Enhancing Spill Response through Modeling and Automation

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The following slides describe ongoing staff research as of February 10, 2025, and do not necessarily reflect policies or proposals of the Delaware River Basin Commission.

This presentation is provided as a contribution to an ongoing dialogue in the spirit of advancing collective understanding of environmental processes.

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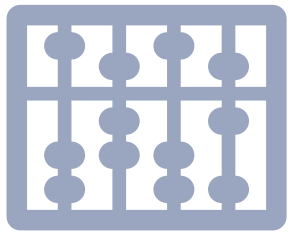
Motivation for Spill Modeling



DRBC Estuary Spill Model

Ongoing Developments

Spills Happen in the Delaware River

- November 2004:
  - *Athos I* Oil Spill – 263,000 gallons of crude oil released
  - Original spill model procedure created by Namsoo Suk and John Yagecic[1]
- The Delaware Valley Early Warning System (EWS) has reported over 460 events since its formation in 2005[2]

Photo Credit: *NOAA*

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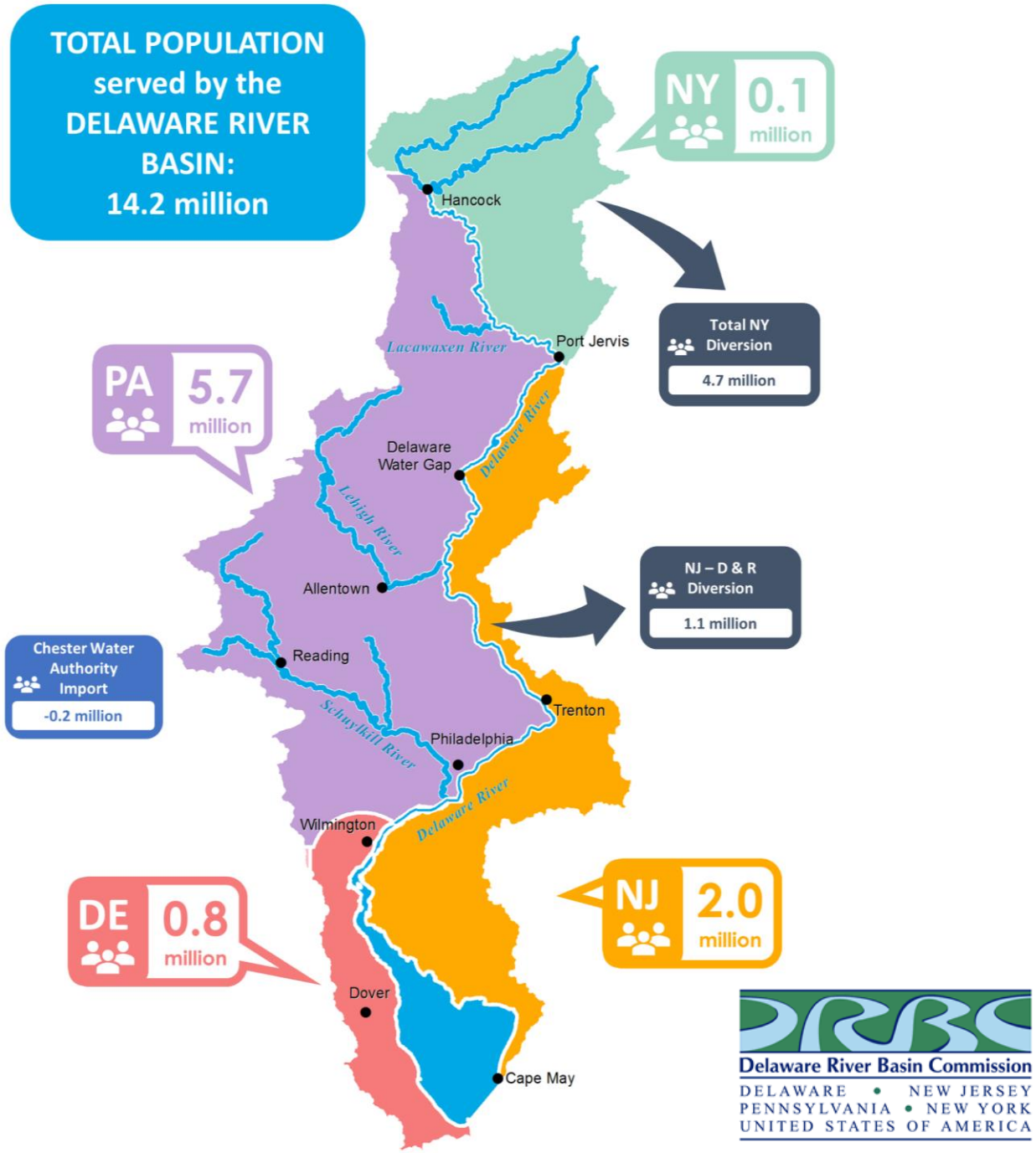
[1]Yagecic & Suk, *JAWRA* (2014)

[2]Schuylkill Action Network, *www.schuylkillwaters.org* (2024)

Over fourteen million people rely on drinking water from the Delaware River Basin[1]



[1]Water Resources Program FY 2025-2027 (DRBC Report No: 2024-3)

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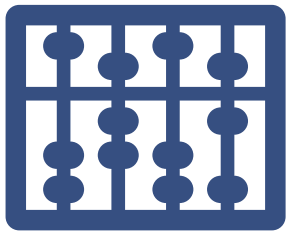
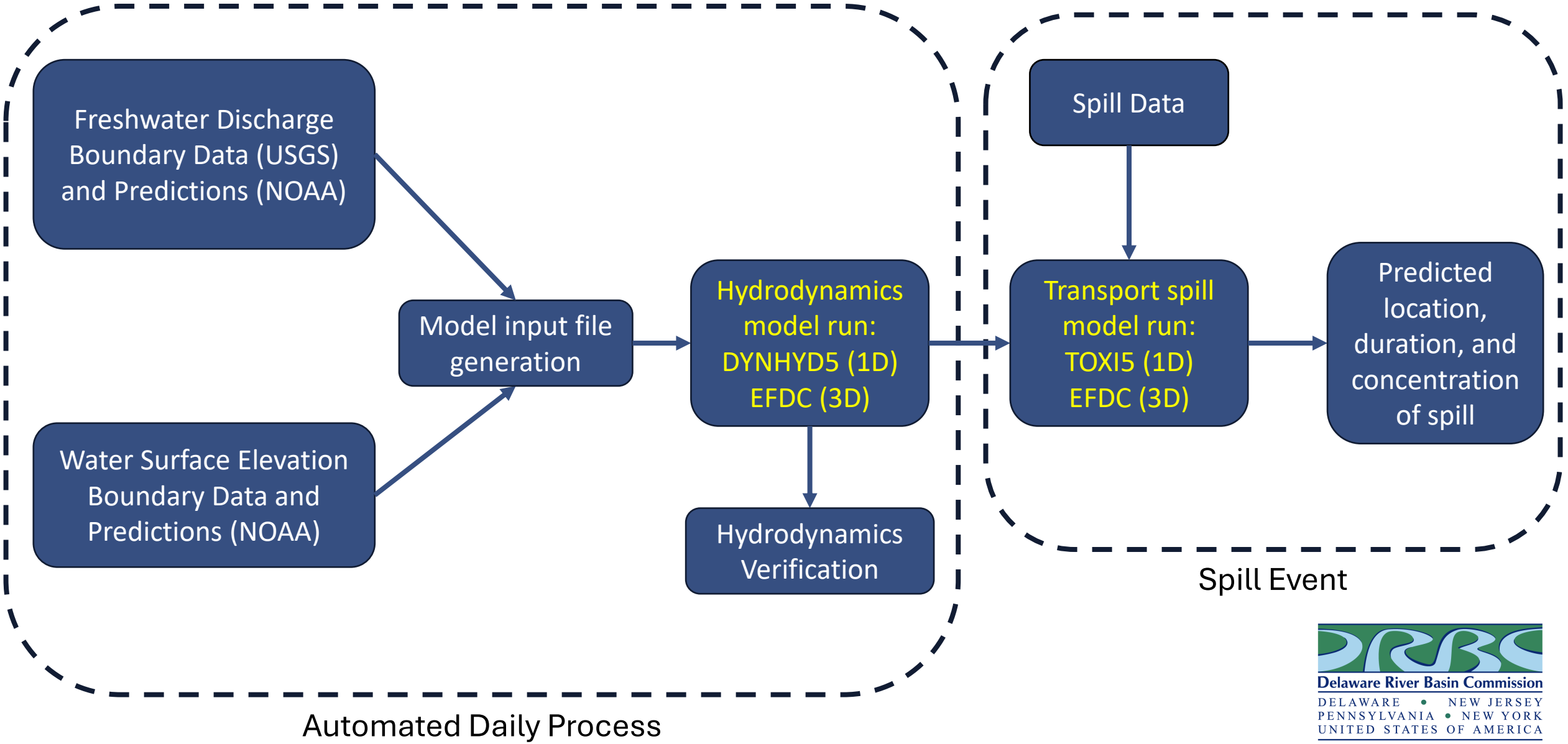


DRBC Estuary Spill Model

Ongoing Developments

Delaware Estuary Spills: Modeling Procedure



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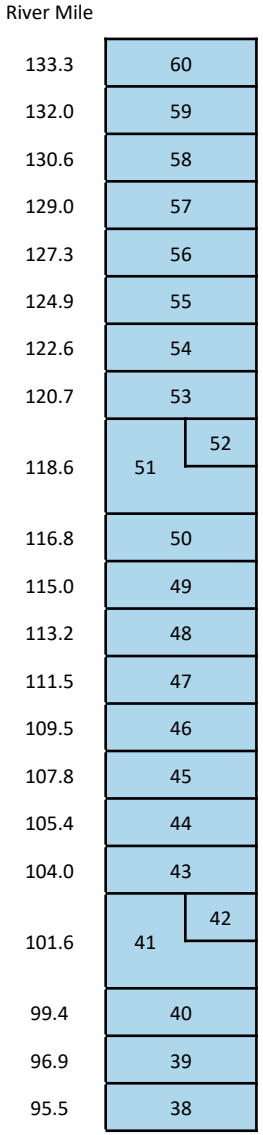
Yagecic & Suk, *JAWRA* (2014)

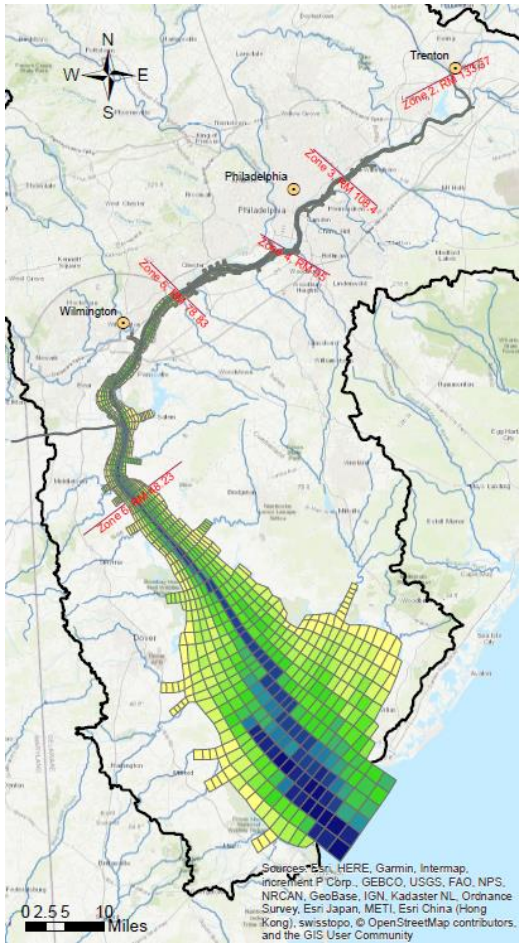
Delaware Estuary: 1D vs. 3D Modeling



One-Dimensional Model Domain

Spilled material is laterally and vertically well-mixed in each river segment

Hydrodynamics and transport model are based on pre-2016 bathymetry



Three-Dimensional Model Domain

Spilled material is still well-mixed in each cell, but grid resolution is higher

Hydrodynamics and transport model are based on post-2016 bathymetry

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Case Study: March 2023 Acrylic Polymer Spill (near Bristol, PA)

- An estimated 8,100 gallons of water-soluble acrylic polymer solution was released into Otter Creek from Trinseo PLC Plant

Simulation Case Study Parameters	
Spill Start:	March 24, 2023, 11:00 PM
Spill Location:	RM 118.87
Spill Duration:	2 hours
Chemical Mass:	65,000 lbs.
Assumptions:	100% dissolved, no decay, no settling, no volatilization

Photo Credit: *US EPA*

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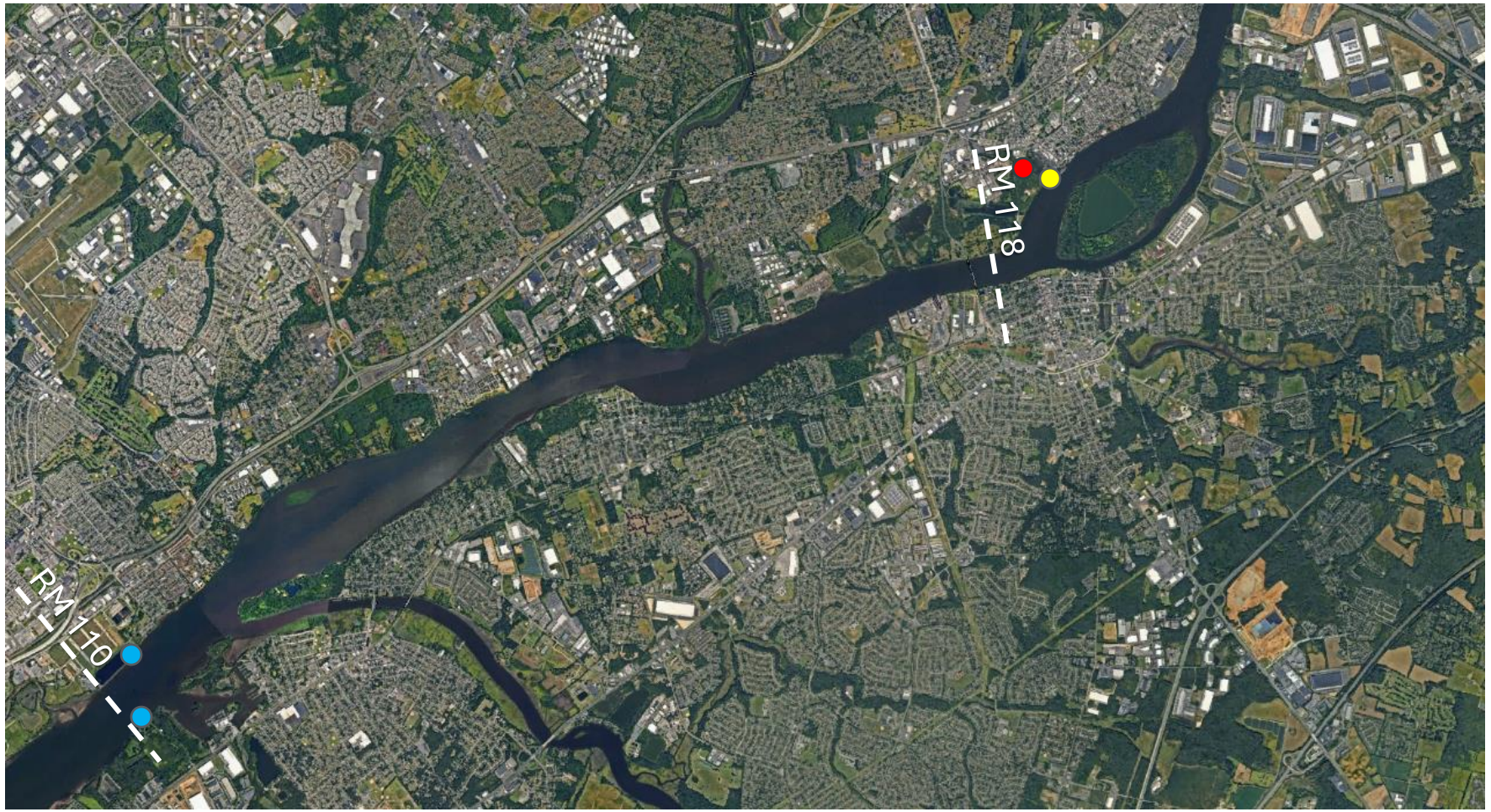
Case Study: March 2023 Acrylic Polymer Spill
(near Bristol, PA)



- Spill Location
- Spill Model Cell
- Drinking Water Intake

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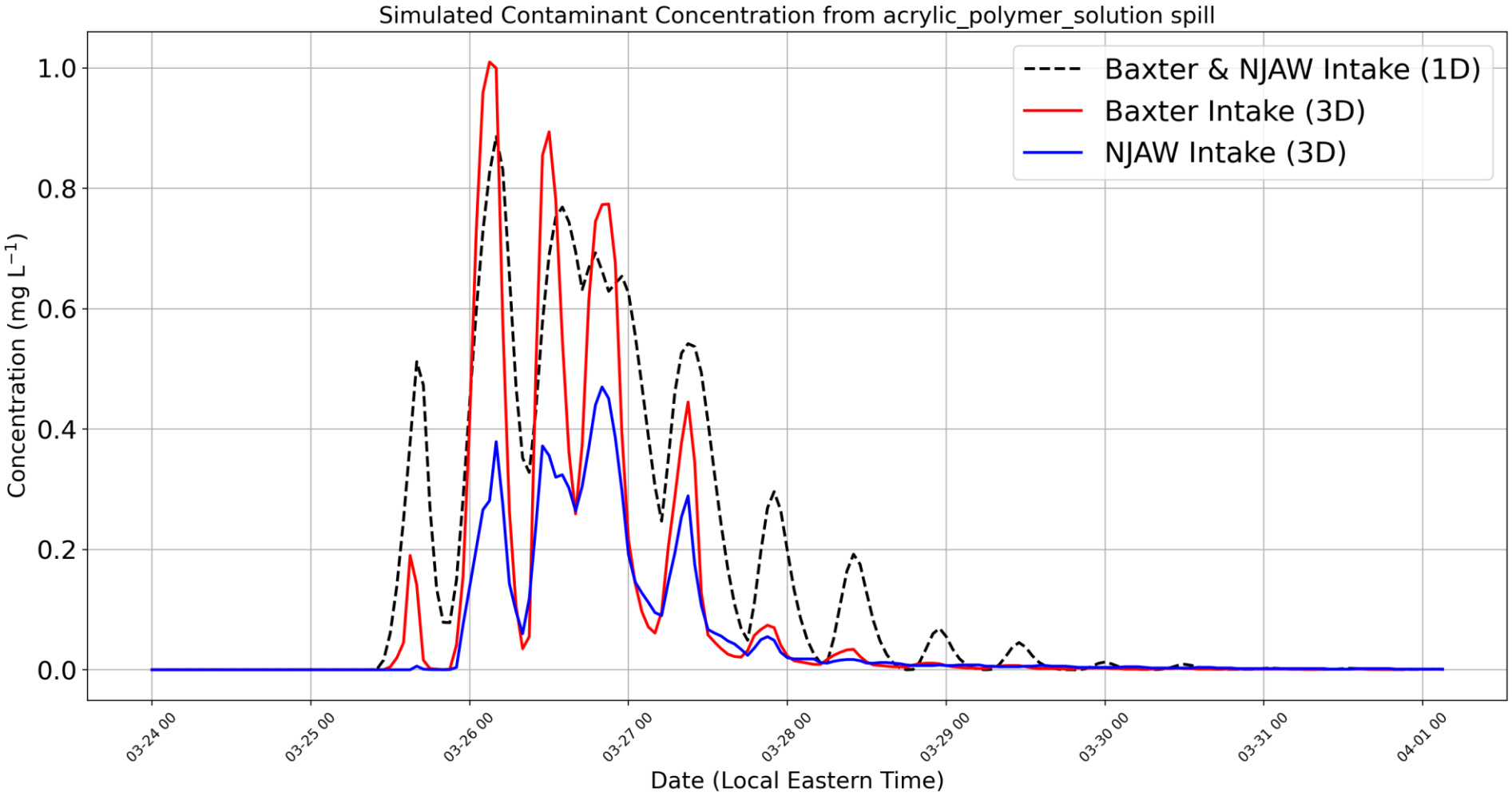
Case Study: Time Series



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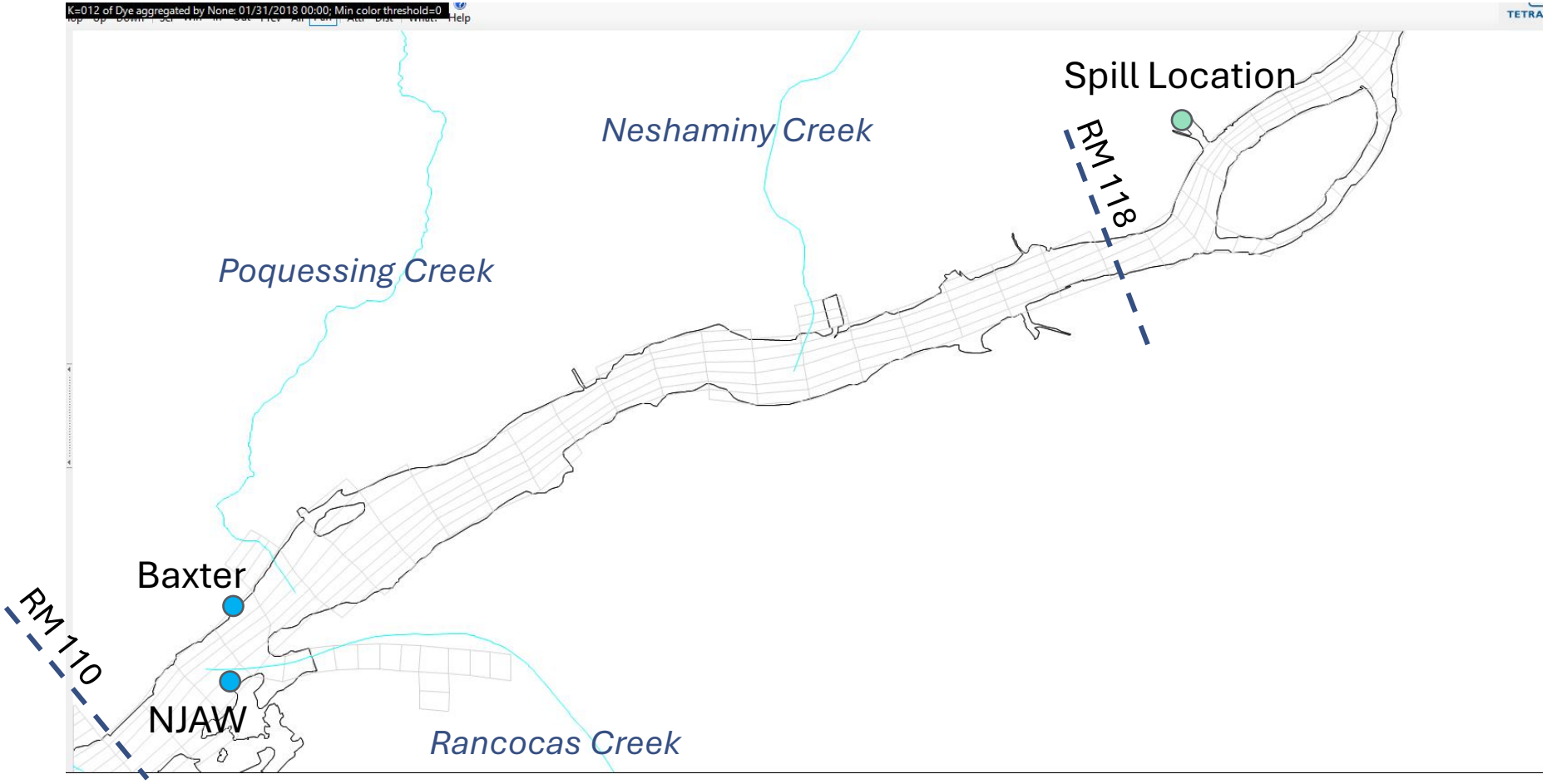
Case Study: Spatial Animation



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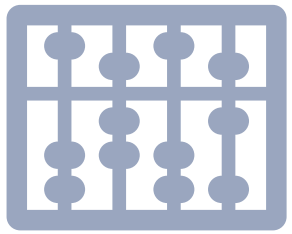

DRBC Estuary Spill Model

Ongoing Developments

The Power of Automation and Scripted Processing

- What is automated?
  - Data retrieval
  - Pre-processing
  - Execution of hydrodynamic model
  - Plot generation
- What is used?
  - Estuary Spill Response: Python
  - Cloud Computing
- More work up front – but *tremendous* return on investment

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Summary

- Spills will continue to happen
  - The DRBC's **estuary spill model** is another available **"tool in the toolbox"** continually being developed and improved to support spill response in the Delaware River
  - **Modeling**, **automation** and **training** will best prepare us for quick and accurate dissemination to water purveyors, first responders, and remediation teams
- Current modeling capacities in estuary include
  - **Quick** one-dimensional spill model (DYNHYD, WASP)
  - **Higher resolution** three-dimensional spill model (EFDC)
  - Ongoing **developments** to automate scripts to enhance and strengthen our spill response

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For more information, contact the ***Spill Modeling Team*** *@ DRBC*

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Special Thanks to:
Namsoo Suk & John Yagecic