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Comparing the performance of Chlorophyll-a retrieval models in coastal and transitional waters

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Among water quality (WQ) indicators, Chlorophyll-a (CHL) plays a pivotal role in assessing algal biomass production in aquatic ecosystems, serving as a crucial parameter for monitoring aquatic health and eutrophication events. Satellite remote sensing (RS) techniques offer an extended spatio-temporal coverage compared to conventional methods, making them valuable for CHL estimation, especially in optically complex waters like coastal and inland areas. However, the retrieval of CHL using RS in such environments poses challenges, and selecting the appropriate algorithm is one such challenge.

In this study, Sentinel-3 OLCI images were employed to estimate CHL levels in Cork Harbour, Ireland. Twenty widely used CHL retrieval algorithms, ranging from traditional blue-green band-based ocean color algorithms (e.g., OC4, OC5, OC6) to two-band and three-band NIR-red algorithms, were applied to water leaving reflectance data obtained from the Case 2 Regional CoastColour atmospheric correction algorithms. Additionally, in-situ CHL concentration data from 32 monitoring sites within Cork Harbour were used for validation.

The results revealed that three-band algorithms based on NIR-red bands (specifically B12/(B08-B11)) exhibited a higher sensitivity (R^2 = 0.77) to in-situ CHL measurements, outperforming other CHL algorithms with superior performance (RMSE = 0.28 mg/m^3, MAPE = 28.6%, MAE = 0.28 mg/m^3, and MBE = - 0.00 mg/m^3). Furthermore, the study demonstrated the potential of Sentinel-3 OLCI satellite images for CHL retrieval in Irish coastal waters. These findings offer valuable insights into optimizing CHL retrieval from remotely sensed data, potentially enhancing traditional monitoring programs by addressing existing limitations.

Keywords: Coastal and transitional water quality, chlorophyll-*a*, retrieval algorithms; remote sensing, atmospheric correction.