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The Development of Storm Surge Ensemble Forecasting System Combing with Meso-scale WRF Model

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The storm surge prediction is highly influenced by the uncertainty of storm intensity, track, moving speed, and other weather conditions. In comparison to deterministic forecasting, ensemble forecasting can provide more possible results based on the meteorological variability. In this study, we adopt the CWB WRF Ensemble Prediction System (CWB WEPS) results as ensemble members, which differ from the microphysics, boundary layer, cumulus, and surface parameters. The air pressure field and 10-meter wind field of CWB WEPS are used to trigger storm surge propagation. The kernel of coastal storm surge model is COMCOT-Surge (COrnell Multi-Grid COupled Tsunami Model – Storm Surge): 1. Solves nonlinear shallow water equations in Open Ocean and coastal regions by the nested-grid scheme; 2. Consider tide-surge interaction by combing with OSU TPXO 7.2 global tide model; 3. Calculate surge inundation area with the wet-dry-cell treatment; 4. Be one of Taiwan CWB official storm surge forecasting model after validating with a series of practical tropical cyclone events. The severe Typhoon Meranti in 2016 is chosen as the case study. Meranti's central pressure reached to the 890 mb and it had been upgraded to the super typhoon by JTWC (Joint Typhoon Warning Center). In this study, a series of the numerical experiment is conducted by 20 CWB WEPS members. From the gauge comparison in Toucheng, Chengkung, and Jiangjyun, the results show that observed highest storm surges are located in the interval of 25 % and 75 % boxplot range after comparing with observation data. The Talagrand Rank Histogram, Ensemble Spread Analysis, and Member Equal likelihood are used to analyze the ensemble spread in storm surge prediction. The results show that high diversity on storm track and intensity and it would be helpful for the oncoming operational work. In conclusion, the ensemble forecasting can effectively help forecasters to predict storm surge under the uncertainty of storm conditions.