E11

# Numerical Analysis of Flooding Impacts Using Hydro-BEAM in Red River Basin, Vietnam

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Natural disasters have an impact on people, property, society, and the environment at an alarming rate. The number of people affected by natural disasters averaged 125 million per year during 1980-1989, which increased to 203 million per year during 1990-1999 and then to 234 million per year during 2000-2009. Flooding was responsible for half of these affected and caused over one-fourth of the total estimated economic damage. An effective flood modeling and prediction system could help mitigate the worst effects of flood disasters through the rapid dissemination of information in areas under threat. Hence, it is significant to obtain information on flood characteristics, study the hydrological system and simulating different extreme events to visualize the probable floods that would exceed the flood control design standards for disaster mitigation. Flood hazard maps can be a tool to communicate about flooding problem in the region and enhance the awareness of people. This could help community to be proactive and prepared towards such events and reduce loss from flood disaster.

This research develops a distributed model for simulating flood inundation integrating with rainfall-runoff processes. A physically distributed model Hydro BEAM (Hydrological River Basin Environment Assessment Model), has been used as hydrologic model. In the model, it takes a one-dimensional diffusion wave representation for channel flow and a two dimensional diffusion wave approximation of inundation flow solved with the application of fully implicit finite difference scheme. Two dimensional Navier-Stokes equations-based flood propagation model is used considering the suitability in complex urban terrains. The discharge that overflows from each stream segment to the flooded area is calculated from the difference between the water level of the channel and the grid section connected to it by assuming that Honma's overflow formula of a trapezoid dam is applicable. Zero extension theory has been used here to solve a free boundary problem. This theory treats moving boundary with the analytic domain expanded outside (Fig. 1). Here, a hypothetical domain adjoined to the analytic domain along the boundaries is provided and then that variable is assumed to have a constant value of zero over the hypothetical domain.

Hanoi, the capital of Vietnam, which is vulnerable to flood, has been selected as the study area. It is located in the floodplain of Red River. Flood problem has been compounded in recent years by a number of changes, such as environmental degradation, global climate change, and sedimentation.

Flood hazard maps for discharges corresponding to various year return period will be prepared to assess the area likely to be inundated due to potential flooding. Various scenarios such as reservoir operations, dyke failures, future climate change will be evaluated. Finally suitable flood disaster mitigation policies will be found out with the developed scenarios for flood hazards.

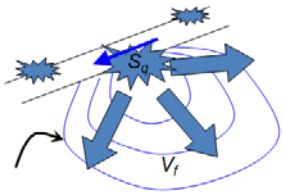


Fig. 1. Moving boundary of flooding/inundating area