Feature analysis of the spectral of snow, ice, and water in Lake Suwa using MODIS data

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The freezing and breakup dates of the lake are important as an index of climate change. There is not enough record of freezing and breakup dates of the lakes in Japan though various publication reports are available in Europe and United States. Estimating freezing and breakup dates in Japanese lakes contributes to grasp the trend of climate change in Japan. Satellite data is expected to complement the dates of such lakes without in-situ observations.
Therefore, our study team has developed the methodology to classify the lake surface on Lake Suwa using optical satellite data. Currently, we tried to classify the lake surface into snow, ice, and water and estimate the temporal surface changes of the lake using the spectral reflectance data and the surface temperature acquired by MODIS on daily observed Terra satellite. However, we found the difficulty to distinguish thin ice and water by the difference of the surface reflectance.
The purpose of this study was to grasp the feature of reflectance of the Lake Suwa, and we used the surface reflectance data derived by MODIS in winter season mainly in 2014 and 2018. This study acquired the lake surface status referring to the newspaper articles.
From the analysis of the reflectance of each band, it showed that the variation of the reflectance between snow, ice, and water was different depending on the wavelength. The ice showed the relatively high reflectance on band 3 (visible blue) and 4 (visible green), while snow had high reflectance on band 1 (visible red) and 2 (near infrared). The water also showed the high reflectance on band 3 and 4, and classification between ice and water was difficult only by the reflectance data. This study also compared the observations derived by the spectral band values of Landsat-8, and confirmed the validity of the result.

Keywords: MODIS, Lake Suwa, Reflectance, Freezing state

