Delta change method with cyclic covariate generalized extreme value model for downscaling extreme rainfall

ABSTRACT

In meteorological data, lots of variables have annual, seasonal or diurnal cycles. These would be based on different climatic patterns in different seasons rising sea levels. The delta change approach is one of the statistical downscaling methods that used to downscale global climate model data in order to use it as a future input for hydrological models and flood risk assessment. In this work, a non-stationary GEV model with cyclic covariate structure for modelling magnitude and variation of data series with some degrees of correlation for real-world applications is proposed. All extreme events were calculated assuming that maximum annual daily precipitations follow the GEV distribution. The method makes it possible to identify and estimate the impacts of multiple time scales-such as seasonality, interdecadal variability, and secular trends-throughout the area, scale, and shape parameters of extreme sea level probability distribution. The incorporation of seasonal effects describes a huge amount of data variability, permitting the methods involved to be estimated more efficiently. Next, the technique of deltachange was implemented to the mean annual rainfall and also the regular rainfall occurrences of 5, 10, 20, 50 and 100 years of return. The capability of the proposed model will be tested to one rainfall station in Sabah. The new model suggesting improvement over the stationary model based on the p-value which is highly significant (approximate to 0). GEV model with cyclic covariate on both location and scale parameters is able to capture the seasonality factor in rainfall data. Hence, a reliable delta-change model has been developed in this study. This could produce more accurate projection of rainfall in the future.

Keyword: Covariate; Cyclic; Delta-change; Generalized extreme value; Rainfall