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Validation of a predictive model of typhoon surge and assessing coastal flooding area around Taiwan

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A numerical predictive model of typhoon surge around Taiwan has been previously developed and validated for the 1996 Typhoon Herb. The typhoon moved across northern Taiwan and caused flooding in coastal lowlands. The typhoon surge model is developed for the spherical coordinates and solved numerically by finite difference method. In this study we choose other typhoons, which passed Taiwan by different paths, to further verify the developed model. The major tracks of typhoons to cause damages in the coastal lowlands can be classified into three categories. Category 1 is the path of typhoon moving along the northern coast of Taiwan from east to west, while Category 2 is that along the western coast traveling from south or southwest of Taiwan towards north. In category 3 typhoons move along eastern coast of Taiwan. Categories 2 and 3 may cause more severe damages than by category 3. The geographical shape of Taiwan looks somewhat like an irregular and asymmetrical oval. The Central Mountain Range extends from the southern tip of Taiwan to the northern part. There are more coastal lowlands areas in the western part of Taiwan than in the eastern part. The population density in the western Taiwan is much higher than that in the eastern Taiwan.

We select some severe typhoons from these 3 categories and compute the storm surges for different paths. We can thus compare the measured and computed surges at different tidal stations for various typhoons and validate the developed typhoon surge model. Moreover we estimate the flooded lowlands area around Danshui Estuary, which is part of Taipei, the capital of Taiwan. In fact there are high levees along riverbanks around Danshui Etuary to prevent lowlands from flooding. However, even

when the surge height may not exceed that of the walls, the high sea level due to the typhoon surge can hinder river discharge of large volume of rainfall and runoff. This is one of the main causes for flooding in the coastal lowland areas around Danshui Estuary. One of the objectives of this study is to implement the model for hazard mitigation of coastal flooding. We will use Taiwan digital elevation data to establish coastal lowlands digital elevation model (costal DEM). Then incorporating typhoon data forecasted by the Central Weather Bureau, we can calculate typhoon surge before typhoon's arrival to assess potential flooding area in the costal DEM.