令和３年度　環境科学院　修士論文内容の要旨

Geospatial data for assessment of forest damage due to typhoon in Eastern Hokkaido, Japan
(地理空間データを用いた北海道東部の森林の台風被害の評価)

Hokkaido University, Graduate school of Environmental Science
Division of Environment science Development, GEM Course

Chen Xinyu

Climate change induced warming oceans and sea level rise intensified the typhoonal acitivities, and have had widespread impacts on terrestrial ecosystems. Tree mortality and forest destruction during typhoon landfalls are important adverse impacts closely linked to terrestrial processes. Due to the sporadic nature of typhoons, evaluating their effects on forest ecosystem is often challenging. This study evaluated the utility of multiple vegetation damage estimation techniques using freely available Landsat 8 images. This study is focused on the Eastern Hokkaido region of Japan, where three typhoons successively struck in 2016 and caused widespread forest destruction. Following indices including Disaster Vegetation Damage Index (DVDI), Difference Normalized difference vegetation index (DNDVI), Enhanced Vegetation Index (ΔEVI), and machine learning models such as Random Forest and Support Vector Machine classifiers with different training data; and the CLASlite software with built-in methods were used to detect the forest disturbance. Our results show that machine learning classifiers obtained the highest damage assessment accuracy but are also most computationally intensive and technically complex to implement. Both Random Forest (AUC = 0.77 – 0.80, ACC = 80.36%) and Support Vector Machines (AUC = 0.75 – 0.79, ACC = 80.36%) gave highest accuracies when using Fractional Vegetation Cover as input variable. Among the vegetation damage indices, DNDVI produced the highest accuracy (AUC= 0.775, ACC = 77.68%). CLASlite's forest disturbance classification gave conservative damage estimates (AUC = 0.77, ACC = 76.95%) but was easy to implement and had classification accuracy similar to the other methods. We also investigated the influence of the terrain characteristics and typhoon path on forest damage by analyzing topographic parameters (windwardness, wind exposition, elevation, slope, and distance from the typhoon path). Maximum damages were occurred on the windward side that exposed forest patches. Forest damage peaked at the highest elevations in the study area, possibly representing exposed hilltops. Methods and results presented in this study can be implemented as a framework for effective tool for stakeholders to monitor forest damages in response to increasing typhoon frequency in Asian region.