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[PLACE HOLDER] A Data Repository for Impacts and uncertainties of climate-induced changes in watershed inputs on estuarine hypoxia

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Title: A Data Repository for Impacts and uncertainties of climate-induced changes in watershed inputs on estuarine hypoxia

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Spatial Information: 36.7 to 39.7°N, -77.5 to -75.5°W; Chesapeake Bay, U.S.A.

Data Access: NetCDF

Abstract: Multiple climate-driven stressors, including warming and increased nutrient delivery, are exacerbating hypoxia in coastal marine environments. Within coastal watersheds, environmental managers are particularly interested in climate impacts on terrestrial processes, which may undermine the efficacy of management actions designed to reduce eutrophication and consequent low-oxygen conditions in receiving coastal waters. However, substantial uncertainty accompanies the application of Earth System Model (ESM) projections to a regional modeling framework when quantifying future changes to estuarine hypoxia due to climate change. In this study, two downscaling methods are applied to multiple ESMs and used to force two independent watershed models for Chesapeake Bay, a large coastal-plain estuary of the eastern United States. The projected watershed changes are then used to force a coupled 3-D hydrodynamic-biogeochemical estuarine model to project climate impacts on hypoxia, with particular emphasis on projection uncertainties. Results indicate that all three factors (ESM, downscaling method, and watershed model) are found to contribute significantly to the uncertainty associated with future hypoxia, with the choice of ESM being the largest contributor. Overall, in the absence of management actions, there is a high likelihood that climate change impacts on the watershed will expand low-oxygen conditions by 2050, relative to a 1990s baseline period; however, the projected increase in hypoxia is quite small (4%) because only climate-induced changes in watershed inputs are considered and not those on the estuary itself. Results also demonstrate that the attainment of established nutrient reduction targets will reduce annual hypoxia by about 50% compared to the 1990s. Given these estimates, it is virtually certain that fully implemented management actions reducing excess nutrient loadings will outweigh hypoxia increases driven by climate-induced changes in terrestrial runoff.

Description: Data files contain summary watershed inputs and estuarine outputs for all experiments. These data include daily estimates of discharge, and nitrogen loadings (both nitrate and organic nitrogen) at the river inputs to ChesROMS-ECB for all baseline and future scenarios.

File Description (Table or list):

File Name	Variables	Brief Description
Climate_Inputs.nc	ExptID, esmID, Tair, Precip	NetCDF file containing inputs of climate forcing variables used in model experiments.
Watershed_Inputs.nc	ExptID, RiverID, time, discharge, NO3, OrgN	NetCDF file containing watershed inputs to estuarine model used for all model experiments.

Hypoxic_Volume.nc	ExptID, time, HypoxicVolume	NetCDF file containing estimates of hypoxic volume for all baseline and future climate scenarios.
Bay_Oxygen.nc	ExptID, time, surfaceOxygen, bottomOxygen	NetCDF file containing averaged surface and bottom oxygen concentrations used in relevant model experiments.

Keywords: Chesapeake Bay, Climate Change, Hypoxia, Numerical Modeling

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