Tidal marshes as a source of optically and chemically distinctive colored dissolved organic matter in the Chesapeake Bay

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ABSTRACT: The role of tidal marshes as a source of dissolved organic carbon (DOC) and colored dissolved organic matter (CDOM) for adjacent estuarine waters was studied in the Rhode River subestuary of the Chesapeake Bay. Water in a tidal creek draining brackish, high-elevation marshes was sampled every hour during several semidiurnal tidal cycles in order to examine the tidal exchange of dissolved organic matter (DOM). Water leaving the marsh during ebbing tide was consistently enriched in DOC compared to water entering the marsh during flooding tide. There was a net DOC export from the marsh to the estuary during seasons of both low and high marsh plant biomass. Optical analysis demonstrated that, in addition to contributing to the carbon budgets, the marsh had a strong influence on the estuary's CDOM dynamics. Marsh-exported CDOM had optical properties that were consistently and markedly different from those of CDOM in the adjacent estuary. Specifically, marsh CDOM had: (1) considerably stronger absorption, (2) larger DOC-specific absorption, (3) lower exponential spectral slope, (4) larger fluorescence signal, (5) lower fluorescence per unit absorbance, and (6) higher fluorescence at wavelengths >400 nm. These optical characteristics are indicative of relatively complex, high-molecular-weight, aromatic-rich DOM, and this was confirmed by results of molecular-weight-distribution analysis. Our findings illustrate the importance of tidal marshes as sources of optically and chemically distinctive dissolved organic compounds, and their influence on CDOM dynamics, DOC budgets, and, thus, photochemical and biogeochemical processes, in adjacent estuarine ecosystems.

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