A Space-Based Retrieval Approach for Red-Brown Tides in Long Island Sound

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Often referred to as “the Urban Sea”, Long Island Sound is an *Estuary of National Significance* located near one of the largest coastal megacities in the world. Home to a variety of marine life, the Sound holds large ecological, cultural, and economic significance. Yet, LIS has been suffering from major water quality issues, including seasonal hypoxia, and recurring harmful algal blooms (HABs) such as red and brown tides. Detection and monitoring of red-brown tides is challenging due to the large spatial extent but also patchiness of the blooms, the transient natures of these events, and the time intensive nature of in-situ sampling. Space-based monitoring can provide high-frequency, synoptic observations of the entire ecosystem, over different seasons and across a range of conditions, uniquely complementing in situ monitoring. Here, we applied the Normalized Red Tide Index (NRTI) approach, to detect red-brown tide blooms across Long Island Sound from space. To validate the NRTI retrievals, we used flow microscopy, high performance liquid chromatography, hyperspectral phytoplankton absorption, and hyperspectral remote sensing reflectance measurements. HPLC analysis showed strong correlation between NRTI and red-brown pigments with an R^2 value of 0.79. Seasonal transitions in phytoplankton diversity were captured, showing a 57% increase in phytoplankton diversity in the summer. Combing patterns in microscopy and relative pigment contribution, differences in NRTI values and overall red-brown tide biomass can be explained. These results highlight the value of the NRTI as an approach that can be applied to capture the magnitude and spatiotemporal extent of red-brown tide events in complex urban estuarine waters.