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Evaluation of the Benefit of Flood Reduction by Artificial Groundwater Recharge Lake Operation in a Coastal Area

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Inundation disasters often occur in the southwestern coastal plains of Taiwan. The coastal plains suffers mostly from land-subsidence, surface water is difficult to be drained during the typhoon period, leading to more severe flood disasters. Global climate warming has become more significant, which in turn has resulted in the increase in amplitude and frequency of climate change related disasters. In addition, climate change also induces a rise in sea water level year by year. The rise in sea water level does not only weakens the function of existing drainage system but also increases tidal levels and storm tide levels, which increases the probability and amount of inundation disasters.

The serious land subsidence area at Linbian river basin was selected as the study area. An artificial groundwater recharge lake has been set up in Linbian river basin by Pingtung government. The development area of this lake is 58 hectare and the storage volume is 2.1 million cubic meters ($210 \times 10^4 m^3$). The surface water from Linbian basin during a wet season is led into the artificial groundwater recharge lake by water diversion project, and then employ special hydro-geological conditions of the area for groundwater recharge, increase groundwater supply and decrease land subsidence rate, and incidentally some of the flood diversion, detention, reduce flooding. In this study, a Real-time Interactive Inundation Model is applied to simulate different flooding storage volume and gate operations to estimate the benefits of flood mitigation. According to the simulation results, the hydrograph shape, peak-flow reduction and time lag to peak of the flood reduction hydrograph into the lake are apparently different for each case of different gate operation at the same storage volume. Therefore, the effect of flood control and disaster mitigation is different. The flood control and disaster mitigation benefits are evaluated by different operation modes, which provide decision makers to develop operational rules during flood.