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Geostationary Satellite-Model Data Combined Technique for Tropical Cyclone Formation Detection using Machine Learning

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Of the hundreds of tropical disturbances that occur over the western North Pacific each year, only a few develop into tropical cyclones (TCs). For an operational tropical cyclone center such as National Typhoon Center (NTC) in Korean Meteorological Administration (KMA), it is firstly necessary to detect and forecast which disturbances develop into TC and which ones just decay. While recent remote sensing has capabilities in observe dynamics, thermodynamics, and clouds in many tropical disturbances, the current satellite application to TC tends to qualitative and subjective. While advances in numerical modeling have been achieved for several decades, challenges still remain in accurate forecast of TC formation.

An objective technique for defining (TC candidate) tropical disturbances over the western North Pacific has been developed by analyzing the large-scale tropical cyclone formation factors condition from National Centers for Environmental Prediction (NCEP) FNL analysis data. Then, we have developed Geostationary Satellite-Global Model data combined technique for TC formation detection using machine learning approaches. For each tropical disturbance, the developed TC detection techniques produce TC formation possibility (high, medium, low) within few days using machine learning algorithms based on satellite indices and global model predictors.

For quantifying mesoscale indices related to TC formation, cloud organization level and top height are quantified using geostationary satellite infrared and visible data from the Communication, Ocean and Meteorological Satellite (COMS)/Meteorological Imager (MI) data. From the NCEP FNL analysis, low-level vorticity, vertical wind shear, divergence, relative humidity around each tropical disturbance have been used as important large-scale factor related to TC formation.

Currently, Geostationary Satellite-Global Model combined technique for Tropical Cyclone Formation Detection shows 87.5 % (100 %) of possibility of detection with 20 % (30 %) False Alarm Rate within 48 hour prior to formation of a tropical depression (typhoon). The validation results for 2017 tropical cyclone cases will be newly shown in the talk.