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Error quantification of abnormal extreme high waves in Operational Oceanographic System in Korea

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In winter season, large-height swell-like waves have occurred on the East coast of Korea, causing property damages and loss of human life. It is known that those waves are generated by a local strong wind made by temperate cyclone moving to eastward in the East Sea of Korean peninsula. Because the waves are often occurred in the clear weather, in particular, the damages are to be maximized. Therefore, it is necessary to predict and forecast large-height swell-like waves to prevent and correspond to the coastal damages.

In Korea, an operational oceanographic system (KOOS) has been developed by the Korea institute of ocean science and technology (KIOST) and KOOS provides daily basis 72-hours' ocean forecasts such as wind, water elevation, sea currents, water temperature, salinity, and waves which are computed from not only meteorological and hydrodynamic model (WRF, ROMS, MOM, and MOHID) but also wave models (WW-III and SWAN).

In order to evaluate the model performance and guarantee a certain level of accuracy of ocean forecasts, a Skill Assessment (SA) system was established as a one of module in KOOS. It has been performed through comparison of model results with in-situ observation data and model errors have been quantified with skill scores. Statistics which are used in skill assessment are including a measure of both errors and correlations such as root-mean-square-error (RMSE), root-mean-square-error percentage (RMSE%), mean bias (MB), correlation coefficient (R), scatter index (SI), circular correlation (CC) and central frequency (CF) that is a frequency with which errors lie within acceptable error criteria. It should be utilized simultaneously not only to quantify an error but also to improve an accuracy of forecasts by providing a feedback interactively. However, in an abnormal phenomena such as high-height swell-like waves in the East coast of Korea, it requires more advanced and optimized error quantification method that allows to predict the abnormal waves well and to improve the accuracy of forecasts by supporting modification of physics and numeric on numerical models through sensitivity test.

In this study, we proposed an appropriate method of error quantification especially on abnormal high waves which are occurred by local weather condition. Furthermore, we introduced that how the quantification errors are contributed to improve wind-wave modeling by applying data assimilation and utilizing reanalysis data.