CHAPTER V

CONCLUSION

Artificial neural networks (ANNs) are the so-called sub-symbolic process descriptors. That is to say they do not produce equations to model the process but rather act as a black box, producing outputs according to input that it receives. Still, artificial neural networks are evolutionary algorithms since they can learn how to model a process. The ANN approach used in this study does not take into account the physical processes nor information about the catchment area involved in runoff generation. Therefore, this is a very attractive substitution for the lump conceptual watershed modeling. This thesis is focused on rainfall-runoff modeling and three hourly discharge forecast by adopting the ANN model with limited hydrological data. The method can be generalized to determine the flood hydrograph for the studied area. Here, the Mae Tuen watershed in Om Koi District, Chiang Mai Province is a selected site for experimenting the application of the proposed technique. The distinct features of this selected area are its geographical location and the limited rainfall and runoff records from a single hydrologic station. A trained feedforward ANN based on the available historic data, is achieved by using the Levenberg-Marquardt algorithm. This is another variation of the backpropagation algorithm. The input parameters for the model are the antecedent rainfall information and runoff discharge. It is obvious that rainfall records from one hydrologic station cannot represent the storm distribution in the watershed. This is indeed a challenge problem for the modeling task. It is necessary to design appropriate input-target pairs and to primitively filter the original records prior to the training. In this study, the optimal network structure is obtained by trial and error procedure based on average absolute relative error (*AARE*). To find the optimal network, four ranges of linear transformation [a, b] are tested. There are [0.3, 0.7], [0.2, 0.8], [0.1, 0.9], and [0.05, 0.95]. Two cases of model input (I1 and I2) are examined for the best suitable model input. Case I1 of model input composes of antecedent rainfall and previous runoff discharge. Case I2 is similar as case I1 with the inclusion of the last 24 hours of discharge from the predicted time. The statistical results from the simulation tests show that the range [0.2, 0.8] is best for a given linear transformation and the model input case I2 can better described the watershed characteristics. Furthermore, it is found that information during the last 24 hours of runoff discharge from the predicted time can improve the accuracy of the model prediction, particularly the maximum discharge. In the same studied area, Pukdeboon (2001) applied Tank model to forecast the three hourly discharges based on the same set of data. To compare with their result from the same hydrologic data, 72 patterns of input-target pairs are used for statistical evaluation. The results and comparative study show clearly that the ANN model is more suitable to forecast the three hourly discharges with limited hydrologic data than the Tank model in this studied area.

In summary, the statistical results indicate that the ANN model is capable of modeling the rainfall-runoff relationship in the small watershed area with limited hydrologic data. However, there are some periods of time that the model cannot predict very well but still better than the Tank model. This is due to the fact that the rainfall data from one hydrologic station used in the model input cannot represent the actual distribution of the storm in the watershed. Therefore, it is a challenge task to improve the model accuracy for discharge prediction. One alternative way is to use the idea of data interpolation technique. If we can find the suitable technique for interpolating the missing hydrologic data in the night-time, it may help improve the performance of ANN trained by the interpolated data.