting of the design rainfall (underestimation by 11% - 23% depending on the recurrence interval) compared to the traditional approach of Poisson cluster rainfall modeling (underestimation by 20% - 40%). The design rainfall of the synthetically generated rainfall of the future period was corrected by the degree of the underestimation obtained from the validation period. According to the analysis, the design hourly and daily rainfall with the recurrence interval between 10 year and 200 year will increase by $\sim$24% and $\sim$14%, respectively, by the year 2089 under the RCP scenario of 4.5.