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# Predicting Storm Surges using Artificial Neural Networks

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Storm surge prediction is an important subject for coastal defense in order to protect large amount of human activities along the coastal area. Empirical methods of surge prediction based on statistical analysis of sea level records and meteorological conditions during past storm surges were developed and applied in Europe after the 1953 storm. Numerical models for surge forecasting based on the integration of the hydrodynamic governing equations are wide operated over the last two decades. The accuracy of this type is mostly depending on the accuracy and the resolution of the weather forecast. Area with high geometric variety, e.g. coast next to high mountain, may encounter difficulty on accurate surge prediction if fine grid local area model is not available. The purpose of this study is to predict storm surges using an Artificial Neural Network (ANN). A non-linear hidden-layer forward feeding neural network using back-propagation learning algorithms was developed with a detailed analysis of model design of those factors affecting successful implementation of the model. The factors were obtained from the formulation of storm surge discrepancies after Horikawa (1987). These factors were first investigated through correlation analysis using data collected from two tidal gauges, i.e. Dapeng Bay and Kaohsiung Harbor, southwest of Taiwan. The surge discrepancies were, then, calculated with the aid of harmonic analysis of the records. The selected input variables were local wind, both speed and direction, and atmospheric pressure. Features of ANN model were investigated, including training set creation, number and layers of neurons, neural activation functions, and back-propagation algorithms. Two series of typhoons in 2008 were used for the training processes. The best trained parameter set was then applied to another event for the comparison. Over 90% of correlation coefficient can be found. In order to test the ANN model to a different location, a set of data from Belgian stations were tested with the same model. Similar accuracy can also be obtained. The most important step during model development and training was the representative selection of data records for training of the model.