Deep Learning Applied to Reservoir Monitoring using SAR Images

Meng-Che Wu[1], Lena Chang[2], Guan-Lin Li[3], Yi-Ting Chen[2], Mohammad Alkhaleefah[3], Yang-Lang Chang[3]*

[1] Taiwan Space Agency

[2] National Taiwan Ocean University

[3] National Taipei University of Technology

In recent years, Taiwan has faced a severe water shortage problem, with many reservoirs holding less than 20% of their water capacity. To proactively address this issue, the establishment of a long-term monitoring system to measure the catchment area and monitor water conditions becomes crucial. Synthetic Aperture Radar (SAR) offers valuable insights in this regard, as different objects exhibit distinct scattering characteristics and polarization properties. These properties allow for basic observations of long-term changes in reservoir water conditions. Additionally, SAR phase characteristics enable the detection of short-term fluctuations in the catchment area, which can be accumulated and used in conjunction with other data, such as water level and storage percentage, to serve as a reference for long-term reservoir water condition monitoring. In this study, we utilized the Taiwan Datacube (TWDC) platform to collect multi-temporal SAR images of reservoirs in Taiwan, complemented by water condition data recorded by the Department of Water Resources, Ministry of Economic Affairs of Taiwan. Our aim was to observe the dynamic changes in reservoir water conditions. By leveraging SAR's scattering and polarization properties, we were able to make basic observations of long-term changes and utilize SAR phase characteristics to monitor short-term trace changes in the catchment area. The accumulation of these short-term changes, combined with other data, provided a reference basis for comprehensive and long-term reservoir water condition observations. The study contributes to the development of an effective monitoring system to address Taiwan's water shortage problem and facilitate proactive management of water resources.

Keywords: Synthetic Aperture Radar (SAR), Sentinel-1, Deep Learning, Segmentation, Reservoir Monitoring