Comparative Analyses on Disaggregation Methods for the Rainfall Projection

Wan Amirul Syahmi Wan Mazlan[a] *and Nurul Nadrah Aqilah Tukimat*[a]

[a] Faculty of Civil Engineering Technology, Universiti Malaysia Pahang, Lebuhraya Persiaran Tun Khalil Yaakob, Pahang, Kuantan, 26300, Malaysia

ABSTRACT

Climate modeling data are typically available in the daily climate time series for a particular year of observation. However, studies for urban drainage and stormwater management require rainfall data on sub-daily time scales for design such as the development of IDF curves. Most hydrological studies dealing with the impacts of climate change are particularly challenging due to this explicit requirement. Therefore, this study aims to establish more accurate disaggregation methods for constructing hourly rainfall under the projected climate scenarios. Three disaggregation methods with different theoretical underpinnings have been evaluated: Scaling Properties (SP), Indian Reduction Formula (IRF), and Stochastic Method (SM). The results show that the SP method generally outperforms the other methods based on statistical analyses and comparisons of statistical properties with historical data. The SP method performs well by having the lowest RMSE and percentage difference values across all rainfall stations. Moreover, the hourly mean and standard deviation of disaggregated rainfall from the SP method correspond well to the historical data. The projected rainfall data from 2025 to 2100 were obtained from the MRI-ESM2-0 model and disaggregated from daily-time to hourly-time series using the SP method. In general, the SSP5-8.5 scenario showed the highest projected rainfall compared with the other scenarios.

KEYWORDS

Climate change; Disaggregation; IDF curves; Indian reduction formula; Scaling properties

ACKNOWLEDGEMENT

The authors would like to thank the Ministry of Higher Education Malaysia (MOHE)for providing financial support under Fundamental research grant No. FRGS/1/2019/TK01/UMP/02/1, Universiti Malaysia Pahang (University Ref: RD1901141), Malaysian Meteorological Department (MMD), and Department of Irrigation and Drainage Malaysia (DID).