APPLICATION OF DEPTH-AVERAGED TWO-DIMENSIONAL NUMERICAL MODELS TO DAM BREAK FLOWS

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The integrated hydrodynamic modeling software SEC-HY21 introduced by Hsu (2002), consists of the flow solvers for solving the two-dimensional shallow water equations, GUI tools for grid and bed topology generation, and post-processor for flow visualization, is continuously developed with improvement of the GUI tools and with enhancement by adding new modules such as pollutant transport models and sediment transport models. In this paper, the current status of the embedded hydraulic models is described.

Currently, two numerical hydrodynamic models are implemented in this software. The framework of the solution engine is based on the shock-capturing cell-centered finite-volume upwind TVD method. The first one use of the structured quadrilateral mesh with multi-block capacity was developed and with many applications for years (see Hsu, 2001), and the second one using edge-based unstructured mesh is recently developed. Applications using these two numerical models to two two-dimensional dam-break flows with corresponding physical models are presented. The first case simulates the dam-break flow through a channel with sharp bend, the layout and gauging points shown in the Fig. 1. The second case is a simulation of a flood event on the Toce river valley, the topology and gauging points shown in the Fig. 2.

Fig. 3 shows the time evolution of the two-dimension water level contours for the case 1. When the gate is opened instantaneously, the water flows rapidly into the channel and reaches the bend. There, the water reflects against the wall, a bore forms and begins to travel in the upstream direction, back to the reservoir. For the water flowing further downstream after the bend, multiple reflections on the walls can be clearly observed from these graphics.

Time history of the water levels at gauging points for both of the case 1 and case 2 are given and compared with corresponding experimental data in the full paper, which show general good agreement and demonstrate the presented models are capable of simulating unsteady discontinuous flow conditions on irregular domains with complex topography.

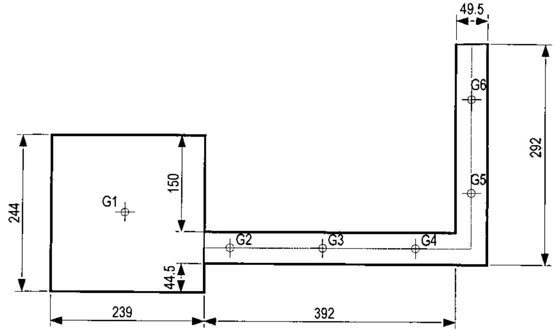

Fig. 1 Channel with 90° bend and position of the gauging points (dimension in cm)

Fig. 2 Toce valley and position of the gauging points

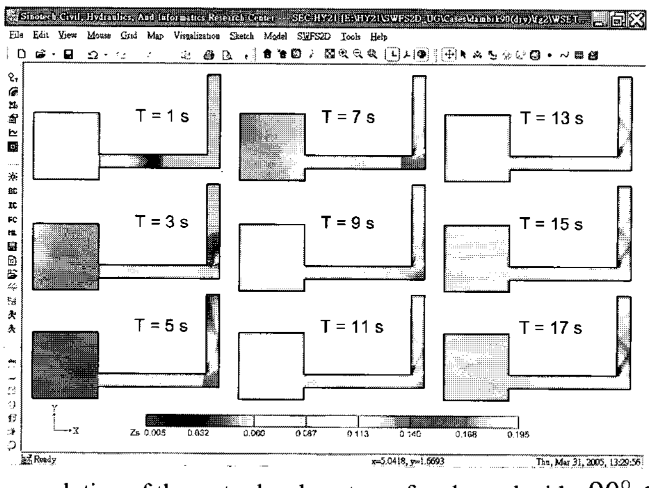

Fig. 3 Time evolution of the water level contours for channel with 90° bend case

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