

NASA MUREP/SMD Ocean Biology and Biogeochemistry Awards (OCEAN)

Title: Improving the coastal carbon budget: is sediment-derived CDOM a significant portion of CDOM in coastal areas?

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Summary: Dissolved organic carbon (DOC) fluxes from coastal marine sediments (i.e., in sediment pore waters) have been recognized to represent globally significant sources of carbon to the ocean for a few decades, with cumulative inputs from coastal and shelf sediments potentially rivaling those from rivers. However, these estimates are extrapolated from just a handful of measurements, as sediment flux measurements are difficult to obtain. In turn, even less is known about the eventual fate of sediment pore water-derived DOC upon fluxing, especially across the mesoscale. Absorption of CDOM (Colored Dissolved Organic Matter) can be used as a proxy for DOC concentration and thus lends well to quantifying fluxes from local to regional scales, e.g., from discrete water samples all the way to continental margin-scale satellite remote sensing. However, few studies have identified sediment-derived DOC using satellite remote sensing, due in part to 1) the physical disconnect between sediments and the water surface visible to satellites; 2) non-specific optical signatures leading to a confounding of signals with riverine DOC. Based on these few studies, evidence indicates that several geographical or water column characteristics may contribute to a higher likelihood of observing sediment-derived CDOM in the water column: 1) continental shelf region sediments in proximity to terrestrial freshwater inputs contain higher concentrations of organic carbon in sediments acting as precursors to sediment-derived DOC fluxes.

This proposal aims to quantify the contribution of sediment-derived pore water dissolved organic carbon (DOC) as a potentially significant component of regional carbon budgets to be identified and quantified via remote sensing, hydrodynamic modeling and field work in the Gulf of Mexico hypoxia region off the coasts of Texas and Louisiana. The proposal targets OCEAN objective 1.2. The investigation would analyze >20 years of ocean color satellite data, primarily absorption, backscatter and spectral K_d products, from SeaWiFS, MODIS-Aqua and VIIRS to identify elevated concentrations of surface water chromophoric dissolved organic matter (CDOM) beyond those from riverine sources. The TXLA-ROMS model spanning 25 years would be applied to compute the riverine CDOM fraction from model salinity and CDOM versus salinity relationships. Field work on several cruises would provide direct flux measurement of DOC and CDOM from sediments to the water column above the seabed. The proposal team would extrapolate these measurements across the entire study region at various timescales to corroborate satellite-derived estimates. The STEM portion of the proposal is weaved throughout the research proposal and presents a detailed plan to support 12-18 K-12 STEM internships, one full-time graduate student, and a part-time graduate student.