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The evaluation of downscaled 3-D model for typhoon-induced Coastal Inundation considering both effects of the Surge and Wave

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In general, typhoon induces strong surge and wave, which can result in inundation within the lower coastal region. South coastal cities of South Korea including Busan, which has a lot of high-rise buildings and residential areas near the coast, are very vulnerable to the typhoon and typhoon-induced coastal inundation suffering a tremendous damage. When a typhoon 'Chaba' hit South Korea in 2016, the coastal city Busan was seriously damaged by the typhoon-induced coastal inundation, which seems to be affected by both effects of strong wave and surge induced by the typhoon. When a sea level was raised by the surge, the coastal inundation is supposed to be caused by the wave with a long period of more than 10 s actually. Therefore, to predict the coastal inundation more accurately, both effects of surge and wave must be included in the numerical approach. The present research focuses on the simulation of coastal inundation in Busan induced by 'Chaba' considering both effects of surge and wave. In this research, several numerical models, which are the Weather Research and Forecasting model (WRF) for the typhoon simulation, the Finite Volume Community Ocean Model (FVCOM) for the surge simulation, and the Simulating WAve Nearshore (SWAN) for the wave simulation, were applied to the downscaling study, and the downscaled 3-D model for coastal inundation was evaluated. The surge and wave were simulated in the mother domain covering the Korean peninsula using the meteorological data produced by WRF. In particular, the 3-D numerical approach was applied to the surge prediction for more realistic dynamics because the surge is affected by the vertical structure of water column. And then, the coastal inundation was predicted within the downscaled domain covering Busan, combining the surge and wave results obtained from mother domain. To consider both effects of the surge and wave, an irregular wave height under JONSWAP spectrum was generated at intervals of 1s using the significant wave height and peak period predicted by the SWAN, and it was combined with a storm tide height predicted by FVCOM. Also, through several numerical experiments related to the configuration and resolution of vertical layers, we evaluated the effect of vertical stratification on the coastal inundation to improve the numerical accuracy.