



Impact-based Forecast and Warning Services for swell disaster in coastal regions of North Gyeongsang Province, Republic of Korea

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The shoreline of the East Sea in Korea is so smooth that it does not sufficiently absorb wave energy coming from far distant seas. Also, the recent expansion of marine leisure infrastructure in the East Sea area has increased the number of tourists, resulting in more marine accidents caused by swells. To prevent and minimize impacts from swells on the east coast, the Daegu Branch Office of the Korea Meteorological Administration (KMA) has developed impact-based swell forecasting and warning services, as well as conducting various studies to improve the accuracy of swell forecasts.

As a first step, we set levels of swell risks by using observed swell wave heights in marine accidents caused by swells on the east coast over the last 15 years from 2004 to 2018. Then, we determined the threshold of swell risk levels based on significant wave heights and peak wave periods in the past accidents, and divided the risks into 11 levels. Secondly, we developed multiple regression equations to predict wave heights and wave periods of main areas by using observations from wave buoys in the vicinity of the Daegu Branch Office of the KMA. We used significant wave height, wave period, wave direction, wind speed, and wind direction as dependent variables of the equations. Thirdly, we divided each risk level into three warning categories - Attention (Green), Caution (Orange), and Alert (Red). Then, we developed a swell information statement showing an impact-based swell forecast which contains swell risk level, consequent impacts, and actions to be taken by disaster-related agencies. Lastly, we verified the accuracy of swell forecasting information produced from the multiple regression equations in comparison with Coastal Wave Watch III (CWW 3) model. The verification showed that the RMSE of the values from multiple regression equations was smaller than that from CWW 3 model, in terms of wave height (difference of RMSE = 0.01-0.16) and wave period (difference of RMSE = 0.1-0.6).

Based on the studies, the Daegu Branch Office of the KMA is capable of providing impact-based swell forecasts to help related agencies' decision-making to reduce risks and damages to people and property from swell accidents. In addition, we will focus on improving the accuracy of the multiple regression equations to contribute to the safety and convenience of local residents and tourists who visit the east coast.