## Prediction of Storm Surge due to Typhoon passing Korea using by Machine Learning

\*Boonsoon Kang<sup>1</sup>, Jongjib Park<sup>2</sup>, Wanhee Cho<sup>3</sup>, Jongyoon Mun<sup>3</sup>, Seokjae Kwon<sup>1</sup>, Eunil Lee<sup>1</sup>

1. Ocean Research Division, Korea Hydrographic and Oceanographic Agency(KHOA), 2. Department of Coastal Management, Geosystem Research Corporatio, 3. Oceanographic Division, Marine information Technology Corporation

There have been growing interests in the coastal regions exposed to the threats by typhoons, storm surges, high waves and so on. Recently, the external threats seem to be intensified with global warming and effect on the human life suffering more than that ever before. As one of the policies to protect coastal areas, the Korea Hydrographic and Oceanographic Agency (KHOA) has provided the maps of Coastal Flooding Forecast by Typhoon, indicating flooding coastal areas due to storm surges by Typhoon, to the local governments with coastal areas.

In this study, the machine learning method using Artificial Neural Network (ANN) is conducted to predict the storm surges with two scenarios of typhoons passing the Korean peninsula. The first is the scenario with the straightened path and central pressure of typhoons artificially created. It is a hypothetical scenario that is slightly different from the typhoons really occurred in paths and central pressure. The second is a stochastic scenario with possible typhoons based on the occurred typhoons, that is created by the TCRM(Tropical Cyclone Risk Model) developed in Geoscience Australia(Geoscience Australia, 2018; William, 2019).

The numerical simulations for storm surges were performed under the two scenarios. The results of the simulations were used in the ANN as learning data, and then the predicted storm surge heights obtained the machine learning were analyzed. Both scenarios represent the results of storm surge prediction that are in much better agreements with the measured data in the southern Korean coasts than those in the western coasts.

The difference between the prediction results by the hypothetical and stochastic scenarios is dominant in the western coasts where typhoons occur with more complicated pathway than that in the southern coasts. The accuracy of storm surge prediction for the stochastic case is higher than that for the hypothetical case, meaning that the accuracy of the machine learning forecast depends on the quality of the input data.

\* Ref. : Geoscience Australia: Tropical Cyclone Risk Model, https://github.com/GeoscienceAustralia/tcrm. William C. Arthur, A statistical-parametric model of tropical cyclones for hazard assessment, Natural Hazards and Earth System Sciences, https://doi/10.5194/nhess-2019-192.

Keywords: Storm Surge, Prediction, Typhoon, Machine Learning