

# Seasonal and interannual changes in the lake surface of Izunuma wetland

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Internet of Things (IoT) technology has been developed to utilize information by connecting various devices to a network. These technologies are capable of collecting and analyzing environmental information in remote and inaccessible areas, and are important for obtaining real-world information in situations where mobility is restricted. The Izunuma and Uchinuma wetland areas located in the northern part of Miyagi Prefecture in the Tohoku region are internationally important wetlands and have been registered under the Ramsar Convention. Japanese Ministry of the Environment has established the Internet Nature Research Center (2021), which connects images taken in nature parks by camera to a network in an attempt to utilize them for nature park management and information disclosure. Every winter, 100,000 migratory birds fly to Izunuma from the Arctic region of Siberia to overwinter around the lake. In this study, these images were used to analyze the winter environment of the lake and to obtain vegetation information during the summer season.

A study of changes in the number of days of lake surface freezing shows that even in the early 2010s, the number of days of freezing in winter (DJF) ranges from 10 to 40 days. The number of days of freezing is high and low every few years, and the number of days of freezing is particularly high in the years of low temperatures and heavy snowfall in northern Japan. In the analysis of the camera images so far, it is found that the number of freezing days in the winter season of 2020 (December 2020 to February 2021) is the largest (48 days), and that in 2019 it is the smallest. Classification of the lake surface was conducted using image data from spring and summer using a neural network to discriminate the vegetation of the lotus, and it was found that the classification was highly accurate (approximately 98%), indicating that discrimination by the presence of vegetation is possible. Therefore, we prepared a cutout of the lake surface from the images from 2013 to 2017 and calculated the percentage of green to the entire lake surface using HSV. The the highest percentage of vegetation was found around August each year, and that within a few weeks, the vegetation took up the majority of the lake surface. The weather data for the points where the percentage of green vegetation decreased dramatically showed a significant increase in precipitation (e.g. typhoon).