Optical Properties, Water Quality, and Carbon Dynamics in Long Island's Coastal Waterways

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The Long Island Sound system is unique for its proximity to New York City, the largest metropolitan area in North America. With this proximity come several important implications for water quality research and resource management: population density, agricultural and residential inputs, and the use of the water body for fishing and recreation. However, its many semi-enclosed bays and coastal waterways have little to no record of historical bio-optical monitoring that would allow scientists to observe changes in water quality state from space. This research seeks to better understand the biogeochemical processes and water quality of these bodies through in-situ and remote observations. In particular, it asks: "What factors are driving differences in chlorophyll and carbon dynamics between the Peconic Bay and the Great South Bay?" In order to address this question, a 3-part approach was devised, combining in-situ and satellite observation of the water's optical quality with laboratory analysis of samples collected over 4 field cruises. Our findings suggest that differences in tidal flushing and freshwater input play a major role in determining biogeochemical variability in the two areas. Greater interchange with fresh ocean water from the east leads to lower colored dissolved organic matter (CDOM), lower chlorophyll-a (Chl_a), and lower turbidity in the Peconic Bay, with a strong East-West gradient from the greatest concentration of CDOM in the mouth of the Peconic river, which brings larger amounts of terrestrially-derived carbon into the system. The less tidally-influenced Great South Bay shows higher CDOM and Chl_a values, an influence of both terrigenous (e.g., wetlands) and autochthonous production of organic matter. Further research is needed to discern the specific stores of organic carbon in the system, including species composition and dissolved organic carbon (DOC), which could be used to construct a carbon budget. Developing stronger hydrodynamic models of these smaller water bodies would offer a spacial understanding of how tidal variability affects their biogeochemical processes.