

IoT measurements of the winter environment around Lake Izunuma, Miyagi

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Lake Izunuma and Uchinuma are interconnected lakes located in the Senpoku-plain of Miyagi prefecture, Japan. The wetland around the lakes is recognized as a natural habitat and wintering area of migratory birds; Greater White Fronted Goose, Whooper Swan or so. The population of these birds around lakes are more than 100,000. It occupies 90 percent of Greater White Fronted Goose in Japan. The wetland was designated as the Ramsar site in 1985.

The distribution of surface aquatic plants in the lake has changed significantly in recent years. Lotus area is increasing year by year. It occupied 75 % of water area in 2012 though it was 23 % in 2006. Water degradation of the lake and hypoxia in Lotus vegetated area is also recognized (Nakada et al., 2015; Yasuno et al., 2015). The monitoring of vegetations such as Lotus growth and developments of trimming/planting plan and related technologies (e.g. Mizuno and Asada., 2014; Yusa et al., 2015) are significant for the conservation of biodiversity.

The monitoring camera was also settled by Japanese Ministry of Environment for its environmental monitoring and preservation activities. The camera is located in the Izunuma-Uchinuma Sanctuary Center, Miyagi Prefectural Izunuma-Uchinuma Environmental Foundation, in Kurihara City. We analyze the monitoring photos to investigate the lake surface environment and its seasonal changes. Monitoring images have been recorded once in a hour. It is also possible to check images by internet connection as a web camera. The UAV measurements are conducted to monitor and detects aquatic plants using multispectral image sensor technique (Kobayashi and Sato, 2018; Sato and Kobayashi, 2018).

The super-pixel segmentation is applied to segment lake ice area and water area. Although it does not freeze up whole of the lake, it repeats freeze and melt in winter. Freezing time was measured using images. Total freezing time is one fifth of a winter, December to February, from 2015 to 2017. It almost totally disappears from surface water in a wintertime. The surface aquatic plants almost disappear in the same time. Surface ice cover also affect activities of birds in the lake. Many cases, lake ice is formed in morning or former nighttime and melt in afternoon. Ice cover continues several days only when cold weather continues and/or snowfall conditions.

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