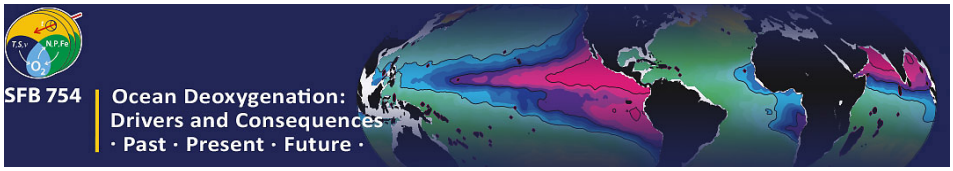

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Climate change is projected to exacerbate impacts of coastal eutrophication in the northern Gulf of Mexico

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The northern Gulf of Mexico receives excessive nutrient inputs from the Mississippi-Atchafalaya River Basin that promote high phytoplankton production and high respiration rates due to algal decomposition. Every summer, respiration, in combination with vertical stratification, results in hypoxia, high dissolved inorganic carbon concentrations and low pH in bottom waters. By the end of the century, rising temperatures, higher freshwater inputs from the Mississippi-Atchafalaya River Basin, and a drastic increase in atmospheric CO_2 are expected to further intensify eutrophication-induced hypoxia and acidification. Using a high-resolution, regional biogeochemical model, we simulate the dynamics of oxygen and inorganic carbon in the Northern Gulf of Mexico under present and end-of-the-century climate conditions. Results indicate a modest spatial expansion of the hypoxic zone in the future, but more severe hypoxia with greater exposure to prolonged hypoxic conditions, primarily due to lower oxygen solubility and increased stratification. Simultaneously, pH will decrease across the shelf to a minimum of 7.39 in hypoxic waters, primarily controlled by future atmospheric and offshore CO_2 levels. The lower buffering capacity in acidified waters will exacerbate the effect of respiration on pH. The magnitude of the changes in hypoxia and eutrophication-induced acidification varies significantly from year to year. The largest response to future conditions occurs in years with high freshwater discharge and upwelling-favorable wind.

Position

Postdoc

Affiliation

Dalhousie University

Email Address

arnaud.laurent@dal.ca

Are you a SFB 754 / Future Ocean member?

No

Primary author(s) : LAURENT, Arnaud (Dalhousie University)

Co-author(s) : Prof. FENNEL, Katja (Department of Oceanography, Dalhousie University); Dr KO, Dong (Naval Research Laboratory, Stennis Space Center); Prof. LEHRTER, John (Dauphin Island Sea Laboratory)

Presenter(s) : LAURENT, Arnaud (Dalhousie University)

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