

Assessment of Chesapeake Climate Change Using A Suite of Airshed, Watershed, and Estuary Models

Lewis C. Linker¹, Gopal Bhatt², Richard Tian³, Carl F. Cerco⁴, and Isabella Bertani³

¹U.S. EPA Chesapeake Bay Program Office (CBPO)

²Penn State - CBPO

³UMCES - CBPO

⁴Attain Inc. - CBPO

A comprehensive analysis of Chesapeake climate change was done in order to quantify impairments to water quality and subsequently implement needed nutrient reductions in Watershed Implementation Plans (WIPs) to remove the impairments. The assessment used integrated models of the Chesapeake watershed, airshed, and estuary with scenarios run for the years 2025, 2035, 2045, and 2055. The intent of this presentation is to examine the Chesapeake climate change analysis as a case study to provide a guide to modeling practitioners and resource managers in the assessment of climate change impacts in eutrophic coastal watersheds.

The climate change analysis looked at 22 different influences on Chesapeake water quality standards, principally on the living resource-based oxygen concentration criteria in the deep waters of the Chesapeake. The major and minor influences of climate change were identified and quantified allowing decision makers to choose appropriate levers of watershed or estuarine management to respond to its challenge. In the Chesapeake watershed, the major influences are greater precipitation volumes and to a lesser extent intensities, which increase flows and consequently nitrogen, phosphorus, and sediment loads. In tidal waters the estimated key impacts on water quality standards were higher water temperatures, which decrease DO saturation rates and increase stratification, and deep-water respiration causing an amplification of hypoxia in the Chesapeake.

Climate change is a multi-generational challenge for Chesapeake Bay restoration. Flow, nutrient, and sediment loads from the watershed and tidal Bay hypoxia are estimated to continue to increase from 1995 to 2055 from climate change. In response, the Chesapeake Bay Program is developing better management tools combined with an ongoing multi-decadal plan of adaptation to climate change to maintain the Chesapeake TMDL restoration objectives. The assessment of climate change impacts on the Chesapeake TMDL is an iterative process and reassessments each decade are currently planned.

Contact Information: Lewis Linker, CBP Modeling Coordinator, U.S. EPA Chesapeake Bay Program, Science, Analysis, and Implementation Branch, 1750 Forest Drive Suite 130, Annapolis, MD, 21401, USA, Phone: 410-267-5741 or 443-875-8070, Email: linker.lewis@epa.gov