

# Application of the artificial neural network to regional frequency analysis for estimating rainfall quantiles at ungauged sites

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The occurrence frequency and magnitude of hydrologic extreme events such as heavy rainfalls and floods has been increasing due to anthropogenic climate change and urbanization. The design of stable hydraulic structures is important to reduce the social and economic damages caused by such extreme events. Regional frequency analysis is one of the commonly used methods to estimate hydrologic quantiles underlying the design of hydraulic structures. On the other hand, artificial neural network (ANN) is widely used to solve the complex nonlinear problems in the hydrologic field such as rainfall-runoff modeling, and streamflow forecasting. However, there still have been few studies on the application of the ANN model to regional frequency analysis. The aim of this study is to apply the ANN to regional frequency analysis in order to estimate hydrologic quantiles at ungauged sites. From 61 weather stations over South Korea, various geographical and hydro-meteorological variables were obtained and rainfall quantiles for various return periods were calculated using generalized extreme value distribution. To develop the ANN-based regional model, about 70% of weather stations were used as the training data set while about 30% of weather stations were used as the test data set. Using various geographical, hydro-meteorological, and statistical variables as input variables, ANN-based regional models were constructed to estimate rainfall quantiles for various return periods. The performance of the constructed ANN-based regional model was compared with that of conventional regional models using the relative root mean square error and relative bias. The developed ANN-based regional model is expected to provide more accurate rainfall quantiles for the design of hydraulic structures at ungauged sites. And this will contribute to society by mitigating the damage caused by hydrological extreme events.

**Keywords** : Extreme rainfall, Regional frequency analysis, Artificial neural network, Quantile estimation