

Application of SGLI and MSI sensor to estimate ice breakup dates on Lake Suwa

*Takashi Nonaka¹, Tomohiro Nakazawa¹

1. College of Industrial Technology, Nihon University

The freeze-up and breakup dates for lakes are important indicator of climate change. Freezing point on the lakes were observed in Europe and North America, while there is not enough record of freeze-up and breakup dates of the Japanese lakes. Lake Suwa in Nagano Prefecture in Japan, which is critical due to the frozen surface located in the middle latitude, had observed those freeze-up dates until 1994, however there is no records after that. Even lakes without record are observable utilizing satellite data. In previous studies, we used MODIS sensor mounted on the Terra satellite which can observe the same spot every day, and estimated the surface condition of Lake Suwa. As a result, we successfully classified the surface condition into ice and water using both surface reflectance and water temperature data acquired by MODIS. However, the spatial resolution (1 km) was coarse to observe the small lakes. In addition, selecting different satellites allow more frequent observation.

The present study focused on “Second generation Global Imager (SGLI)” on “Global Change Observation Mission –Climate (GCOM-C)” satellite, an optical sensor with resolution of 250 m, which was launched on December 23, 2017. The objective of this study was to acquire the knowledge for the application of SGLI to estimate the ice breakup dates. Before the examination of the method, we revealed about the accuracy of “Sea Surface Temperature (SST)” and “Normalized Water Leaving Radiance (NWLR)” products quantitatively. The result showed that SST had the accuracy better than 1 degree, though the reflectance of NWLR was underestimated. Therefore, we proposed a method to use the reflectance of Multispectral Imager (MSI) on Sentinel-2 instead of SGLI. We applied the proposed method to analyze 2018 data, and tried to grasp the surface status and ice breakup dates on Lake Suwa. It showed that the reflectance was fluctuated at 2 degree or less same as the previous study using MODIS data. In addition, we revealed that the result acquired by SGLI/MSI complemented the surface status acquired only by MODIS, and shortened the range of the ice breakup dates of Lake Suwa. We intend to develop the methodology to estimate the ice breakup dates using water temperature trend by SGLI data in the future study.

Keywords: Reflectance, Surface temperature, Freezing state, Lake Suwa