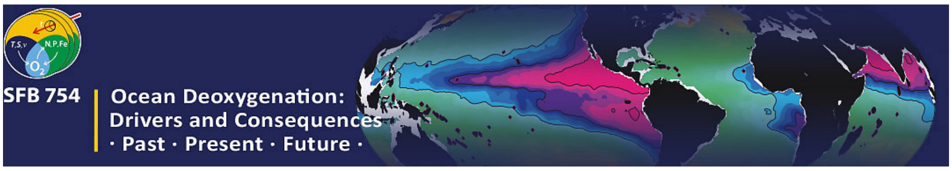

Contribution ID : **129** Type : **Oral**

Future climate change exacerbates hypoxia in Chesapeake Bay due to warming temperatures

Thursday, 6 September 2018 15:45 (15)

Hypoxia is a potent stressor on living resources in waters adjacent to populated coastal areas due to excessive nutrient inputs, and may be further impacted by global climate change. The Chesapeake Bay, the largest estuary in the continental United States located in the Mid-Atlantic region of the east coast, undergoes hypoxic conditions annually and is also experiencing increases in sea level, temperature, and precipitation. Coastal managers rely on numerical models to assess the magnitude of nutrient reductions needed to increase oxygen concentrations to desired levels in the Bay, and also utilize the results of climate scenarios to better gauge the resiliency of planned management actions in the face of uncertain future conditions. Here we used a 3-D hydrodynamic-biogeochemical model of the Chesapeake Bay linked with a regulatory watershed model to simulate the impacts of climate change on hypoxia along the river-estuary-sea continuum. We examined three major anticipated effects driven by a mid-century (2050) future climate change scenario: increasing levels of riverine nutrient inputs and freshwater flow due to increased precipitation, increased water temperatures, and sea level rise. Of these factors, increased temperatures were found to exert the greatest control on changes in the extent and duration of hypoxia throughout the Bay, with a +1.75℃ temperature change causing an increase in the cumulative hypoxic volume for low oxygen waters (DO < 5 mg L-1) of ~15% (219 km3 days-1), and an increase in the cumulative hypoxic volume of anoxic waters (DO < 0.2 mg L-1) of ~30% (13 km3 days-1). These increases are due to both an earlier onset and a greater spatial extent of low oxygen conditions. Impacts of temperature on hypoxia result from a combination of increased biological rates (production, respiration, remineralization, grazing) and decreased solubility. Multiple sensitivity experiments demonstrate that solubility drives approximately 85% of the decrease in dissolved oxygen concentrations averaged annually throughout the water column. However in areas and times with the most severe hypoxia, changes in solubility and biological oxygen demand account for approximately equal percentages of the decreased dissolved oxygen concentrations. Ultimately, this study demonstrates that increasing temperatures due to climate change have the potential to limit the effectiveness of nutrient management actions designed to reduce hypoxia, a goal explicitly tied to numerous ecological management objectives within the Chesapeake Bay.

Position

PhD Candidate

Affiliation

Virginia Institute of Marine Science

Email Address

kehinson@vims.edu

Are you a SFB 754 / Future Ocean member?

No

Primary author(s) : HINSON, Kyle (Virginia Institute of Marine Science)

Co-author(s) : Dr FRIEDRICHS, Marjorie (Virginia Institute of Marine Science); Mr IRBY, Isaac (Virginia Institute of Marine Science)

Presenter(s) : HINSON, Kyle (Virginia Institute of Marine Science)

Session Classification : 08 Coastal Systems: From Understanding to Management

Track Classification : 08 Coastal Systems: From Understanding to Management