Geophysical Research Abstracts
Vol. 18, EGU2016-2408, 2016
EGU General Assembly 2016

Extreme Wave Simulation due to Typhoon Bolaven based on locally Enhanced Fine-Mesh Unstructured Grid Model

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The performance of an integrally coupled wave-tide-surge model using the unstructured mesh system has been tested for the typhoon Bolaven which is regarded as the most powerful storm to strike the Korean Peninsula in nearly a decade with wind gusts measured up to 50 m/s, causing serious damages with 19 victims. Use of the unstructured mesh in coastal sea regions of marginal scale allows all energy from deep to shallow waters to be seamlessly followed; the physics of wave-circulation interactions can be then correctly resolved. The model covers the whole Yellow and East China Seas with locally refined meshes near the regions of Gageo Island (offshore southwestern corner of the Korean Peninsula) and south of Jeju Island (Gangjeong and Seogwipo ports). The wind and pressure fields during the passage of typhoon Bolaven are generated by the blending method. Generally the numerical atmospheric model cannot satisfactorily reproduce the strength of typhoons due to dynamic and resolution restrictions. In this study we could achieve an improved conservation of the typhoon strength by blending the Holland typhoon model result by the empirical formula onto the ambient meteorological fields of NCEP dataset. The model results are compared with the observations and the model performance is then evaluated. The computed wave spectrums for one and two dimensions are compared with the observation in Ieodo station. Results show that the wind wave significantly enhances the current intensity and surge elevation, addressing that to incorporate the wave-current interaction effect in the wave-tide-surge coupled model is important for the accurate prediction of current and sea surface elevation as well as extreme waves in shallow coastal sea regions. The resulting modeling system can be used for hindcasting and forecasting the wave-tide-surges in marine environments with complex coastlines, shallow water depth and fine sediment.