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Simulation of Storm Surge by a Depth-integrated Non-hydrostatic Nested-gird Model

Yu-Lin Tsai (1), Tso-Ren Wu (2), Chuen-Teyr Terng (3), and Mei-Hui Cheung (2)

(1) Graduate Institute of Hydrological and Oceanic Science, National Central University, Chungli, Taiwan (opo1208@hotmail.com), (2) Graduate Institute of Hydrological and Oceanic Science, National Central University, Chungli, Taiwan, (3) Central Weather Bureau, Taipei, Taiwan

This paper presents COMCOT-SS (COrnell Multi-grid Coupled of Tsunami Model – Storm Surge) operational model, a depth integrated non-hydrostatic storm surge model developed for the Central Weather Bureau (CWB) in Taiwan. This model is based on the widely-validated COMCOT tsunami model. However, the governing equations were modified to be a depth-integrated vertical momentum equation, and the nonlinear shallow water equations including extra terms, such as the non-hydrostatic pressure, weather forcing, and tidal terms. The non-hydrostatic term enables the model to simulate relatively steep waves in the near-shore region. The conventional features in COMCOT, such as the nested-grid system, spherical and Cartesian coordinate systems, and the moving boundary scheme for inundation prediction were preserved. In this study, we carefully validated the model with analytic solutions for wind shear stress and pressure gradient terms. TWRF (Typhoon Weather Research and Forecasting) model was coupled for providing the meteorological forces generated by typhoons. Besides, parametric typhoon models such as Holland model (1980) and CWB model were also coupled with COMCOT-SS in which the drag coefficient was advised by Large and Pond (1981) and Powell (2003). Astronomical tide provided by the TPXO global tidal model was imported from the domain boundaries. As for the model performance, COMCOT-SS spends less than 30 minutes to finish a 48-hrs forecasting with a large computational domain which covers Taiwan Strait and most parts of Western Pacific Ocean and South China Sea and satisfies the requirement of early warning. In this paper, we also presented the results of nine typical typhoon routes defined by CWB in Taiwan for the model verification. The simulation results accompanied with the non-hydrostatic effect presented good agreement with observation data. Detailed results and discussion will be presented in EGU, 2015.