Identification and Characterization of Surface Water Intakes on the Chesapeake Bay

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Presented to the Modeling Workgroup
Chesapeake Bay Program
October 9, 2024

Outline

- Motivation
- Surface water intake characterization
- SaltCast

Salt water intrusion into tidal rivers is in the news

PBS NEWS

Menu Full Episodes Podca

By —
Roby Chavez

Leave your feedback

Why the saltwater wedge climbing up the Mississippi River is a wake-up call to the region

DROUGHT

Salt water creeping into drought-depleted Bay Area fresh water supply

CBS NEWS BAY AREA

Updated on: August 8, 2022 / 8:07 AM PDT / CBS/AP

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Article | Open access | Published: 31 January 2024

Increasing risks of extreme salt intrusion events across European estuaries in a warming climate

Jiyong Lee, Bouke Biemond, Huib de Swart & Henk A. Dijkstra

Communications Earth & Environment 5, Article number: 60 (2024) | Cite this article

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Climate Forward

Uruguay Wasn't Supposed to Run Out of Water

A devastating drought has hit a country that seemed to have abundant fresh water.

Share full article

Paso Severino reservoir in Uruguay last month. Gaston Britos/EPA, via Shutterstock

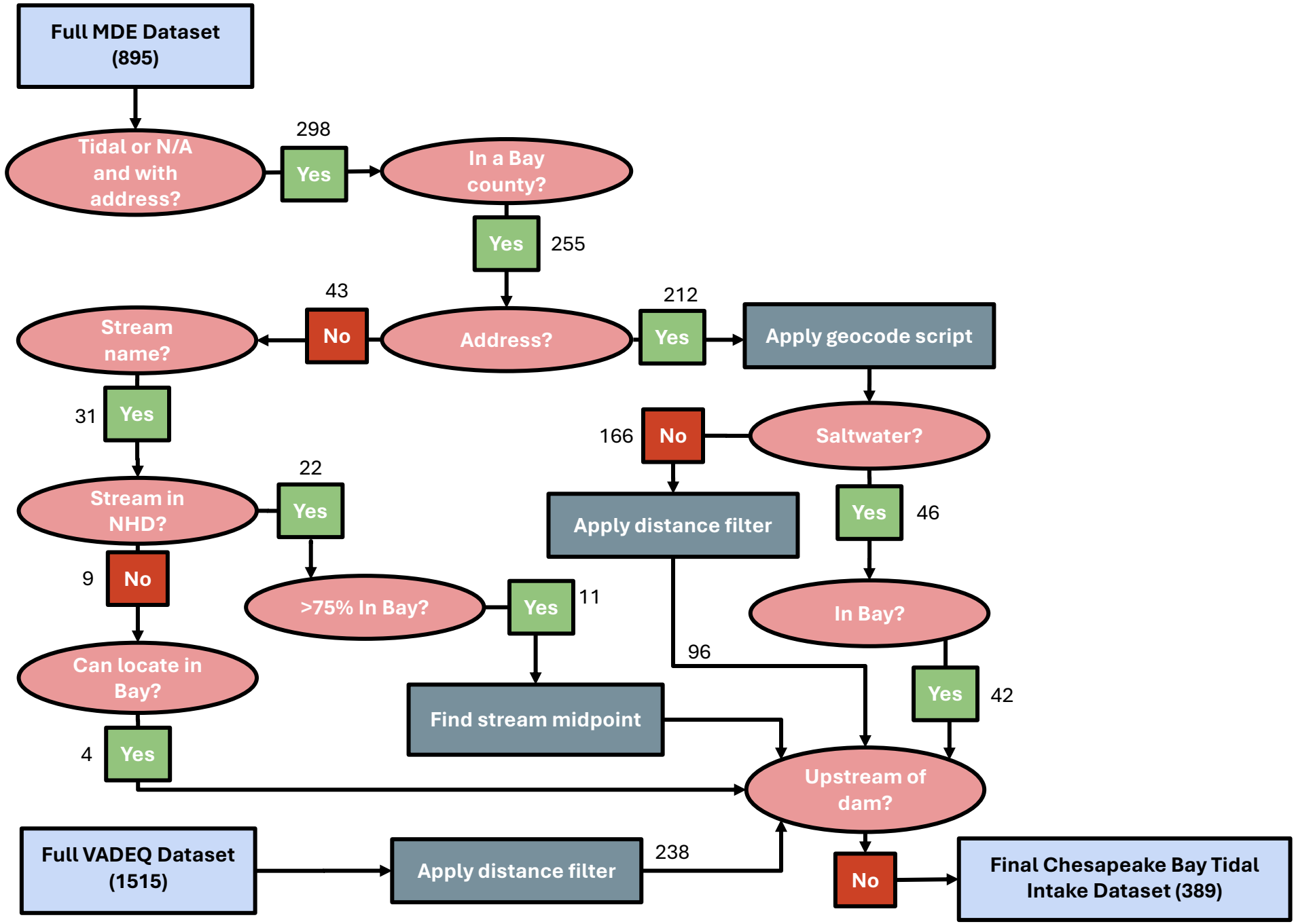
By Manuela Andreoni

Where are the intakes in tidal waters?

- No national database
- States have detailed databases of intakes, but characterization is inconsistent in terms of
  - Location information
  - Use type
  - Salinity
  - Tides
  - Volume withdrawn

Flowchart for determining tidal intakes in Maryland and Virginia

Data provided by Maryland Department of the Environment and Virginia Department of Environmental Quality



Homogenization of use types between MD and VA

Irrigation and Agriculture

- Crop irrigation
- Golf course irrigation
- Lawn & park irrigation
- Nursery irrigation
- Sod farm irrigation
- Small intermittent irrigation
- Irrigation (Undefined)
- Aquaculture

Municipal

- Government run water supply
- Recreational drinking/sanitary
- Institutional drinking/sanitary
- Commercial drinking/sanitary
- Environmental enhancement
- Laboratories
- Wildlife ponds and recreational

Industrial, Commercial, and Manufacturing

- Industrial (undefined)
- Industrial heating and cooling water
- Industrial wash and separation processes
- Commercial (undefined)
- Hydrostatic testing and fire protection
- Sand and gravel washing

Fossil Power

- Fossil fueled power generation

Nuclear Power

- Nuclear power generation

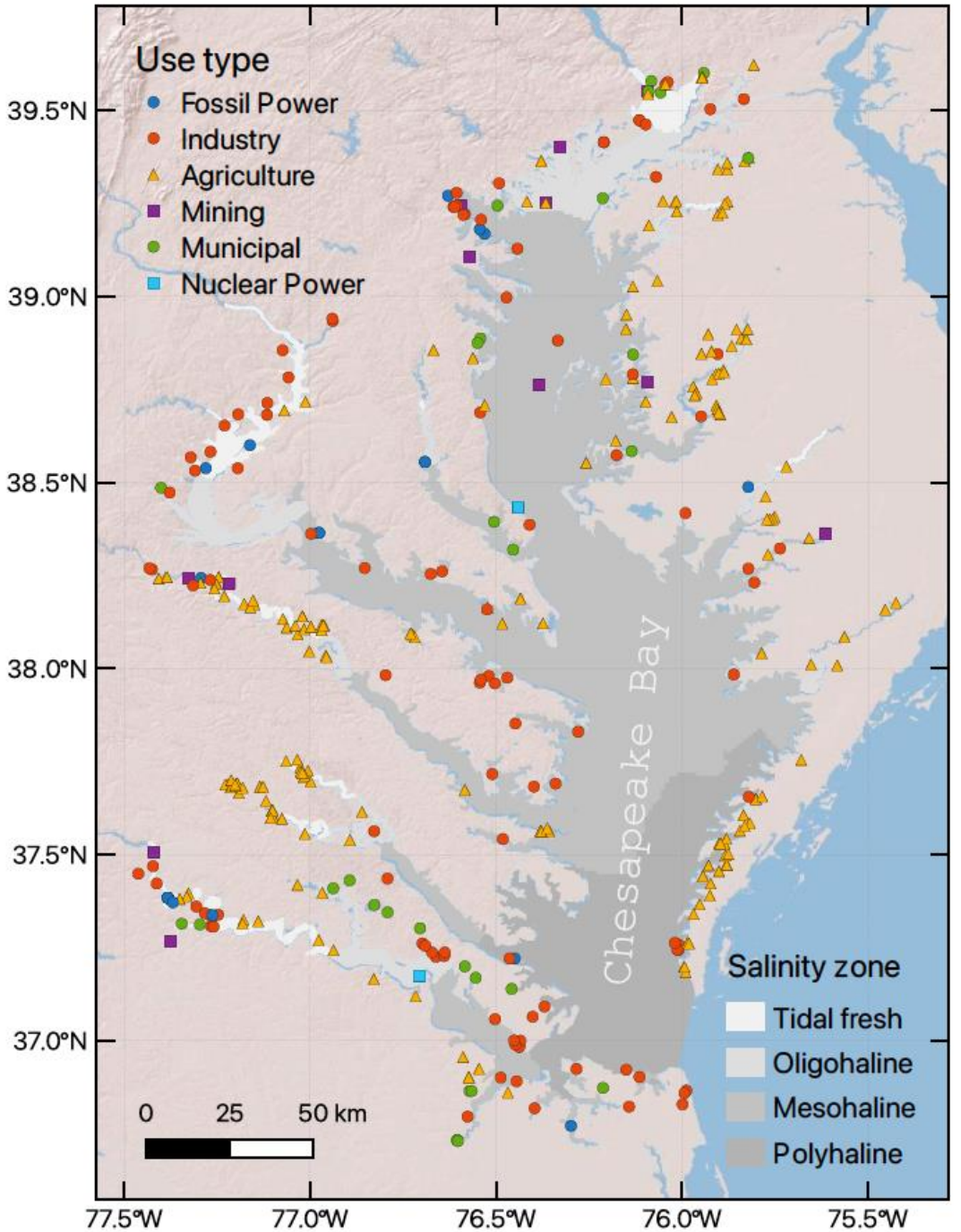
Mining

- Mining operations (undefined)

Final Chesapeake Bay water intake map

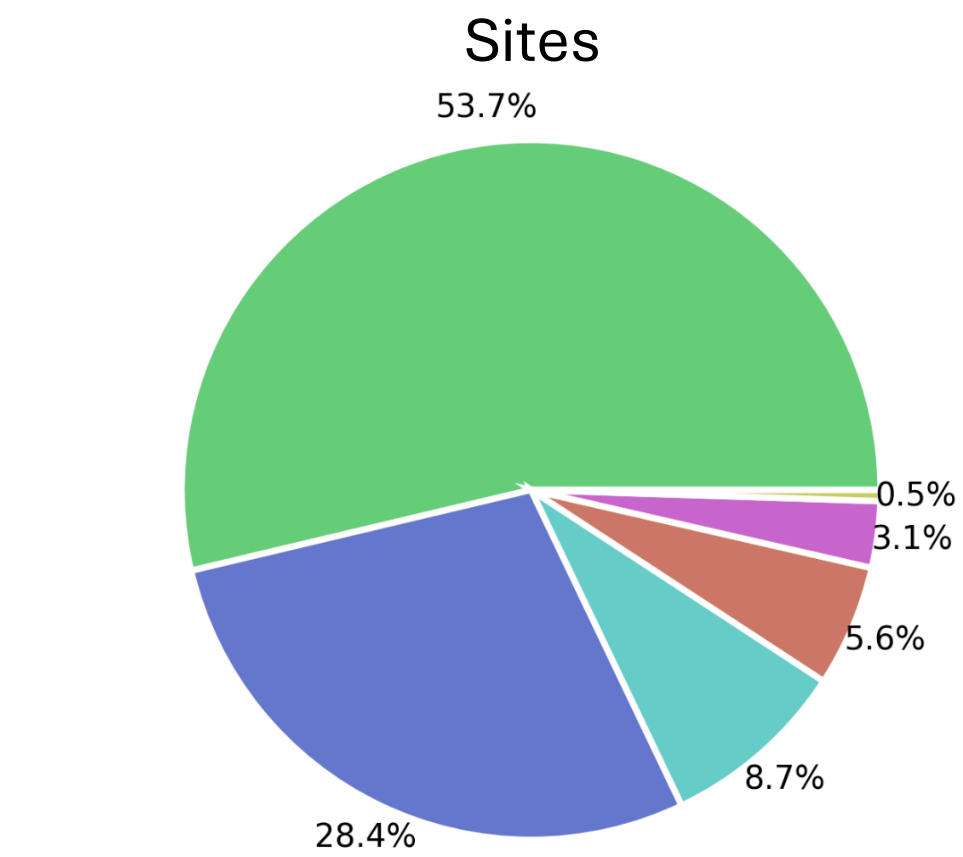
389 sites:

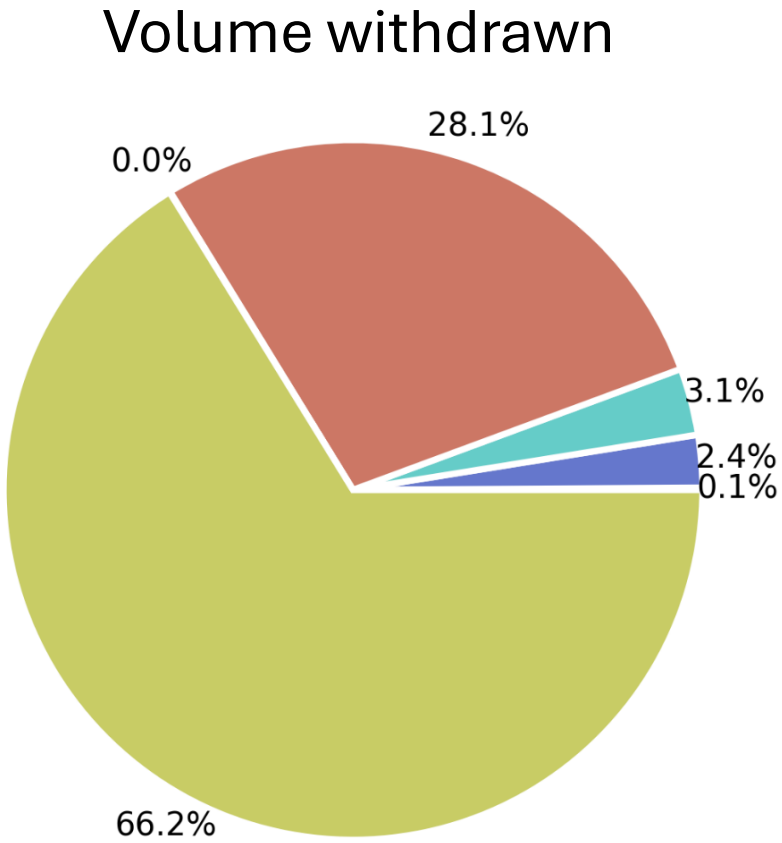
- 238 in Virginia
- 151 in Maryland



Most of the sites are for irrigation and agriculture

Most of the volume withdrawn is for power



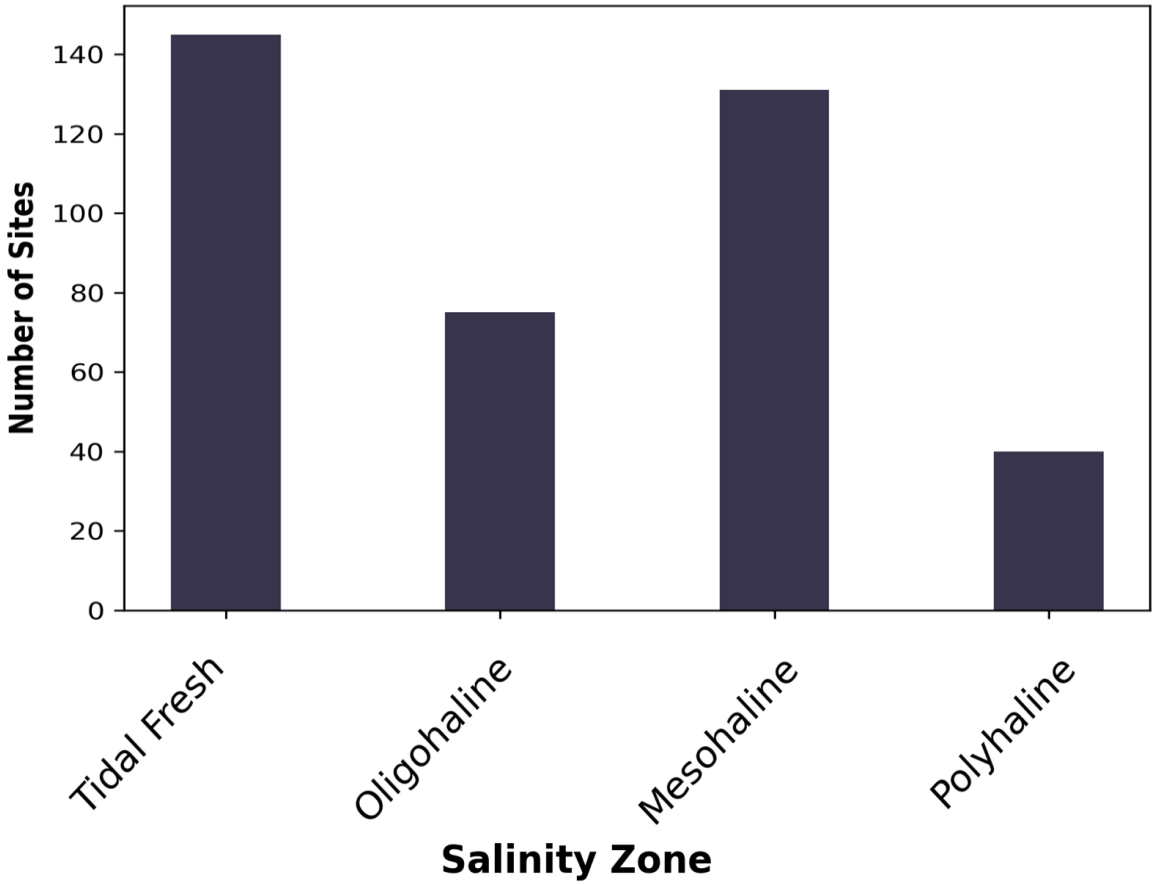


Irrigation and Agriculture
Industrial, Commerical, and Manufacturing
Municipal

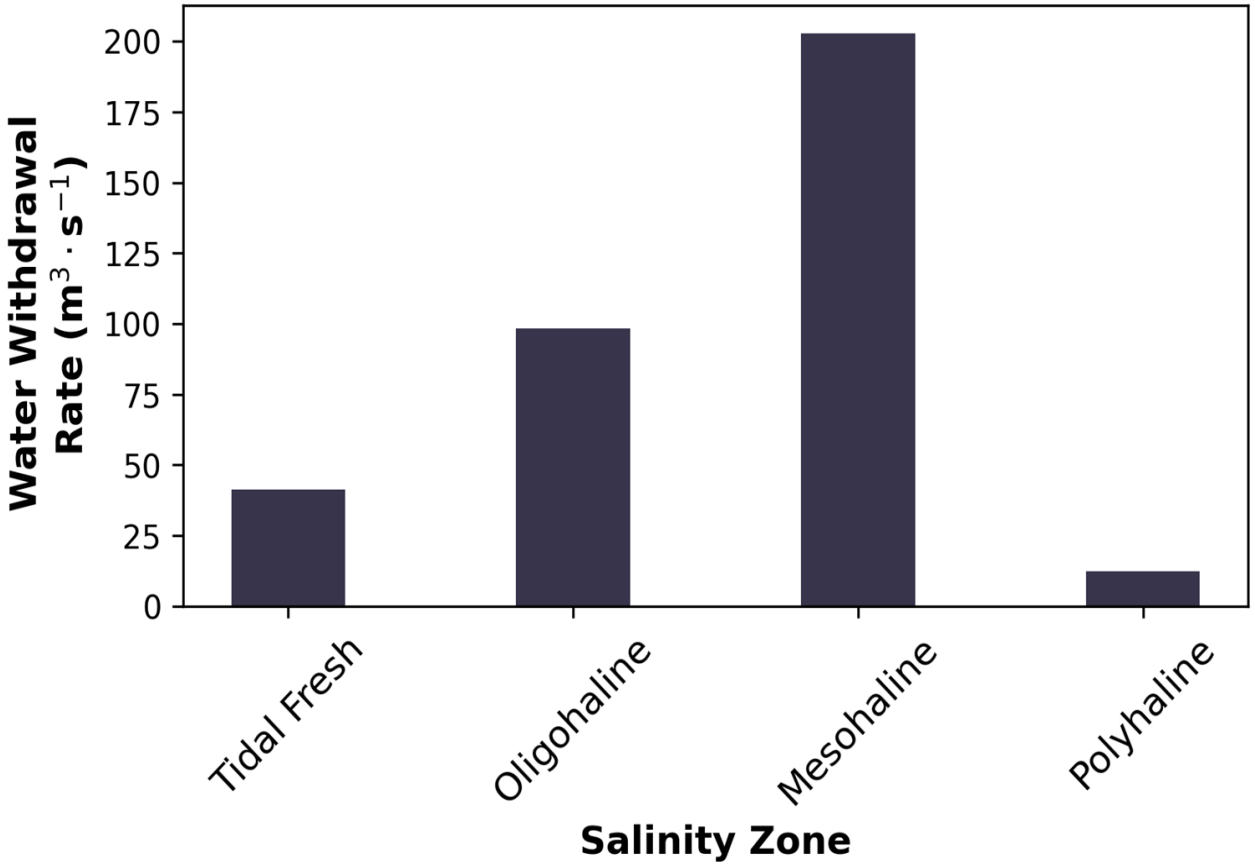
Fossil Power
Mining
Nuclear Power

Water is withdrawn from all salinity classes

Number of sites



Water withdrawal rate



SaltCast: A Decision Support System to Predict and Manage Salt Levels for Water Security

PIs: Ming Li (lead), Raymond Najjar, Allison Lassiter, Alfonso Mejia, and Sujay Kaushal

SaltCast.

Our proposal

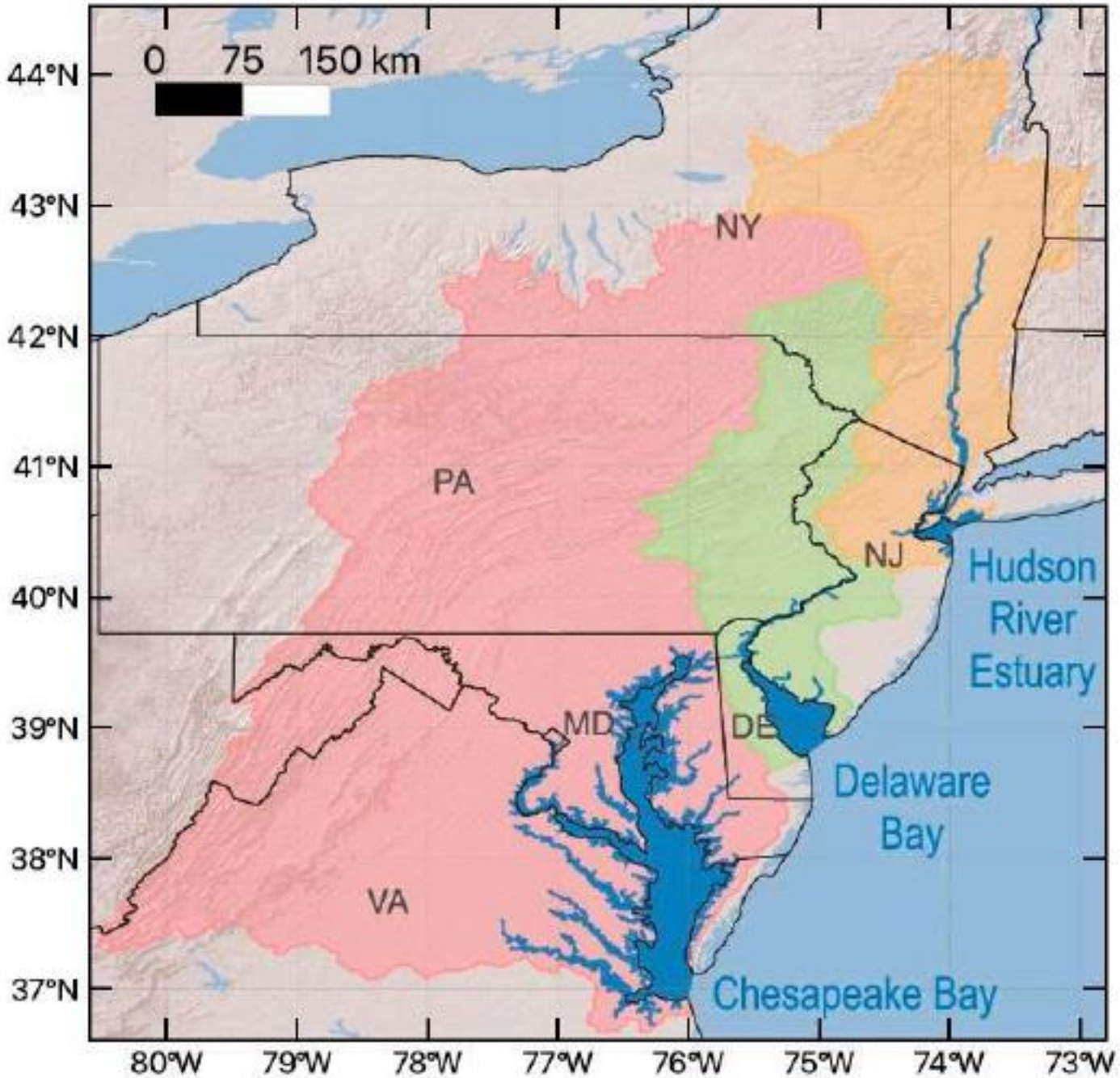
- Develop a new coupled watershed–estuary model
  - Simulates the transport and fate of major salt ions

- Use model and artificial intelligence (AI) algorithms in decision support system
  - co-developed with stakeholders
  - identifies management strategies
  - quantifies the tradeoffs between competing needs for freshwater resources

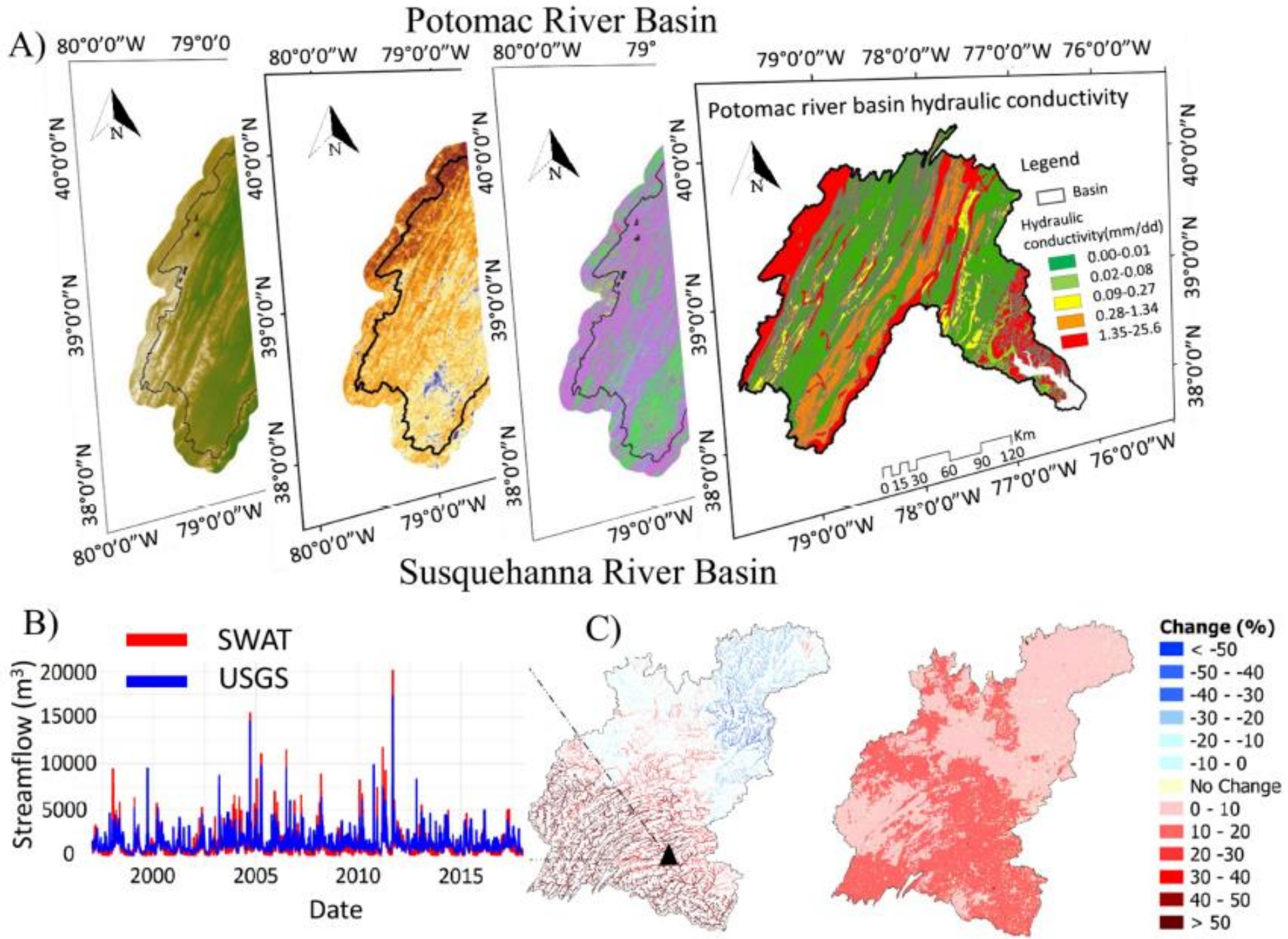
NSF Convergence Accelerator Program

- Phase I: 1 year proposal ($600K) to develop low-fidelity prototype (about to end)
- Phase II: 3-year proposal ($5 million) to fully develop product (just submitted!)
- Both phases involve intensive coursework with NSF

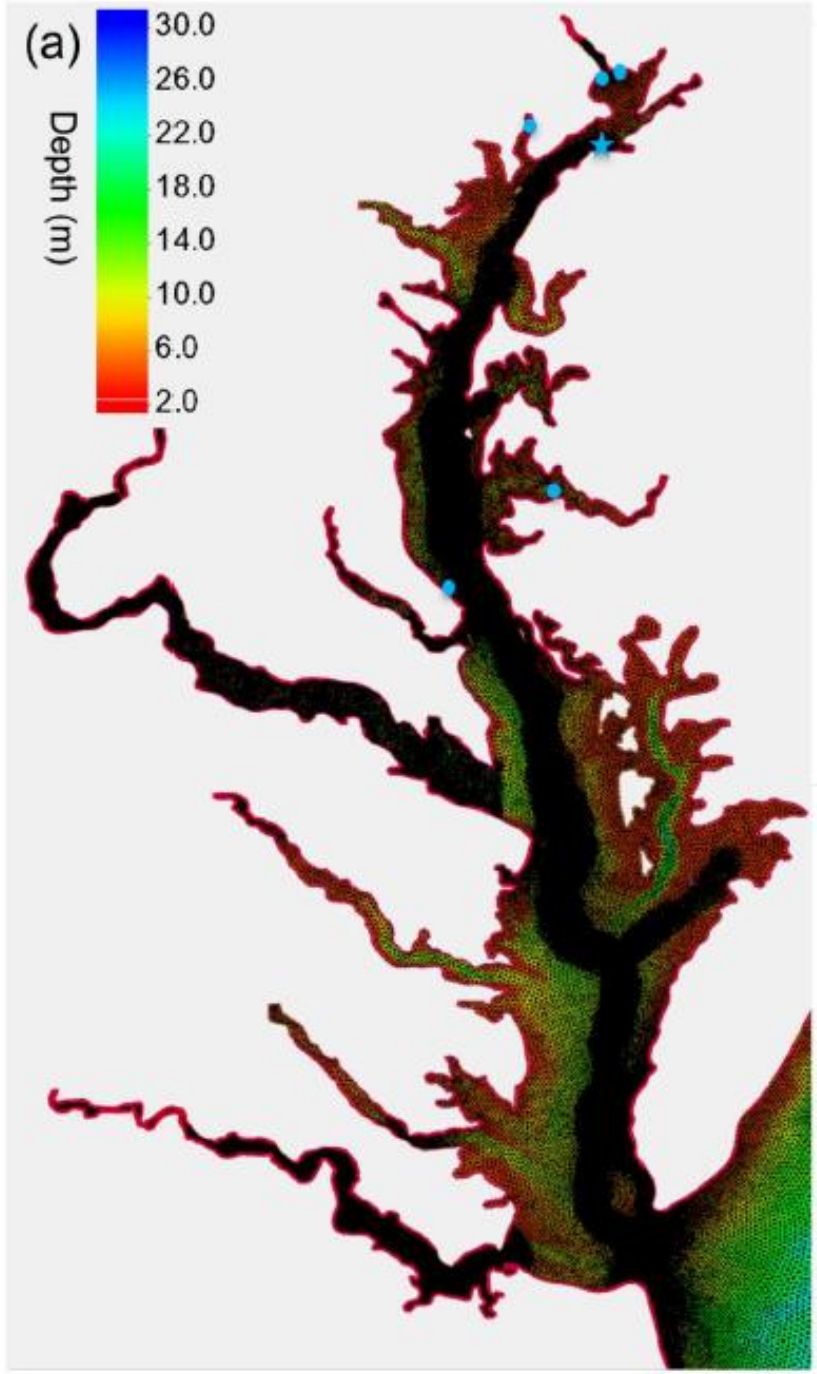
Region of focus: Mid-Atlantic

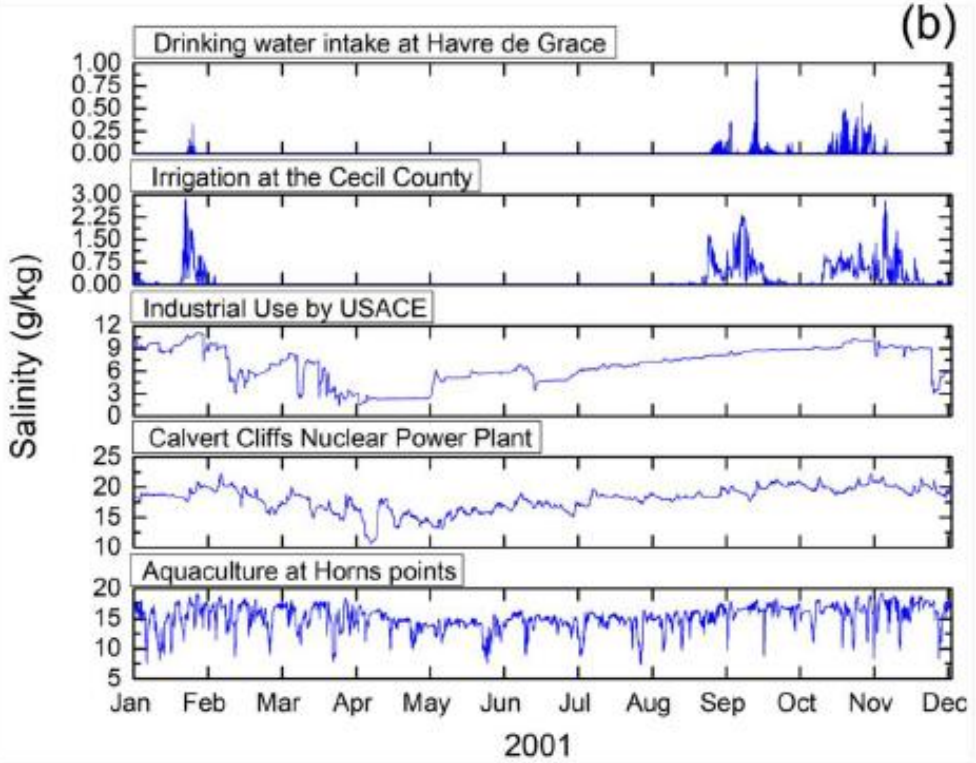


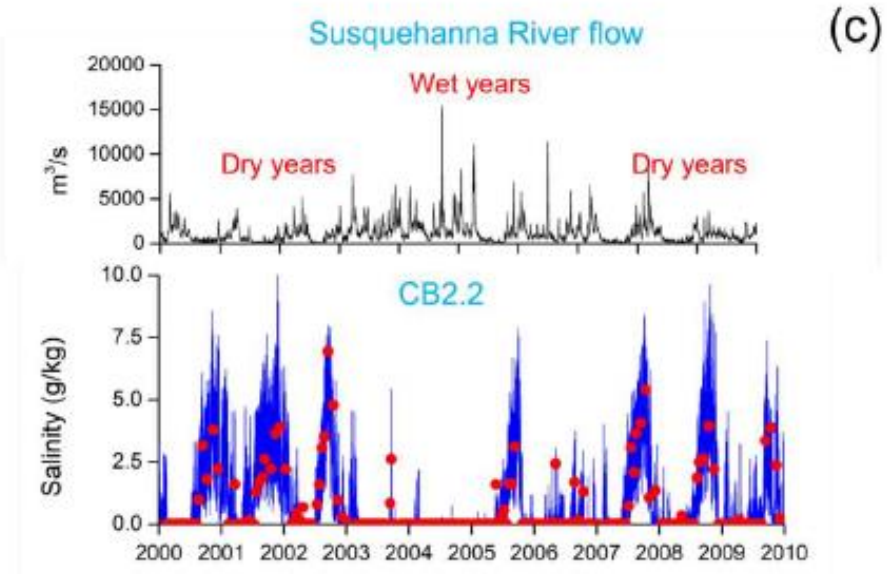
SWAT watershed model



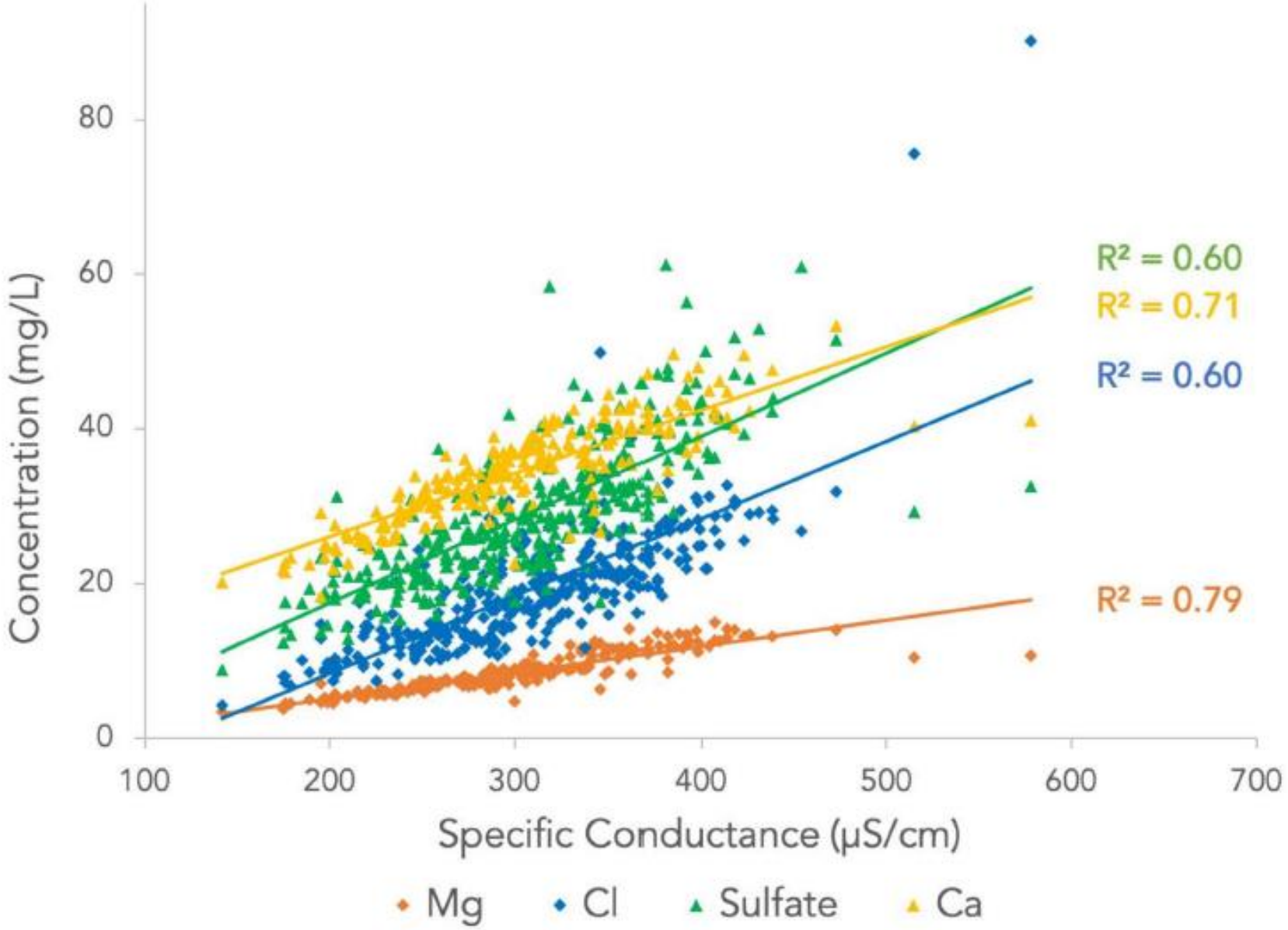
FVCOM Estuarine Model



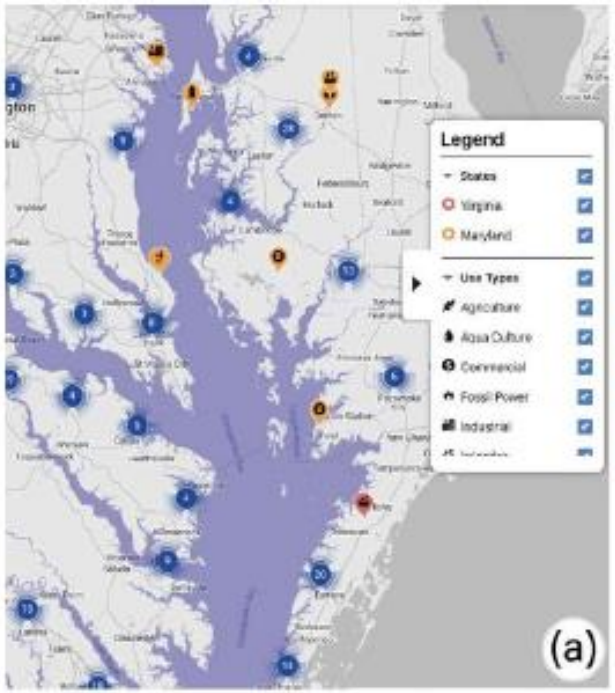




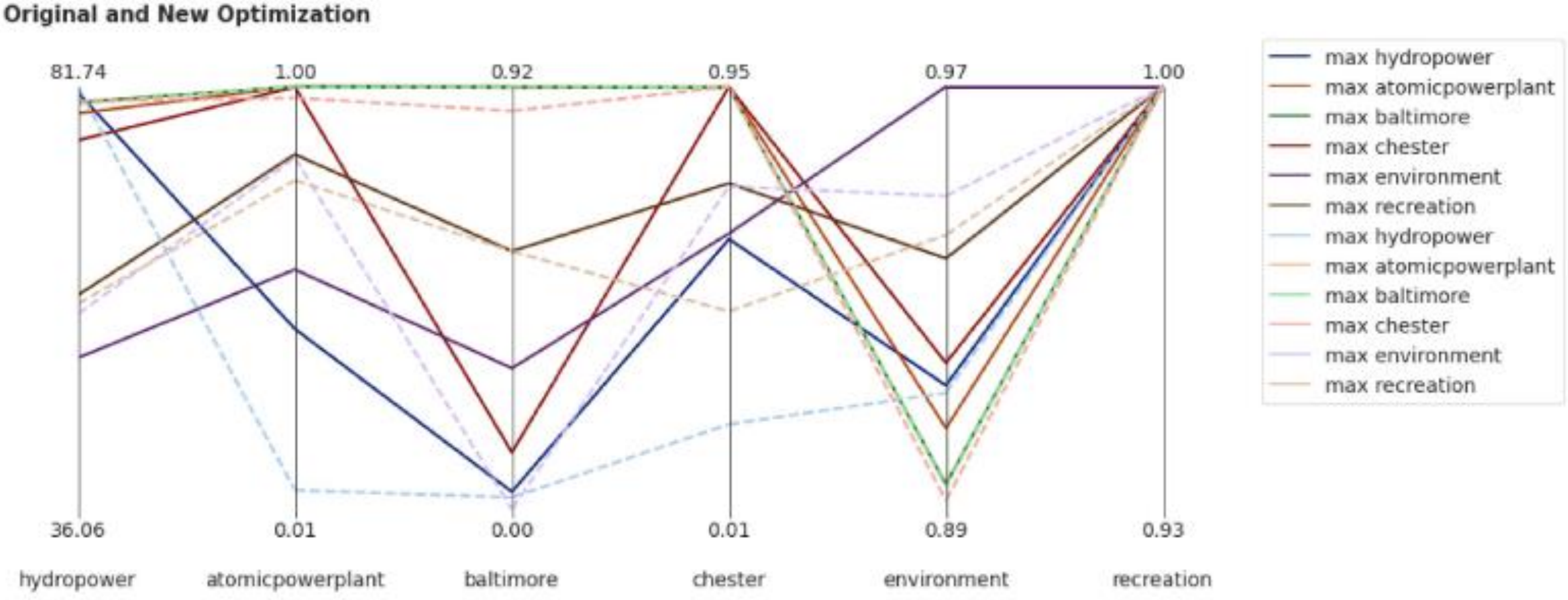
Salt ion data for model evaluation



Low-fidelity prototype of decision support system



Optimization under original constraints (solid lines) and salinity constraints (dashed lines)



Questions? Feedback?