

Rainfall-Runoff-Inundation Analysis of 2011 Thailand Flood in the Chao Phraya River Basin

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A large amount of rainfall during the 2011 monsoonal season caused an unprecedented flood disaster over the Chao Phraya River basin in Thailand. The number of death and missing tolls exceeded 800 people. Flooding caused severe damage even to urban life in Northern part of Bangkok. Furthermore, several industrial zones with factories of foreign capitals were also severely damaged. Because of economic globalization, the flooding influenced the world's supply chains and its economic impact was immediately felt by other countries.

In mid-October 2011, ICHARM decided to conduct quick response-type simulations. The aims of the simulation were to understand the basin's flood situation holistically and predict the possible development of the large scale flooding with available satellite-based information. The model used in this study was based on two-dimensional diffusive wave equations for rainfall-runoff and inundation calculations. The model takes into account the effects of lateral subsurface flow and vertical infiltration flow since these two types of flow are also important processes.

This paper presents prediction results obtained in mid-October 2011, when the flooding in Thailand was approaching to its peak. Our scientific question was how well we can predict the possible development of a large-scale flooding event with limited information and how much we can improve the prediction with more local information. To address the questions, we compare simulation results with assumed conditions in the quick response simulation and the one reflecting more local information by means of adjusting satellite based rainfall with gauged rainfall, incorporating evapotranspiration effects, updating river cross section information, setting tidal boundary conditions, etc. The analysis revealed the importance of evapotranspiration for better flood predictions. The impact of evapotranspiration for mitigating the long-term and large scale flooding and how to incorporate the effect into the prediction will be also discussed.

By conducting the prediction and validation for the Thailand flooding, quite a few important aspects became clear concerning the current simulation model: what the current model can and cannot predict and what information we should prioritize as input over other information. Conducting this kind of prediction and validation repeatedly for large-scale flooding events in the world can reduce prediction uncertainty and also help understand hydrologic processes at the large river basin scale.

Keywords: flood, hydrology, Thailand, Chao Phraya River, Rainfall-Runoff-Inundation