Remote Sensing of Chlorophyll-a and Submerged Aquatic Vegetation for a Freshwater Lake in Japan

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Freshwater lakes, particularly shallow lakes often exhibit alternative vegetative states, a clear-water state dominated by submerged aquatic vegetation (SAV) and a turbid-water state dominated by phytoplankton. Phytoplankton and SAV constitute the base of the aquatic food web and are the primary driver of the biogeochemical process in both the freshwater and coastal water bodies. The abundance of phytoplankton biomass can potentially indicate the degree of eutrophication in a specific waterbody. On the other hand, the massive overgrowth of invasive SAV species can also pose a serious threat to the aquatic ecosystem. Conventional methods (eg. Site-specific Boat survey) used to monitor the large water bodies are often time-consuming and expensive. In this study, we used a remote sensing based approach to monitor SAV and phytoplankton of the Lake. A multi-spectral satellite image (Landsat-8 Operational Land Imager) was used to assess the phytoplankton concentration and SAV biomass. A spectral decomposing algorithm was used to estimate and quantify both phytoplankton and SAV. Based on the peak growth period of SAV in the lake, the estimations were limited to a certain period of the year (i.e. mainly August and September). The image was used to classify and map the SAV coverage area using the spectral mixture analysis. The SAV biomass estimation model was used to determine the biomass of the SAV classified pixels in the lake. The satellite-derived phytoplankton and SAV were validated using the in-situ measured data of the lake. The result indicates the time and location-specific variation in the dominance of the phytoplankton and SAV.

Keywords: Phytoplankton, Submerged Aquatic Vegetation, Remote Sensing, Lake Water Quality

