METU Environmental Engineering
Departmental Seminar Spring 2023

Near-Real-Time SAR-Based Water Level Change Monitoring Framework Development

Lakes are an essential carrier of water resources, vital for maintaining the balance of watershed ecosystems, regional and global climate stability, and socioeconomic development. Water must be managed holistically as a scarce, sensitive, and critical resource. The water level in a lake is one of the most important factors to consider deciding what managerial action should be taken. The variation of lake water reserves can be evaluated in real-time by developing long-term water level sequences. This allows us to understand local climate change, create efficient environmental protection rules, and recognize the long-term growth of the local ecological ecosystem. Although monitoring water level changes and water quality indices is critical, it may be expensive for developing countries. Studies show that the financial capacities of countries and the establishment of water quality monitoring are highly related.

Water depth and water level variations affect vital environmental factors in lakes, such as nutrient content, light intensity, and temperature variation. This research aims to create a near-real-time SAR (Synthetic Aperture Radar)-based depth change monitoring system for lakes by focusing on shoreline pixels to monitor water level changes. Image acquisition with SAR systems is possible at any time of the day and under any weather by being an active system with a high wavelength. Sentinel 1 satellites used in this study have around five days of temporal and 10 meters of spatial resolution. We created a framework for this goal by combining the Sentinel-1, the Digital Elevation Model, and Sentinel-2 Dynamic World land cover data from Google Earth Engine. With a temporal resolution of about five days, Sentinel-1 satellites provide the temporal resolution required for frequent monitoring. We are evaluating five ground monitoring sites in Sweden and one in Turkey for the initial development phase. The method begins by using Sentinel-1 to locate water bodies within a defined area of interest. Then we extract shoreline pixels to calculate the temporal changes in different polarizations. The identified changes are further classified depending on the median Dynamic World data to handle the temporal difference for each land cover type. The slope and aspect values of the measured pixels are also considered input features to the machine learning model we are developing. Machine-learning-based model development is proceeding with the created framework.

By Utku Berkalp Ünalan

Advisor: Prof. Dr. Ayşegül Aksoy
Co-Advisor: Dr. Onur Yüzügüllü

Date:29.03.2023 & Time: 15:40

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