Remote Sensing Assessment of Typhoon-Induced Vegetation Damage over the Philippines

Kaye Kristine Vergel[1], *Yukihiro Takahashi[1]

1. Graduate School of Science, Hokkaido University

Philippines is an archipelago composed of 7,107 islands, located in the Southeast Asia. It is one of the the 18 mega-biodiverse countries in the world, containing two-thirds of the earth's biodiversity and between 70 - 80% of the world's plant and animal species. It is a country rich in natural resources but at the same time, it is vulnerable to numerous natural hazards. According to a study conducted by the United Nations Office for Disaster Risk Reduction (UNISDR) and the Centre on the Epidemiology of Disasters (CRED), over the past two decades (from 1995-2015), the Philippines endured a total of 274 natural calamities, making it the fourth most disaster prone country in the world. The main reason for this is its location. The country is located in the pacific ring of fire which explains the presence of numerous volcanoes, faults and trenches in the country. Its location in the pacific has also a high exposure to tropical cyclones. From 1990-2006, it was estimated by the Climate Change Commission of the Philippines that of the PHP 12.43 billion or USD 248.7 million average annual cost of natural disasters to the agricultural sector, about 70% is from damages brought by typhoons.

Remote Sensing is a cost-effective tool in analyzing areas that are challenging to observe with field surveys. With the presence of numerous satellites equipped with high resolution and multi-spectral sensors, images of areas hit by natural calamities are easily obtained few days after the disaster struck. Comparison of the Normalized Difference Vegetation Index (NDVI) method obtained pre- and post-storm is commonly used by numerous researches in detecting damages after a storm's passing.

In this research we examine typhoon-induced damage to vegetation by utilizing NDVI and relating it to the typhoon's features: wind and rainfall, and to the characteristic of the area hit: elevation, aspect and land cover type. This research is in support of the goal of rapid post-typhoon assessment in the Philippines with the use of its microsatellite, Diwata. In the future, we want to use images taken by Diwata in post disaster assessment.

Two typhoons were analyzed, Typhoons Haiyan and Koppu. Both hit the Philippines and brought devastating damages to the country. The area analyzed are the provinces of Leyte and Nueva Ecija for Typhoon Haiyan and Koppu, respectively. The main difference between these two storms is that Typhoon Haiyan carried with it strong winds more than heavy rainfall while Typhoon Koppu, on the other hand, carried more heavy rain than strong winds. In both cases the NDVI significantly decreased after the typhoon hit with values of -0.12 +- 0.13 (mean +- standard deviation) and -0.14 +- 0.14 with paired t-test p values < 0.001 for Typhoons Haiyan and Koppu, respectively. Damage as a function of rainfall, aspect, land cover type and elevation were analyzed for each case. We also calculated the influence of each variable to the measured damage using Artificial Neural Network. We found that the elevation is the strongest influence, followed by aspect, rainfall and lastly land cover.

Keywords: Typhoon, damage asessment, Philippines, Landsat

