Exploring Synthetic Aperture Radar (SAR) data for a better understanding of irrigation status at paddy fields

*Aliya Binti Mhd Zahir -[1], Hiroaki SOMURA[1]

1. Graduate School of Environmental and Life Science, Okayama University

The use of remote sensing (RS) in application related to paddy irrigation evaluation are expanding as RS datasets nowadays are more accessible and produced at better spatiotemporal resolution. Due to the requirement of multi-level inputs from in-situ measurement, is not feasible to obtain information on the irrigation management targeting large area paddy fields. RS on the other hand, has the advantage to cover the weakness of in-situ measurement. Although RS has the potential to understand the management and operation of paddy irrigation at a large scale, the relationship between crop stages and irrigation timing should be assessed because paddy has different water demands during their growth development. Considering the limitation on cloud contamination of optical RS datasets measurement in the tropical regions, the SAR dataset in this study was explored to understand the irrigation events at different paddy stages. Twelve days of SAR data with a resolution of 10 m from Sentinel-1 were used to monitor the backscattered values of the VV (Vertical-Vertical) and VH (Vertical-Horizontal) bands in the research area. Validation of crop cycle growth was performed using the NDVI (Normalized Difference Vegetation Index) collected from the Sentinel-2 satellite during the study period. With the verification of daily rainfall and crop phenology, the timing of irrigation events could be detected by understanding the fluctuation of the SAR data. Irrigation events could be detected from the variation of the VV band corresponding to the water needs of crop phenology represent by the VH band. From the results, the VV band was useful to identify the dynamic change of soil water content in the rice paddy field. VV band increases after rainfall events, but it lost its sensitivity when the vegetation cover of the rice field increased. The VH band, on the other hand, is useful to validate crop stages and to understand the level of water requirement. The results of the study will be useful for SAR data applications, especially in the context of monitoring paddy irrigation practices.

Keywords: SAR, sentinel-1, agriculture, paddy, irrigation, remote sensing

