Delaware Center for the Inland Bays Scientific and Technical Advisory Committee Meeting

October 26, 2018, 9:00 AM to 12:00 PM

DNREC Lewes Field Facility

Attendees:

STAC MEMBERS	CIB STAFF	OTHER
Scott Andres	Marianne Walch	Jeremy Testa
Jennifer Volk	Bob Collins	Bill Hitz
Douglas Janiec	Andrew McGowan	Arlene Givens
Chris Main	Michelle Schmidt	Roy Messman
Ed Whereat		John Kiker
Kari St. Laurent		Barbara Kiker
Susie Ball		Marcia Fox
Claire Simmers		Alison Rogerson
Kelly Somers		Amanda Zahorik
Judy Denver		Kate Fleming
Richard Watson, Secretary		Tyler Pettay
		Mark Nardi
		Ellen Dickey
		Siena Davis
		A G Robbins
		Ben Anderson
		Roger Shepherd
		Kristin Civitella
		Kent Stevens
		Olivia Devereaux

The Meeting was called to order at 9:05 AM by Chairman Scott Andres. Round robin introductions were made.

STAC Announcements – Scott Andres

CIB Announcements – Marianne Walch

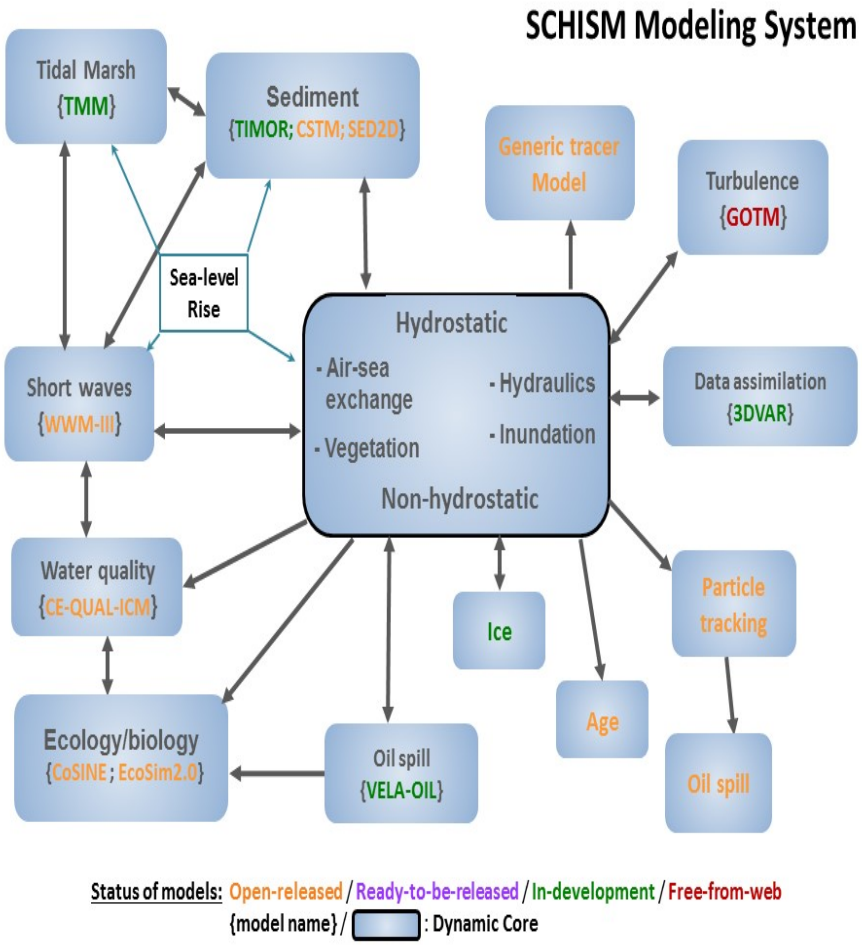
The dates for the upcoming STAC Meetings are as follows: February 1, 2019 and April 26, 2019. Additional dates will be e-mailed to committee members.

Update on Monitoring Subcommittee - Scott Andres, Marianne Walch

Scott indicated that the subcommittee has developed the "Inland Bays Hydrodynamic/Water Quality Model Implementation Plan" (copies provided at sign-in desk and e-mailed previously to STAC Members) which describes the proposed updates to and implementation approached for the hydrodynamic model of the Inland Bays. Two presentations on modelling will be made today by Drs. Zhang and Testa; additional presentations on modelling approaches will be made to the subcommittee. A list of subcommittee members was provided in the handout; Scott indicated to the group that if there were any additional people interested in serving on the subcommittee to please either see him after the meeting or contact him by e-mail.

Cross Scale Modelling from Creek to Ocean – Implications for Delaware Inland Bays - Dr. Joseph Zhang, VIMS [*Remote presentation*]

SCHISM (Semi-implicit Cross-scale Hydro-science Integrated System Model) is an open-source community-supported modeling system based on unstructured grids, designed for seamless simulation of 3D baroclinic circulation across creek-lake-river-estuary-shelf-ocean scales (www.schism.wiki). It uses a highly efficient and accurate semi-implicit finite-element/finite-volume method with Eulerian-Lagrangian algorithm to solve the Navier-Stokes equations (in hydrostatic form), in order to address a wide range of physical and biological processes. The numerical algorithm judiciously mixes higher-order with lower-order methods, to obtain stable and accurate results in an efficient way. Mass conservation is enforced with the finite-volume transport algorithm. It also naturally incorporates wetting and drying of tidal flats.



Dr. Zhang and others have successfully applied SCHISM to study hydrodynamic and water quality problems in a number of estuaries around the world including the San Francisco Bay and Delta, Chesapeake Bay, Germany Bight and estuaries. They are working with NOAA to use the seamless creek-to-ocean capability of SCHISM to couple coastal processes with the National Water Model to account for compound flooding from coastal surges and river flooding, using Delaware Bay as a test-bed.

Dr. Zhang discussed the reasons that using SCHISM would be appropriate for modelling the Delaware Inland Bays:

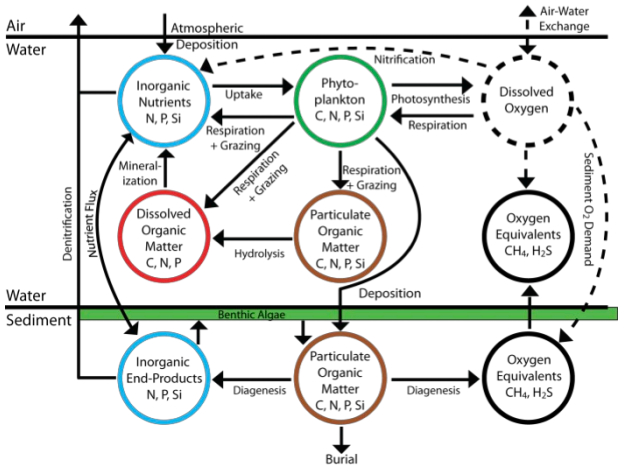
1. Model is seamless;
2. Resolution on demand is available with the unstructured model which is very tolerant of bad meshes;
3. Model has been applied to the Chesapeake Bay and Maryland Coastal Bays with success;
4. No bathymetry smoothing is necessary; and
5. VIMS is working on the NOAA Water Initiative Program and would have data available from the program.

Questions

1. ***How did you assess the model validity in instances where the humans were tweaking the inputs?*** They are working on the Chesapeake Bay Model in a predictive, "what if", mode only.
2. ***Can you use the model to study the Gulf Stream?*** Yes, it was done in the Chesapeake Bay Model.

Using Ecosystem Models to Explore Eutrophication, Hypoxia, and Acidification in Estuarine Ecosystems – Dr. Jeremy Testa, UMCES

Estuarine ecosystems are complex environments that respond to a variety of external forces, including watershed nutrient and sediment inputs, exchanges of gases and energy with the atmosphere, and large inter-annual and seasonal changes in temperature and freshwater input. Numerical models are useful tools to simultaneously quantify the many processes that respond to external forcing. Dr. Testa described the modelling efforts (Regional Ocean Modelling System – ROMS) that have been used to address how long-term changes in nutrient inputs and ocean acidification impact the biogeochemistry and quality of coastal waters.



The combined effects of anthropogenic and biological CO_2 inputs may lead to more rapid acidification in coastal waters compared to the open ocean. It is less clear, however, how redox reactions would contribute to acidification. Here he reported estuarine acidification dynamics based on oxygen, hydrogen sulfide (H_2S), pH, dissolved inorganic carbon and total alkalinity data from the Chesapeake Bay, where anthropogenic nutrient inputs have led to eutrophication, hypoxia and anoxia, and low pH. He showed that a pH minimum occurs in mid-depths where acids are generated as a result of H_2S oxidation in waters mixed upward from the anoxic depths. Their analyses also suggest a large synergistic effect from river–ocean mixing, global and local atmospheric CO_2 uptake, and $CO_2$and acid production from respiration and other redox reactions. Together they lead to a poor acid buffering capacity, severe acidification and increased carbonate mineral dissolution in the USA's largest estuary.

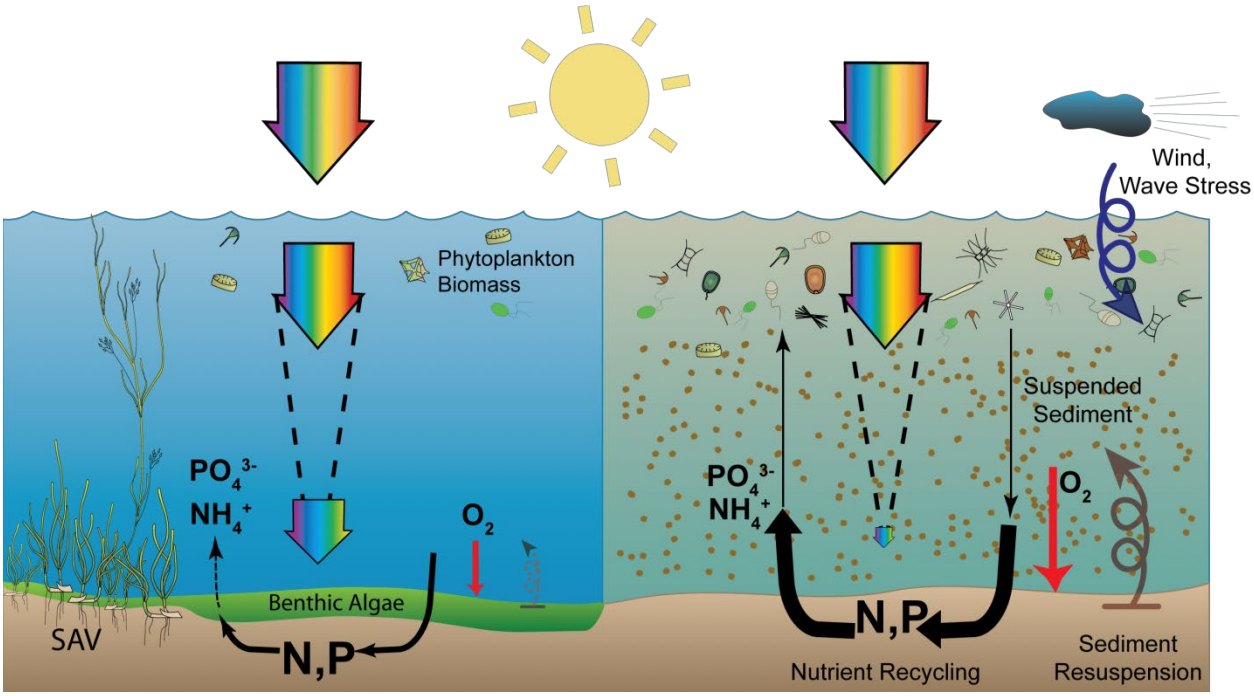


Figure 1: Key biogeochemical processes in shallow water habitats in Chesapeake Bay. The availability of light drives nutrient and carbon dynamics in shallow coastal ecosystems, as once light reaches the sediment, benthic algal communities can (1) absorb nutrients and retain them in sediments, (2) stabilize sediments and limit resuspension, and thus (3) lead to elevated water clarity. In the absence of light at the sediment surface, limited benthic algal growth leads to high sediment nutrient recycling and potentially less stable sediments.

Recent research indicates that eutrophication can exacerbate ocean acidification (OA), where respiratory processes contribute a far greater acidification in the coastal oceans relative to the open ocean. Coastal eutrophication occurs with increased inputs of nutrients from the application of chemical fertilizers, discharges of human and animal wastes, and atmospheric NO_x inputs from fossil fuel burning, which have fueled large algal blooms in many coastal water bodies, especially those near population centers. He also indicated that they have also been able to model submerged aquatic vegetation (SAV) impacts.

Dr. Testa discussed a project in West Falmouth Harbor on Cape Cod. He indicated that they have been able to obtain good agreement with observed data.

Questions

1. ***Does the modelling include the total freshwater budget?*** No but they are preparing a larger budget of the bay that will include it.
2. ***For the SAV Model, I it species dependent?*** Right now only one specie is modelled but additional species will be modelled in the future.
3. ***What is being modelled for oysters in Chesapeake Bay?*** They are looking at how much the oysters can affect (improve) their environment and are looking at the impact of buffering capacity on the oyster survivability.
4. ***Have you considered acid rain impact?*** It has not been done yet but they are considering how changes in carbonate chemistry affects rivers.

CCMP Seagrass Action - Michelle Schmidt, CIB

Michelle is working on the update of the CCMP and has one remaining action to assign roles for: healthy bay ecosystems – re-establishing bay grasses. Her question to the group is should this continue to be included in the CCMP or eliminated? It could also be incorporated into another section. After a lengthy discussion, it was decided to keep it in the plan. DNREC will also re-evaluate their role for this section

Potential Sea Grant Research Topics - Marianne Walch, CIB

Marianne is requesting potential research topics for the Sea Grant Program. After a general discussion on funding options, the following topics were suggested:

1. Monitoring activities from the Environmental Monitoring Plan;
2. Burton Island Ash Study Monitoring after six years;
3. Emerging contaminants in the bay from agriculture;
4. Groundwater issues for the Indian River (Mountaire discharges);
5. Benthic macro invertebrate monitoring; and
6. Bacterial source tracking; and Aquaculture impacts such as parasites.

New Business - No new business

Meeting was adjourned by Chairman Andres at 11:37 AM