Estimation of the surface freezing condition of Lake Suwa using optical MODIS data

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The freezing and breakup dates of the lake are important as an index of climate change. Although there are various publication reports on the freezing state of the lakes focusing Europe and US, there is not enough record of freezing and breakup dates of Lake in Japan. Satellite data complement such lakes for the long term record without in situ periodic observations. Estimating freezing and breakup dates in Japanese lakes contributes to grasp the trend of climate change in Japan. To achieve the purpose, we focused on MODIS sensor mounted on the Terra satellite observing every day over the entire earth.
We focused on Lake Suwa in this study, and tried to classify the lake surface into ice and water using reflectance data of each band and surface temperature data derived from MODIS. The goal in our research was to estimate freezing and breakup dates, and we analyzed data from December 1, 2013 to March 5, 2014 in this study. Also, we used information of newspaper articles as freezing and breakup dates of Lake Suwa. As a result of the analysis using reflectance and surface temperature, it showed that the variation of the reflectance between water and ice was different depending on the band (wavelength). Even among them, standard deviation of Band 3 (visible blue) was 0.047, and the variation of reflectance was the largest. The results showed that the reflectance of Band 3 fluctuated below 2 ℃ and reflectance of other Band did not appear such feature. Therefore, it was suggested that Band 3 was the most suitable for classifying the lake surface into ice and water. In addition, the classification results based on the reflectance of Band 3 and surface temperature implied the possibility of re-freezing day on without information of the newspaper article.

Keywords: MODIS, Lake Suwa, Reflectance, Surface temperture, Freezing state

