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Exploring the Spatial Relationship between Typhoon Track and Rainfall by Using the Self-Organizing Maps

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Typhoons hit Taiwan several times every year, which could cause serious flood disasters. Because mountainous terrains and steep landforms can rapidly accelerate the speed of flood during typhoon events, rivers cannot be a stable source of water supply. Reservoirs become the most effective floodwater storage facilities for alleviating flood damages in Taiwan. Forecasting typhoon rainfall is a long-standing and challenging issue due to the complexity of typhoon. In this study, we proposed the Self-Organizing Maps (SOM) to visibly explore the spatial distribution of rainfall in Shihmen Reservoir Basin. Predicted rainfall is obtained from Quantitative Precipitation Estimation and Segregation Using Multiple Sensors (QPESUMS). We design a parameter named predicted rainfall ratio (PRR), which is defined as the predicted rainfall of a grid divided by the total predicted rainfall within a watershed. Each 3-hour moving average of PRR is used as the input of SOM. The SOM neural network is implemented to cluster a large amount of PRR distribution for extracting their implicit information from high-dimensional input data sets and partition the observed patterns into low-dimensional topological maps. For each typhoon, the SOM topological maps of PRR are identified, and these maps correspond to the path of typhoon. Extracting the interrelation between the location of the eye of typhoon and the rainfall pattern can be functional for increasing the accuracy of rainfall forecast during a typhoon event, which is highly valuable for emergency planning and real-time reservoir operation.