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Sensitivity analysis of coastal storm surge forecasting using NEMO-based CTSM model

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The present study introduces a high-resolution Coastal Tide/Storm surge model (CTSM). Recently, the NIMS (National Institute of Meteorological Sciences) developed the CTSM, based on the NEMO ocean model to enhance forecasting capabilities for sea conditions and storm surges. The CTSM is constructed with a two-dimensional barotropic sigma coordinates and has a 1 km horizontal resolution. It consists of Tide/Surge model and Tide model, and their residual is used as surge forecasts. The surge forecasts are then added to the harmonically predicted tides to give forecasts of total water level at the 30 tidal stations around Korea Peninsula. Based on the sensitivity studies, the constant values of 0.0275 and 1024 hPa are adopted as the Charnock coefficient, bottom friction and reference pressure of the model, respectively.

In addition, this study investigated the effect of temporal and spatial variations of Charnock coefficient on the surge forecasts during Typhoon HINNAMNO, which caused substantial damage to the Korean Peninsula in 2022. For this, the 2-D Charnock coefficients derived from an operational Coastal wave model are added to the CTSM. It was found that the Charnock values generally exceeded the model's constant value of 0.0275 during typhoon period. This alteration in Charnock coefficient impacts on the surge forecasts especially near the coastal regions, showing about 10% increase in the sea level.