Monitoring Temporal Variation of Ecological Ponds in Taiwan by Using Sentinel Images

Wei-De Chen (1), Yu-Ching Lin (1), and Kuo-Hsin Tseng (2)

(1) Department of Environmental Information and Engineering, Chung Cheng Institute of Technology, National Defense University,Taiwan (s790807610@gmail.com; yuching.ncl@gmail.com), (2) Center for Space and Remote Sensing Research, National Central University, Taiwan(khtseng@csrsr.ncu.edu.tw)

Thousands of ecological ponds lie within Taoyuan City in northern Taiwan for multiple purposes. The functionalities are not only to dam water over the low-lying plains but also for irrigation, aquaculture, and tourism. Owing to the economic growth and urban expansion, the number of ponds has been decreasing from more than 8000 to about 1000 since 1960. Such phenomenon has threatened local biodiversity and ecology with shrinking habitats. This study provides a workflow to monitor water bodies by using ESA's optical (Sentinel-2) and SAR (Sentinel-1) images. Since ascending and descending track of SAR images provide different viewing angles of backscatters toward the ground, combining both passes of SAR backscatters could eliminate the effects of SAR shadow. This study aims to maximize the potential of multi-temporal Sentienl-1 SAR images, with partial support from Sentinel-2 optical images in order to delineate water boundary.

To classify water, image segmentation with object-based image analysis (OBIA) with both VV/VH polarization was employed for Sentinel-1. And the Normalized Difference Water Index (NDWI) using green and near infrared bands was derived for Sentinel-2. Ecological ponds map was further validated against POI geo-database from local surveys. It was found that 94% of ecological ponds were successfully detected. Therefore, the area of ponds can be estimated and the spatiotemporal variation can be clearly identified. This would benefit evaluating the sustainability of the ponds and to preserve such a unique landscape.