Development of flood routing models for Wang River basin

Abstrak

Nowadays, severe ﬂooding frequently occurs in various parts of Thailand resulted from changes in climatic condition and land use patterns. The ﬂooding has caused great damages to properties and lives and affects country economy. Experience from the most severe ﬂooding in the northern and central regions of Thailand in the year 2011 reveals that reliable ﬂood warning system is still lagging. For ﬂood warning purpose, it is necessary to have an accurate ﬂood routing system. This
study is aimed at developing mathematical models for ﬂood routing so as to provide data for ﬂood
warning. Two different models are developed, i.e., kinematic overland ﬂow model and kinematic stream ﬂow model. The ﬁnite element method with Galerkin's weighted residual technique is used
in model development. The second order Runge-Kutta method is applied to solve the set of differential equations obtained from ﬁnite element formulation. The developed models are applied to simulate ﬂows in the Wang river basin in the northern region of Thailand during July 1 - October 31, 2011 when severe ﬂooding occurred in this region. Model calibration is made by adjusting some parameters in the models and comparing the obtained results with measured data recorded by RID at 5 stream ﬂow gauge stations along the Wang river. For correlation analysis. three statistical indices are determined, these include coefﬁcient of determination, R2, Nash-Sutcliffe model efﬁciency coefﬁcient, NSE, and coefﬁcient of variation of the root mean square
error, CV(RMSE). It is found that the model results at the upstream portion of the river satisfactorily agree with the observed data, with the values of R2 greater than 0.55 and CV(RMSE) less than 0.57. For the downstream portion of the river, there are remarkable differences between the model results and the observed data. The values of R2 are less than 0.35, CV(RMSE) greater than 0.76, and the NSE values are less than 0.16. This might be due to some errors in the input data, including rainfall pattern, topography, land use, river cross-sectional area, and water seepage along the river. More detailed ﬁeld investigation and model calibration are still needed.