A MACHINE LEARNING APPROACH FOR TROPICAL CYCLONE RAINFALL FORECASTING IN THE PHILIPPINES

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ABSTRACT

The Philippines, situated in the most active tropical cyclone (TC) basin in the world, the Western North Pacific, is frequently affected by TCs all throughout the year. Rainfall brought about by TCs can cause hydrometeorological hazards such as floods and landslides. The importance of having a robust and computationally inexpensive TC rainfall forecasting method is critical in disaster preparation and risk reduction efforts. This study proposes to use machine learning (ML) in developing a model to forecast accumulated TC rainfall from input parameters such as TC characteristics, locale-specific characteristics, and climate-related indices. The ML model will be composed of a self-organizing map (SOM) block and a random forest (RF) block. The SOM block will cluster/classify the TC tracks and the RF block will draw TC rainfall predictions from the input parameters (including the clustered TC track). Model training and testing will utilize the associated input parameters and target response/parameter (TC rainfall amount) for TCs within 5° from the Philippine coastline from 1951 to 2015. The trained ML model will be evaluated using appropriate performance metrics (i.e., mean absolute error) to check for overfitting. Once deemed performant, it will be validated using ground-based observation and will be calibrated (applying biases) to yield the best prediction skill. Output of the calibrated ML model for selected TCs will be compared with satellite observation and WRF-ARW model output for its spatial rainfall distribution. Meanwhile, its forecast ability will be compared with the WRF-ARW model. Data analysis of the response of TC rainfall to the input parameters will be compared with the response relationships learned by the ML model. Preliminary results from the initial ML model that used handpicked TCs for its testing phase showed considerable overfitting.

Keywords: tropical cyclone, TC rainfall, machine learning