Modeling Eutrophication Processes in the Delaware Estuary to Link Watershed Efforts to Control Nutrient Impacts

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Introduction

Project Goal

Project Status
- Data collection
- Model development
What should be the next generation dissolved oxygen water quality criteria for the urban portions of the Delaware River Estuary to properly protect aquatic life use?
Goal

- Develop a linked hydrodynamic and water quality model that will be used to allocate the loads of oxygen demanding nutrients that can be discharged from point and non-point sources into the Delaware River Estuary while maintaining the desired levels of dissolved oxygen.

- The achievable level of dissolved oxygen will be turned into water quality criteria through DRBC’s rule making processes.
Actions Underway

- Development a linked hydrodynamic and water quality model
  - Model working group (Nov. 2018)

- Engineering evaluation & cost estimate for improved WWTP ammonia & TN
  - Benefit analysis

- DO needs study for Delaware Estuary fish species

- Enhanced monitoring:
  - Point discharge monitoring
  - BoatRun to year-round
  - Added salinity at tidal boundaries
  - Added nitrate sensors at Trenton & Chester gages
  - Extensive tributary monitoring
  - Light extinction monitoring
  - Primary productivity study
Water samples collected at 27 tributaries in 2018 to analyze nutrients related parameters:

- Bi-weekly monitoring for Delaware River at Trenton and Schuylkill River
- Monthly monitoring for 25 tributaries

Monitoring stations in tidal portion – collected near one hour before the low slack tide.
Growing Season: April 16 – October 15
Multiple versions of EFDC model was tested using coarse grid 2-D and 3-D models
- Reasonably simulate water surface elevations
- Slight over predict extreme temperatures in Bay section (likely resolve by implementing local metrological data)
- Under predicts salinity intrusion (code validation underway)
- Review & refine turbulence model input parameters

Successfully linked coarse grid 2-D EFDC and WASP8 with key source loadings

Coarse-grid
897 cells
Average: 1370 x 1340m
Next Steps: Linked EFDC – WASP8 Model

- Refine grid resolution
  - Better delineation of navigation channel
  - 8~10 vertical layers
  - Increase computational time step ~20 seconds

- Implementation of GVC hybrid grid

- Link 3-D fine grid EFDC and WASP8

- Initiate model calibration using 2017 – 2018 data sets
Questions?


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