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ESTIMATION OF *CHLOROPHYLL-A* CONCENTRATION FOR A FRESHWATER LAKE FROM SENTINEL 2A MSI DATA

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Abstract

Harmful algal blooms (HABs) have been a major concern for aquatic ecosystems, including killing fish and birds, discoloring water, food web vectoring, and airborne toxic events. Thus, the monitoring of HABs is critical for the formation of water governance policies. Satellite remote sensing is a promising method for monitoring these phenomena in inland and near-coastal waters (synoptic coverage and temporal consistency). The multispectral instrument onboard European Space Agency's Sentinel 2A (S2A) satellite initiates a new era in high-to-moderate resolution (10, 20, 60 m) of Earth observation mission launched in 2015 as a part of the Copernicus program. S2A MSI filter-based push-broom imager measures the reflected solar spectral radiances in 13 spectral bands ranging from the visible-near infrared (VNIR) (0.4422-0.8640 µm) to the shortwave infrared bands (0.9432-2.1857 µm). This study aims to develop a method to estimate chlorophyll-a (Chl-a) concentration in freshwater lake waters using in situ data of Chl-a, water reflectance, and contemporaneous S2A MSI imagery over the Kotmale reservoir. The prediction models were developed by applying the regression analysis between spectral sensor radiance of band ratio and in situ Chl-a concentration over the study points. This was shown through a strong correlation of S2A green-red band ratio with Chl-a by an exponential curve (R^2 = 0.910 and SE = 0.239 mgl^{-1}). The small error between in situ Chl-a and model-fitted Chl-a from S2A acquired, confirmed the S2A green-red band ratio as the most suitable option for monitoring Chl-a in Kotmale reservoir. Although, measurements located under semi-transparent clouds were performed using R^2 as 0.501 and SE as 0.105 mgl^{-1} by polynomial fit. Besides, Chl-a retrieval from S2A imagery over the study points under clouds and cloud shadows resulting a larger margin of error likened to non-cloudy locations. Overall, this study showed that remote sensing can be integrated into future operational water quality monitoring systems.

Keywords: *Sentinel 2 MSI, remote sensing, algal blooms, water quality, chlorophyll-a*