Spatio-temporal monitoring of aquaculture area using Sentinel-1 and Sentinel-2 data in Satkhira, Bangladesh

(バングラデシュのサトキラにおける Sentinel-1 および Sentinel-2 データを用いた養殖漁場の時空間モニタリング)

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Abstract

Aquaculture is one of the world's fastest growing sectors for food production. It contributes more than 50% of the total amount of marine food for human consumption, and provide great opportunities for global food security. Bangladesh was ranked sixth for aquaculture food production around the world. It has a leading economic value contributes around 4.43% of national Gross Domestic Product (GDP). Over the last two decades, fish production has grown significantly, beginning from 1,781 million metric tons in 2000-2001 to 4,134 million metric tons in 2016-2017. There are plenty of aquacultures in Satkhira regions, which has been selected for this study. As per 2018-2019 Govt. fisheries report: 133,325 metric tons (MT) shrimp and different types of fisheries produced by Satkhira region to export within the country and abroad annually. There is a lack of up-to-date, explicit and continuous spatial knowledge about aquaculture and also difficult to monitor everything physically in remote areas. Earth observation is a widely preferred for the mapping and monitoring of aquaculture production. Satellite remote sensing is supportive for monitoring, mapping and extracting information about the aquaculture area. The objective of this study is to monitor the temporal changes of aquaculture area using Sentinel-1 based backscatter information and Sentinel-2 based Normalized Different Water Index (NDWI), Modified Normalized Difference Water Index (MNDWI) to see from 2017-2019. Shuttle Radar Topographic Mission digital elevation model (SRTM DEM) data has been used to identify the location of ponds based on the elevation and to understand the variables and difference between ground and depth of the land. Total numbers of permanent aquaculture samples ponds were 4,672, collected from Google Earth Imagery based on 2018 and 2019 years, to utilize the information about aquaculture pond's shape features. Image segmentation algorithm was used to detect aquaculture ponds based on backscattering intensity, size and shape characteristics. Object-based image classification using Sentinel-1 data shows an overall accuracy above 80% in all the images. Therefore, the results of this study could be considered as significant findings to provide information about aquaculture area in depth for policymakers and environmental administrators for the successful aquaculture management in Satkhira, Bangladesh as well as other countries.