ESTIMATION OF SUSPENDED PARTICULATE MATTER AND WATER CLARITY PARAMETERS IN CHILIKA LAGOON FROM REMOTE SENSING DATA

ABSTRACT

Increasing sediment load and poor water clarity pose significant challenges for many inland water bodies. While remote sensing is a useful tool for monitoring suspended particle matter (SPM) and water clarity indicators such as secchi disk depth (Z_{SD}), diffuse attenuation coefficient (K_d), and euphotic zone depth (Z_{eu}), the bio-optical complexity of these ecosystems creates uncertainty, limiting its usefulness. Therefore, we measured optical properties with different water quality parameters in the Chilika lagoon, the second-largest brackish water lagoon in the world. We evaluated existing quasi-analytical algorithms (QAAs) to retrieve particle back-scattering coefficients (b_{bp}) and K_d from surface remote sensing reflectance (R_{rs}) data. However, existing QAAs underestimated observed b_{bp} and K_d values in the Chilika lagoon. Therefore, a modified inversion algorithm (MIA) is proposed and validated to derive b_{bp} at 665 nm and K_d at 490 nm from R_{rs} to estimate SPM (ranging from 11.54 to 99.00 mg L^{-1}) and Z_{SD} (ranging from 0.15 to 1.2 m) respectively. better root-mean-squared error (RMSE) value of 9.34 mg L^{-1} for SPM and 0.12 m for Z_{SD} were observed with *in situ* measurements when compared with existing QAA models. Specifically, the RMSE value of 11.96 mg L^{-1} for SPM and 0.29 m for Z_{SD} were observed for QAA v6 (n = 77). We further used MIA to Sentinel 2A/2B (S2A/S2B) multispectral instrument (MSI) R_{rs} data for each pixel over the Chilika lagoon to estimate SPM (RMSE = 10.91 mg L^{-1}) and Z_{SD} (RMSE = 0.31) respectively. Also, S2A/S2B MSI- R_{rs} data were used to develop algorithms for mapping Z_{eu} from K_d of photosynthetically active radiation (PAR) for the entire lagoon. A multivariate modeling approach was adopted with S2A/S2B MSI R_{rs}- band ratio and band difference variables selected by stepwise, forward, and backward variable selection methods with $p < 0.05$. Modeling results showed a better RMSE of 1.09 m^{-1} for K_d(PAR) (observed range: 1.29 m^{-1} to 10.74 m^{-1}) while ensuring low uncertainty associated with atmospheric correction. Observed fish landing patterns with temporal SPM content and the presence of macrophytes types with Z_{eu} from S2A/S2B may provide new prospects for managing inland water bodies utilizing remote sensing observations.