

Typhoon Rainfall and Runoff Forecasting and Flood Mitigation

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Among all nature disasters, tropical cyclones are ranked second in loss of life by World Meteorological Organization. The island of Taiwan is situated in one of the main paths of the north-western Pacific typhoons. On average, three to four typhoons attack the island each year. In the Taiwan area, serious disasters such as flooding, landslide or debris flow brought by typhoon rainfall often cause loss of life and major economic impacts. To mitigate disasters due to typhoons, various kinds of disaster warning systems are developed. During typhoons, rainfall forecasting plays the most essential role in almost all kinds of disaster warning systems. Subsequently, more accurate and reliable forecasts of rainfall are required as an important reference for runoff forecasting to mitigate flood damages.

In recent years, several typhoons had seriously hit the Tanshui river basin in northern Taiwan. To protect 6.5 million people and properties, the Keelung River Flood Mitigation Project has been completed and effectively operated. It consists of three major components: Yuanshanzi flood diversion, flood protection zones and flood forecasting/warning system. Additionally, the Sediment Desiltation Project in the Shihmen Reservoir has been undergoing to secure water supply for municipal and agricultural demand in northern Taiwan. The Shihmen Reservoir is situated in the Dahan creek that is one of the major tributaries of the Tanshui River. Adopting various advanced schemes, the two-dimensional coupled system, combining the shallow water equations and the advection-diffusion equation, is solved for flow depth, velocity field and suspended sediment concentration. The talk will cover several engineering applications of the numerical hydraulic modeling such as the flood inundation simulation in the Keelung River Valley, flow characteristics calculation at the Yuansantze flood diversion works and the simulation of suspended sediment transport with natural-irregular topography in the downstream reach of the Shihmen Reservoir.

Moreover, public hearings and presentations are used to demonstrate the progress of the project as well as to communicate with the public. The powerful three-dimensional virtual reality techniques are employed to generate interactive scenes, which create delicate three-dimensional models such as buildings, levees, river flow, topography, etc. For supporting the Keelung River Flood mitigation Project and the Shihmen Reservoir Desiltation Project, the virtual environments created by three-dimensional virtual reality have been developed to increase the efficiency of communication among designers, decision makers and the public.