The Development of Climate Projections for Use in Chesapeake Bay Program Assessments

A Scientific and Technical Advisory Committee (STAC) Workshop

March 7-8, 2016
Westin Annapolis, 100 Westgate Circle, Annapolis MD 21401

Workshop Goals

The 2014 Chesapeake Bay Agreement includes 29 individual strategies to be developed and implemented by six Goal Implementation Teams (GITs). Most, if not all, of these strategies will include a suite of actions necessary to address climate change impacts. In addition, the 2010 TMDL documentation and the 2009 Executive Order call for an assessment of the impacts of a changing climate on the Chesapeake Bay water quality and living resources that will be addressed during the upcoming 2017 Midpoint Assessment.

The Chesapeake Bay Watershed Model, the Chesapeake Bay Water Quality and Sediment Transport Model (WQSTM), and living resource models, such as models of underwater grasses, tidal wetlands, and oysters, will be used to examine the impact of climate change on water quality and estuarine ecosystems. Other assessment tools will be utilized to examine the impact of climate change on other goals and outcomes. Although some localities have established climate projections for planning purposes (e.g., sea level rise), a standardized set of projections has yet to be developed for the watershed. Such projections for sea level rise, precipitation, air temperature, storm intensity, and potential evapotranspiration, among others, are needed as inputs to a variety of hydrological and ecological models to assess potential future climate impacts on natural and human systems.

The 2014 Intergovernmental Panel on Climate Change (IPCC) report relied on a Coupled Model Intercomparison Project featuring approximately 30 global general circulation models (GCMs), each with multiple emission scenarios. Additionally, there are multiple downscaling techniques that are available to move from these global-scale models to an appropriate scale for the Chesapeake Bay and its watershed. Extrapolation of decades of historical observations of temperatures, precipitation intensity, precipitation volume, sea level rise, and estuarine salt intrusion have also been successfully used for future scenarios of climate change.

The Chesapeake Bay Program (CBP) will have to choose among the GCMs, scenarios, downscaling techniques, and historical observation data to establish a framework for climate analysis in the CBP models. The goal of workshop is to assist the CBP with the selection process by addressing the following questions:

1. What climate change variables are of most concern to the CBP partners in the consideration of the 2017 Midpoint Assessment decisions and for longer term climate change management decisions?

2. What are the approaches that can be taken to select climate change scenarios for CBP assessments?

3. What characteristics of those climate variables need to be specified, e.g., temporal, spatial, and other relevant characteristics? In what format are scenarios needed to provide the most utility at the regional, state, and local levels?

4. What climate change scenarios meet CBP decision making needs for the 2017 Midpoint Assessment as well as for longer term climate change management decisions and programmatic assessments?

Day 1: Monday, March 7

8:30 Registration, light breakfast (provided)

9:00 Welcome Address – Rich Batiuk, U.S. EPA Chesapeake Bay Program

9:10 Introduction and Purpose of Workshop – Mark Bennett, USGS

Session I: Introduction and Background

9:25 Climate Change Impacts of Most Concern for Chesapeake Bay Agreement Goal and Outcome Attainment – Zoe Johnson, NOAA/CBPO

9:45 The Use of Climate Change Scenarios for Supporting Decision Making – Chris Weaver, U.S. EPA

10:15 Climate Change in the US with an Emphasis on the Northeast: Past, Present, and Future – Ray Najjar, Penn State
A presentation on how climate has changed in the Northeast region, how it is expected to change in the future and how extrapolation of past trends can be used for short range 10-15 year projections of climate change.

10:45 Sea Level Rise for the Chesapeake Bay Area: Causes, Trends, and Future Projections – Tal Ezer, Center for Coastal and Physical Oceanography, ODU
The various aspects that contribute to local sea level rise in the region and the impact on flooding will be reviewed. These include global sea level rise, land subsidence, and response to oceanic and atmospheric dynamic, such as potential climatic changes in the Gulf Stream. The difficulty of estimating future sea level rise will be discussed.

11:15 DISCUSSION (Moderator: Lew Linker, EPA/CBPO)
What are the approaches that can be taken to develop climate change scenarios for Chesapeake Bay Program decision making? What are the important climate drivers and time periods for assessment of climate change impacts for the 2017 Midpoint Assessment as well as for longer term climate change management decisions?

12:00 LUNCH (provided)

Session II: Case-Study Examples of Climate Trend Assessments, Data, and Scenario Needs for CBP Climate Assessments of the Watershed and Estuary

Overview: This session will provide short, concise presentations on climate change information needs for past and ongoing CBP assessments in the watershed and tidal estuary. Each presenter will provide an overview of data needs and format for temporal and spatial climate drivers to complete the assessment.

1:00 Historical Flow Trends – Karen Rice, USGS
Trends in precipitation and flow in different Chesapeake watersheds will be examined.

1:20 Evapotranspiration – Chris Milly, USGS
The presentation will examine the challenges in the simulation of climate-model-implied growth in potential evapotranspiration.

1:40 Assessing the Hydrologic and Water Quality Impacts of Climate Change in Small Agricultural Basins of the Upper Chesapeake Bay Watershed – Anthony Buda, USDA-ARS
This presentation will examine projected trends in statistically downscaled climate data for a representative agricultural basin of the Upper Chesapeake Bay watershed and outline a proposed approach for assessing the impacts of these trends on watershed hydrology and water quality using the Soil and Water Assessment Tool.

2:00 Patuxent River Case Study (Urban Storm Water) – Susan Julius, U.S. EPA
A study of the application of a scenario selection process in an urban watershed and the findings of that study will be discussed.

2:20 Approaches to the Simulation of Climate Change with the CBP Watershed and Estuarine Model – Gopal Bhatt, PSU; Ping Wang, VIMS; and Guido Yactayo, UMCES

Initial scenarios generated by the Watershed Model based on an extrapolation of observed precipitation based trends and projected to the years 2025 and 2050 will be presented and estimates of the influence sea level rise and temperature increases have on Bay water quality will be discussed.

2:40 2017 Midpoint Assessment Management Needs – Lewis Linker, U.S. EPA Chesapeake Bay Program and Carl Cerco, USACE-ERDC

Initial work done to support an assessment of how climate change in 2025 and 2050 could influence achieving Chesapeake water quality standards will be presented, including simulations of the influence of changes in watershed loads, sea level rise, estuarine temperature increases, and tidal marsh loss.

3:00 Break

3:15 DISCUSSION (Moderator: Ray Najjar, PSU)

What specific climate data are needed for ongoing or planned assessments? In what format are climate data needed: temporal scale (e.g., 2025, 2050, 2100); spatial scale (e.g., field scale, watershed scale, regional scale); and what variables (e.g., min, max daily temp, extreme precipitation events vs. mean annual changes).

4:30 Adjourn Day One

Day 2: Tuesday, March 8

8:00 Registration, light breakfast (provided)

8:30 Welcome, Summary of Day 1, and Comments from Workshop Participants

Session III: Case-Study Examples of Climate Trend Assessments, Data, and Scenario Needs for CBP Climate Assessments of Ecosystems

Overview: This session will provide short, concise presentations on climate change information needs for past and ongoing CBP assessments in key ecosystems. Each presenter will provide an overview of data needs and format for temporal and spatial climate drivers to complete the assessment.

8:45 Downscaling Climate Models for Ecological Forecasting In Northeast U.S. Estuaries – Barbara Muhling, Princeton/NOAA GFDL

Statistical downscaling is commonly used to convert global climate model outputs to a regional scale. The results of recent downscaling experiments for the Chesapeake Bay and Susquehanna watershed will be discussed, along with consideration of variability among downscaling methods.

9:15 Impacts of Climate Change on Chesapeake Oysters – Roger Mann and Ryan Carnegie, VIMS

Oysters provide ecosystem services in the Chesapeake Bay as benthic pelagic couplers, as structural complexity (reefs) in the benthos, and as central components in the bay alkalinity budget. All are subject to change in response to projected climate change: (1) What is the impact of climate driven changes in temperature and/or salinity on oysters, oyster diseases and the oyster-disease interaction; (2) what is the impact of changing water chemistry on oysters in both the larval and adult life history stages; (3) what is the impact of (1) and (2) combined on oyster population dynamics and the role of oysters as an alkalinity bank; and (4) can we proactively manage any of it?

9:45 *Zostera* & SAV Response to Projected Temperature and CO_2 Concentrations – Victoria Hill & Dick Zimmerman, ODU

10:05 Climate Change and Ecological Forecasting in the Chesapeake Bay – Howard Townsend, NOAA

10:25 Loss of Coastal Marshes to Sea Level Rise – Molly Mitchell, VIMS

Molly Mitchell, of the VIMS Center for Coastal Resources Management will describe a survey and analysis of wetland loss due to sea level rise in the Chesapeake as well as data and modeling needs for assessing climate change impacts on tidal wetlands**.**

10:55 Break

Session IV: Climate Scenarios, Projections, and Realizations - What Do We Have and What Do We Need?

Overview: This session will focus on approaches to selecting climate change scenarios for the Chesapeake Bay Program that fit the needs of local, state, and regional partners and stakeholders. One key focus of this session is to identify approaches for streamlining scenario selection while maintaining analytic consistency and rigor across the Program.

11:05 State Perspectives on Climate Change Scenario Selection – Kate Johnson, DC and Jennifer DeMooy, DE

Both Delaware and the District have used statistical downscaling for climate change impact assessments. Why they chose the particular downscaling approach used and how the downscaled projection will be applied in their respective states will be described.

11:35 A Climate Scenario Selection Tool – Phil Morefield, U.S. EPA

12:05 DISCUSSION (Moderator: Susan Julius, EPA)

What climate change scenarios meet Chesapeake Bay Program decision making needs for the 2017 Midpoint Assessment as well as for longer term climate change management decisions? In what format are realizations needed that will provide the most utility at the regional, state, and local levels? Is there a need for consistency among climate change scenarios across the watershed and state and local jurisdictions?

12:30 LUNCH (provided)

1:30 WRAP UP DISCUSSION (Moderator: Rich Batiuk, U.S. EPA Chesapeake Bay Program)

There are many physical, biological, and ecological changes that will take place in a Chesapeake Bay influenced by climate change. In order to better evaluate future behavior of the entire system of watershed, airshed, estuary, and ecosystem under a variety of adaptive climate change management strategies, what are the most important climate data and information needs? This includes considerations of what, when, where, and how to sample the watershed, estuary, and ecosystem as well as how to best synthesize research, observations, and model analysis in order to improve understanding of how the system is changing and adaptive management approaches. Also, what laboratory and field studies should be undertaken to better understand past trends and project future impacts.

In addition to the short and long-term CBP science priorities, we need to consider what steps are needed to make the best use of the current state of our understanding to evaluate management decisions that must be made in the next year as a part of the 2017 Midpoint Assessment. In particular, what are the most important improvements that should be made to the suite of models (watershed and Bay) in order to better predict how climate change will modulate the transport and fate of nutrients and sediment to tidal waters and how that will affect the achievement of the TMDL goals in the Bay?

2:30 Adjourn