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Prediction of storm surge using tropical cyclone information based on a global atmosphere model and a tide-surge model

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The south-eastern coast of Korea (the Republic of Korea) has often been damaged by storm surge and high waves due to the typhoon, therefore it is important to predict typhoon movement and storm surge accurately and quickly. We made an attempt to 1-way couple the Model for Prediction Across Scales (MPAS), a global atmosphere model, and the ADvanced CIRCulation model (ADCIRC), a tide-surge model, i.e. providing the atmosphere model's outputs for tide-surge model's forcing. The MPAS has the unstructured Voronoi meshes and allows higher-resolution for the target area, thus the variable mesh system based on the mesh resolutions of 15 km in the region of interest, the western Pacific region and 60 km in the entire model domain was built and was run for prediction of typhoon once a day during summer, July to September. The ADCIRC model also has a flexible unstructured mesh, thus the high-resolution with minimum mesh size of 50 m was formed in the south-eastern coast. The typhoon information such as typhoon track, maximum wind, minimum air pressure and radius of storm can be extracted from the atmosphere model output using the Geophysical Fluid Dynamics Laboratory (GFDL) vortex tracker, and then the tide-surge model calculates the storm surge using Holland type vortex model and the typhoon information produced by the atmosphere model and vortex tracker. In this study, this coupled model system was used to predict the storm surge due to typhoon Chaba that occurred in the beginning of October, 2016 and struck the south-eastern coast of Korea. The estimated typhoon Chaba (201618) track's distance error was less than 100 km in 48 hours and 200 km in 72 hours, thus this global atmosphere model shows a good performance to predict the typhoon movement and is also comparable to forecasting agencies such as KMA, JMA and JTWC. Generally, the storm surge due to typhoon Chaba was reproduced reasonably for the south-eastern sea of Korea. The modelling system acquired in this study can be extended for the prediction of storm surge, extreme condition and usual barotropic process.