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Potential Inundation Hazards in the Taipei Basin Induced by Reactivation of the Shanchiao Fault in Northern Taiwan

Jihn-Sung Lai[1, 2], Chun-Ying Chiu[3], Hsiang-Kuan Chang[1, 2], Jyr-Ching Hu[3, *], and Yih-Chi Tan[1, 2]

[1] Hydrotech Research Institute, National Taiwan University, Taipei, Taiwan, ROC
[2] Department of Bioenvironmental Systems Engineering, National Taiwan University, Taipei, Taiwan, ROC
[3] Department of Geosciences, National Taiwan University, Taipei, Taiwan, ROC

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ABSTRACT

The Shanchiao fault, located to the west of the Taipei Basin in northern Taiwan, is a highly active normal fault that has a left-slip component and fault length of over 40 km. We suggest that the Shanchiao fault still has the ability to induce coseismic subsidence in the Taipei Basin under present extensional regime of northern Taiwan. In order to characterize the coseismic ground deformation and assess the potential inundation hazards in Taipei Basin, we estimate surface displacements using elastic dislocation models. The largest slip is assumed to be located underneath the Kuandu area due to the observation of deepest Tertiary basement in this area. Based on the topography changes due to coseismic deformation in a potential magnitude 7 event induced by reactivation of the Shanchiao fault, a 2D inundation model was adopted to simulate several inundation scenarios, including potential flood inundation below high tide condition and under various return-period design rainfall events. The predicted inundation maps based on various return-period flood events can provide information to assess potential earthquake-induced inundation hazards.

Key words: Earthquake-induced inundation hazards, Shanchiao fault, Taipei Basin

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1. INTRODUCTION

Located west of the Taipei Basin, the Shanchiao fault is a highly active normal fault that has left-slip component and fault length is over 40 km (Fig. 1). Therefore, an assessment of the seismic hazards is a critical need for the highly urbanized Taipei metropolitan area (e.g., Wang et al. 2006; Wang 2008). In addition, according to historical documents, an earthquake large enough to destroy an aboriginal house and produce an earthquake-induced lake "Kanshi Taipei Lake" might have occurred in this area during April 1694 (Hsu 1983). Consequently, the potential inundation induced by a large earthquake along the Shanchaio fault is an important issue for natural hazard mitigation in this area. During the past few decades, several deep boreholes have been investigated to provide geological information about the geometry of basement rocks, stratigraphic sequences, and coseismic slip of paleoearthquakes (Huang et al. 2007).

Surface overland flow processes are primarily determined by topography, land cover and soil characteristics. They can generally be described by a two-dimensional (2D) diffusive overland-flow model based on non-inertia surface flow dynamics in rural areas (Wasantha Lal 1998). For 2D inundation models, the mathematical equations governing flows over watershed surface are dynamic wave equations. It is difficult to use dynamic wave equations for the analysis of a distributed surface with adverse slopes and irregular geometry in a floodplain. If inertial terms are relatively apparent in the governing phenomena, such as rapidly rising stage flood or dam-break flows, then the dynamic wave equations must be completely considered. On the other hand, a simplified form of the dynamic wave equations, the non-inertia wave (diffusion wave) model, neglecting the inertial terms but considering the backwater effect, is physically applicable to simulate regional overland flow in floodplains. A diffusive-wave model was first proposed by Cunge et al. (1976), and similar approaches have been developed and

* *Corresponding author*
E-mail: jchu@ntu.edu.tw