Geophysical Research Abstracts
Vol. 16, EGU2014-1598-1, 2014
EGU General Assembly 2014


# Effects of Long-Term Land Subsidence on the Flood Hazard- A Case Study in the Southwest Coastal Area, Taiwan

Yin-Lung Chang (1), Tung-Lin Tsai (2), Jinn-Chuang Yang (3), and Hsin-Yu Chiu (4)

(1) Disaster Prevention and Water Environment Research Center, National Chiao Tung University, Hsinchu City, Taiwan (ylchang88@gmail.com), (2) Department of Civil and Water Resources Engineering, National Chiayi University, Chiayi City, Taiwan (tltsai@mail.ncyu.edu.tw), (3) Department of Civil Engineering, National Chiao Tung University, Hsinchu City, Taiwan (yang.jc4169@gmail.com), (4) Green Energy and Environment Research Laboratories, Industrial Technology Research Institute, Hsinchu County, Taiwan (hychiu13@gmail.com)

Typically, the flood hazard assessment is conducted for current states of topography. However, the spatial-temporal variability of land subsidence should be considered in assessing the flood hazard for the land subsidence prone area. This study numerically investigated the effects of pumping induced land subsidence on the freeboard and inundation depth in the southwest coastal area, Taiwan. Firstly, the spatial distribution of accumulative land subsidence between 2012 and 2021 was predicted by a process-based land subsidence model. The digital elevation model (DEM) and channel geometry in 2021 were produced based on the predicted land subsidence field along with the present topography data. The freeboard and inundation depth before and after ten years land subsidence were simulated by the SOBEK Suite (1D channel flow couples 2D overland flow). The analysis of freeboard showed that except the extremely low-lying area where the elevation is lower than the spring high tide level, the change of freeboard after ten years land subsidence is mostly influenced by the spatial variation of land subsidence field. Higher change rate of the land subsidence field along the channel direction induces more significant change of freeboard. Besides, the freeboard at a cross section tends to decrease after ten years land subsidence if the land subsidence decreases in the channel downstream direction, and vice versa. However, the decreased (or increased) freeboard at a cross section is typically less than 0.3 times the magnitude of land subsidence at the same cross section. The spatial variation of land subsidence field also significantly influences the change of inundation depth outside the extremely low-lying area. The inundation depth at a computation grid tends to increase after ten years land subsidence if the land subsidence at this grid is greater than that at its neighbour grids, and vice versa. However, the increased (or decreased) inundation depth at a grid is significantly less than the magnitude of land subsidence at the same grid. Unlike the changes of freeboard and inundation depth outside the extremely low-lying area, the freeboard and inundation depth within the extremely low-lying area are always decreased and increased respectively after ten years land subsidence. Furthermore, the decreased freeboard at a channel cross section or the increased inundation depth at a grid are typically 0.8 to 1.0 times the magnitude of land subsidence at the same cross section or grid. To mitigate the effect of pumping induced land subsidence on flood hazard, a groundwater quantity management model was developed. The management model determines the optimal pumping patterns which prevent the flood hazard to be increased due to long-term subsidence while satisfy the groundwater demand. This study showed that for a coastal area with potential land subsidence problem, the spatial-temporal variability of future land subsidence should be quantified and incorporated into the flood management.