Geophysical Research Abstracts
Vol. 16, EGU2014-10050, 2014
EGU General Assembly 2014

SOM-based Hybrid Neural Network Model for Flood Inundation Extent Forecasting

Li-Chiu Chang (1), Hung-Yu Shen (2), and Fi-John Chang (3)

(1) Department of Water Resources and Environmental Engineering, Tamkang University, New Taipei City, Taiwan (changlc@mail.tku.edu.tw), (2) Department of Water Resources and Environmental Engineering, Tamkang University, New Taipei City, Taiwan (schumy73@yahoo.com.tw), (3) Department of Bioenvironmental Systems Engineering, National Taiwan University, Taipei, Taiwan (changfj@ntu.edu.tw)

In recent years, the increasing frequency and severity of floods caused by climate change and/or land overuse has been reported both nationally and globally. Therefore, estimation of flood depths and extents may provide disaster information for alleviating risk and loss of life and property.
The conventional inundation models commonly need a huge amount of computational time to carry out a high resolution spatial inundation map. Moreover, for implementing appropriate mitigation strategies of various flood conditions, different flood scenarios and the corresponding mitigation alternatives are required. Consequently, it is difficult to reach real-time forecast of the inundation extent by conventional inundation models. This study proposed a SOM-RNARX model, for on-line forecasting regional flood inundation depths and extents. The SOM-RNARX model is composed of SOM (Self-Organizing Map) and RNARX (recurrent configuration of nonlinear autoregressive with exogenous inputs). The SOM network categorizes various flood inundation maps of the study area to produce a meaningful regional flood topological map. The RNARX model is built to forecast the total flooded volume of the study area. To find the neuron with the closest total inundated volume to the forecasted total inundated volumes, the forecasted value is used to adjust the weights (inundated depths) of the closest neuron and obtain a regional flood inundation map.
The proposed methodology was trained and tested based on a large number of inundation data generated by a well validated two-dimensional simulation model in Yilan County, Taiwan. For comparison, the CHIM (clustering-based hybrid inundation model) model which was issued by Chang et al. (2010) was performed. The major difference between these two models is that CHIM classify flooding characteristics, and SOM-RNARX extracts the relationship between rainfall pattern and flooding spatial distribution. The results show that (1)two models can adequately provide on-line forecasts of 3-h-ahead flood inundation depths in the study area; and (2)SOM-RNARX consistently outperform CHIM in online multistep-ahead inundation forecasts, while SOM-RNARX needs more storage for model parameters than CHIM and increases the loading of database as well.