A SIMPLE MODEL TO ESTIMATE HOURLY RAINFALL DDF RELATIONSHIPS BY INCORPORATING DALIY RAINFALL

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Design storms are often required in water-related engineering studies. In most hydrosystems engineering designs storm characteristics, such as total rainfall amount and storm pattern with hourly or shorter duration are needed. Rainfall depth of a specified duration for a design storm can be estimated by the rainfall frequency analysis. Reliable establishment of rainfall-frequency relationships is affected by the quality and length of available rainfall record. In general, record length of daily rainfall from manned stations is longer and widely available than that of automatic raingauges. A transfer mechanism would be desirable to utilize daily rainfall information to derive rainfall frequency-quantile relations for finer time scale (e.g., 1-hr). Even for concurrently available fine resolution rainfall, the incorporation of coarser time resolution records could potentially enhance the accuracy of derived rainfall frequency relationship. This paper presents a simple model to derive hourly-based rainfall DDF relations by incorporating daily rainfalls.

In particular, the proposed annual-maximum-event (AME) model derives the annual maximum hourly-based rainfall DDF relationships by utilizing the annual maximum total rainfall amount. The performance of the proposed AME model is evaluated by comparing the DDF relationships derived by the proposed model with those obtained by the conventional frequency analysis using the annual maximum series. Hourly rainfall data at the Hong Kong Observatory over the period of 1884-1990 are used to demonstrate application of the proposed model. From the numerical experiments, the proposed model is found to yield more accurate and reliable annual maximum rainfall DDF relations than the conventional method based on concurrently available annual maximum hourly rainfalls, especially for the short durations (e.g., 1-hr, 2-hr and 6-hr). The proposed model also shows promising potential to improve the accuracy of rainfall DDF relationships by incorporating extended daily rainfall record.

Note that in the process of deriving of the proposed AME model, the rainstorm events are entirely based on rainy day without considering that rainy events might straddle over two or more consecutive days. This could be the reason that the model does not yield improvement of frequency analysis for the extreme rainstorm events with long duration (e.g., 12- and 24-hr). Hence, a further break down of rainstorm events according to the time of occurrence and duration of rainstorm events might be necessary to improve the performance of the AME model.