Investigation of the Accuracy of Monthly Water Surface Extraction from Landsat 8 using Synthetic Aperture Radar (SAR) Sentinel-1 Data

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Accurate assessment and dynamic monitoring of surface water bodies using long-term satellite data are critical for water resource planning, drought monitoring, flood control, and disaster mitigation applications. Despite the Synthetic Aperture Radar (SAR) Sentinel-1 systems with high accuracy, wide-coverage, and the ability to obtain all-weather conditions, Landsat optical satellite data have been used to obtain long-term water surface area since SAR data is available only from 2014 onwards. However, high-efficiency and high-precision water surface extraction and the use of Landsat data for dynamic water surface monitoring are more challenging than SAR data due to the presence of clouds and their shadows. Therefore, the main focus of this study is to analyze the accuracy of monthly water surface area extracted from Landsat-8 using SAR Sentinel-1 base data for water surface area as it provides the most accurate water surface area. The data extracted for five reservoirs in Sri Lanka namely Iranamadu, Mahavilachchiya, Kantale, Senanayaka Samudraya, and Udawalawe were used to investigate the accuracy of Landsat 8 derived water surface area using SAR Sentinel-1 Data. Furthermore, the study referred to data only from 2015 to 2020, taking into account that the presence of both Landsat 8 and Sentinel-1 data. The study utilized the cloud computing platform and algorithms available in Google Earth Engine (GEE) to make the analysis more efficient and robust as it used a large volume of satellite data to analyze. The Pearson correlation coefficient (r2) was calculated using the water surface areas extracted from both Landsat 8 and Sentinel-1 in the reservoirs used for the analysis. The r2 values for five reservoirs were 0.83 (Iranamdu), 0.91 (Mahavilachchiya), 0.91 (Mahavilachchiya). 0.92 (Senanayake Samudra) and 0.91 (Udawalawe). These results show that the water surface areas extracted from Landsat 8 show high accuracy. Henceforth, it can be confirmed that the Landsat series data (1, 2, 5, 7, 8) which used the same sensing mechanism can be used more efficiently to calculate long-term water surface areas as it is available from 1972. The other important point reflected in this study is that GEE can be used more efficiently for long-term water surface extraction.

Keywords: Landsat, Sentinel-1, Google Earth Engine (GEE)