

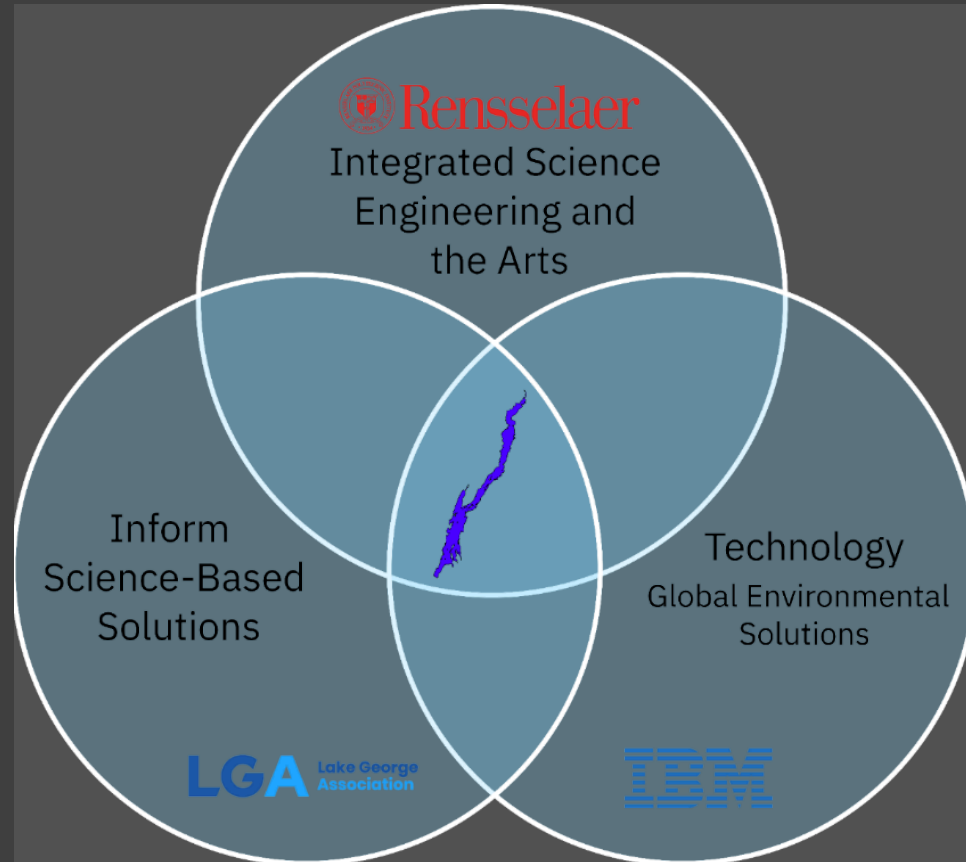
# A Smart Lake Approach

An Overview of Research at the Jefferson Project



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# The Jefferson Project



- **Started in 2013**
- **Founded as a partnership between RPI, IBM, and the Lake George Association**
- **Combines high intensity surveys, state-of-the-art sensor platforms, and coupled high-resolution models**
- **Bigger, better data!**



# Integrating Long-Term and High-Frequency Monitoring

- Physical monitoring since 1980s
  - “Offshore” Sampling Program
  - Whole lake coverage
- High-frequency data since 2014
- Complementary approach: broad trends vs. fine-scale dynamics



I'm a field  
guy...  
  
...but  
sensors  
have clear  
advantages



7:15 AM  
5/9/26

# Anatomy of a Smart Lake - Sensor Platforms

● Tributary Stations



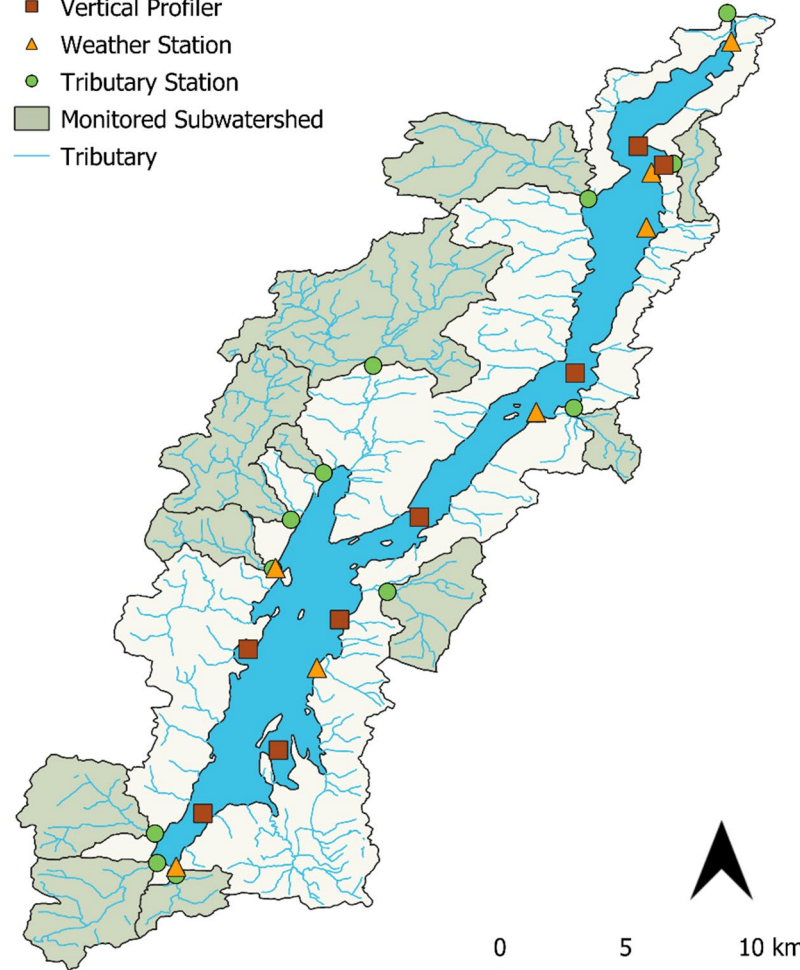
■ Vertical Profilers



## Lake George Sensor Network

### Legend

- Vertical Profiler
- ▲ Weather Station
- Tributary Station
- Monitored Subwatershed
- Tributary



▲ Weather Stations



## Statistics

- 22-25 Sensor deployment sites per year
- Hundreds of individual sensors deployed
- A quarter-billion data points collected per year
- Largest 11 tributaries monitored
- Vertical profilers have been deployed in all 5 sub-basins



# Vertical Profilers

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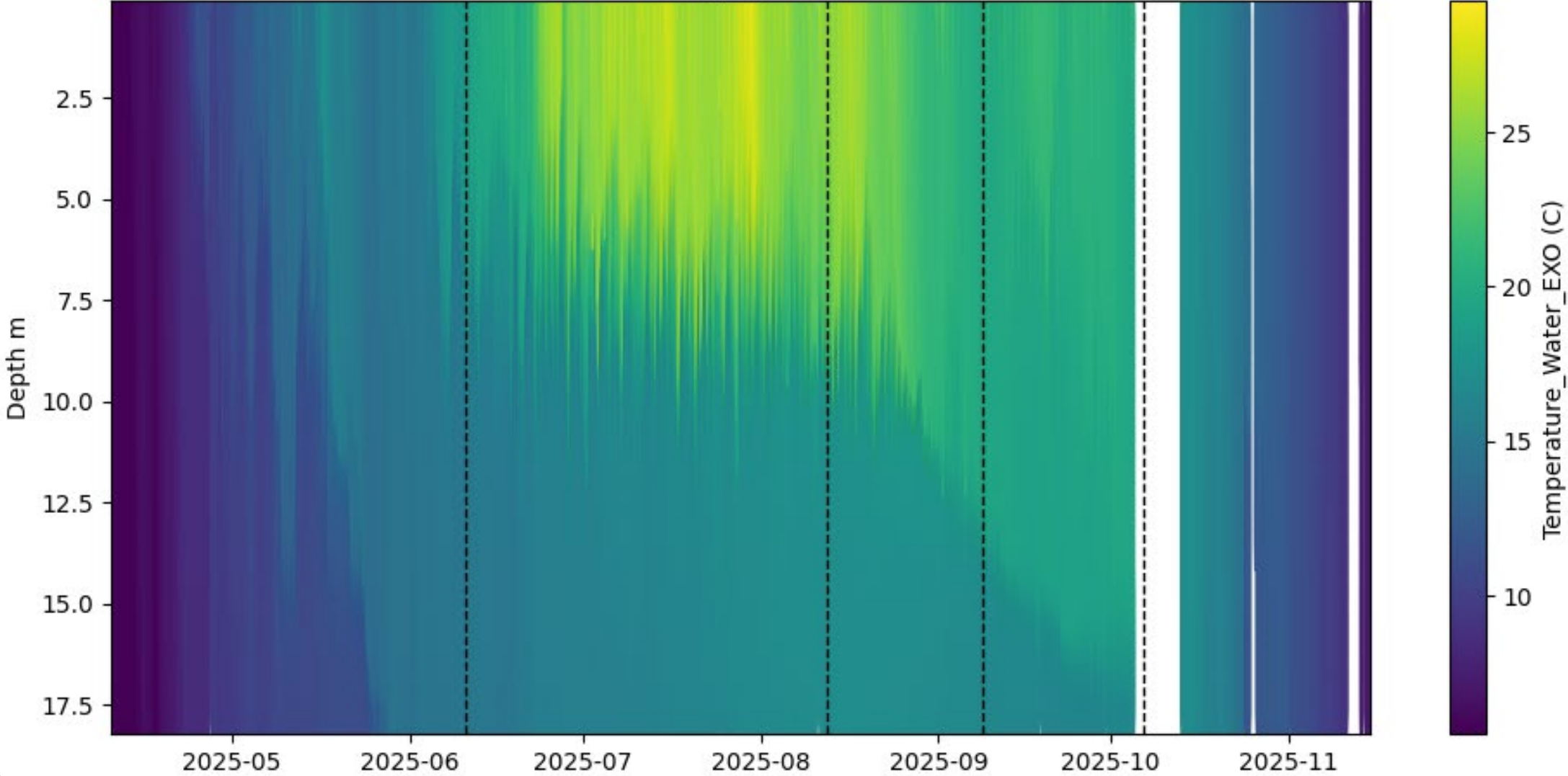
# Sensor Network Platforms: Vertical Profilers

- Function/Purpose
  - Autonomous, continuous monitoring with 10 cm resolution profiles, capturing data at 4 Hz
  - Lake stratification, big data = better models, ephemeral lake conditions, validation
- Sensors
  - Weather, light, hydroacoustic, water quality
- Take home
  - Expensive to build and maintain
  - Large volume of data creates challenges for data wrangling, visualization, QA/QC
  - .....High resolution data allows more accurate modeling

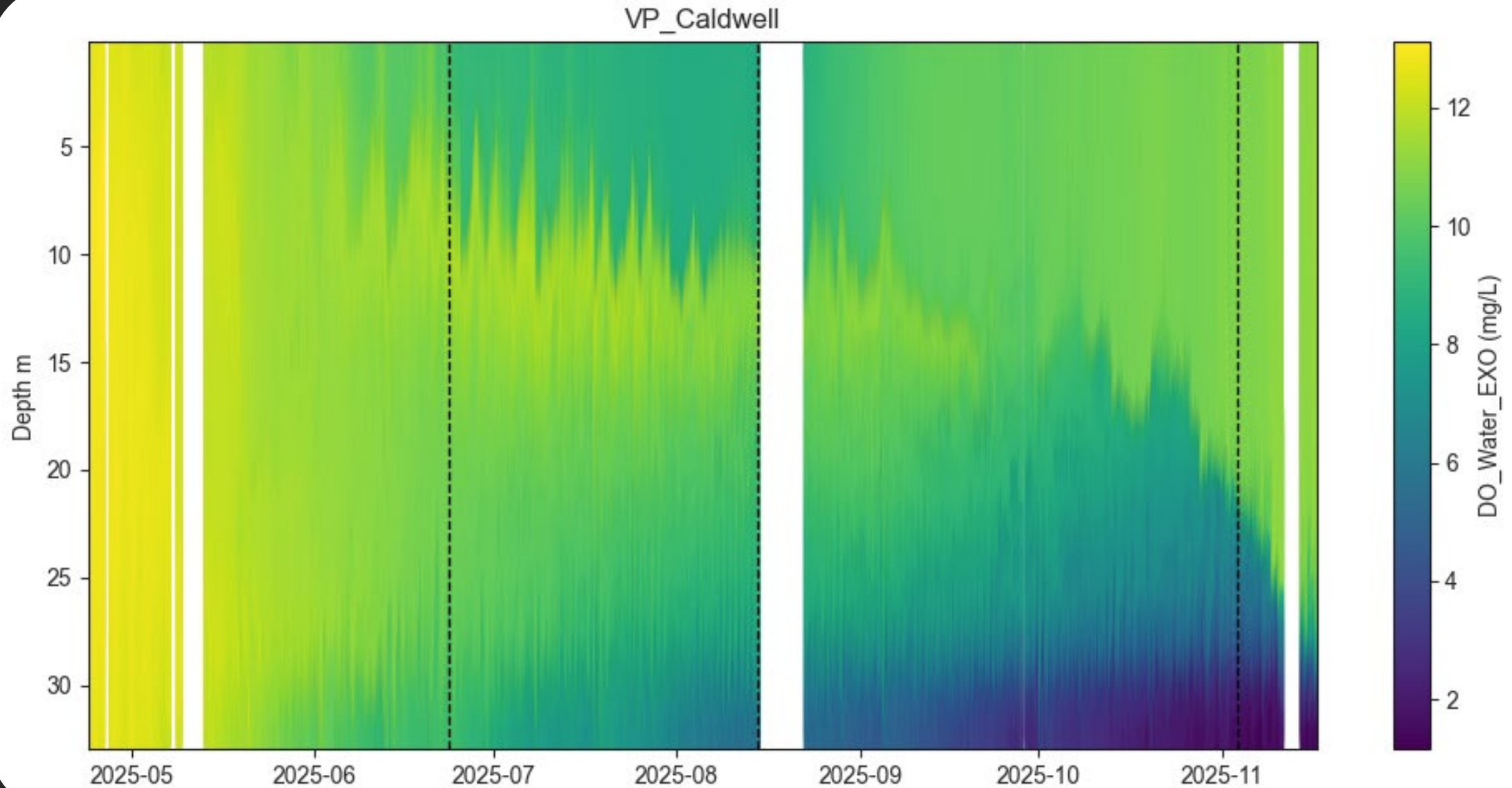


# Temperature in Chautauquua Lake - 2025

VP\_BigBar



# Dissolved Oxygen (mg/L) from Lake George (Look North!) - 2025



# Now and Later



## Gen 1

4 Hz data,  
expandable,  
complete control  
over data collection



## YSI

Lower resolution  
data, somewhat  
expandable, limited  
data collection  
parameters and  
post-processing



## Gen 2

4 Hz data, even MORE  
expandable/customizable  
(Specifically HABS),  
complete control over  
data collection

# Tributary Stations

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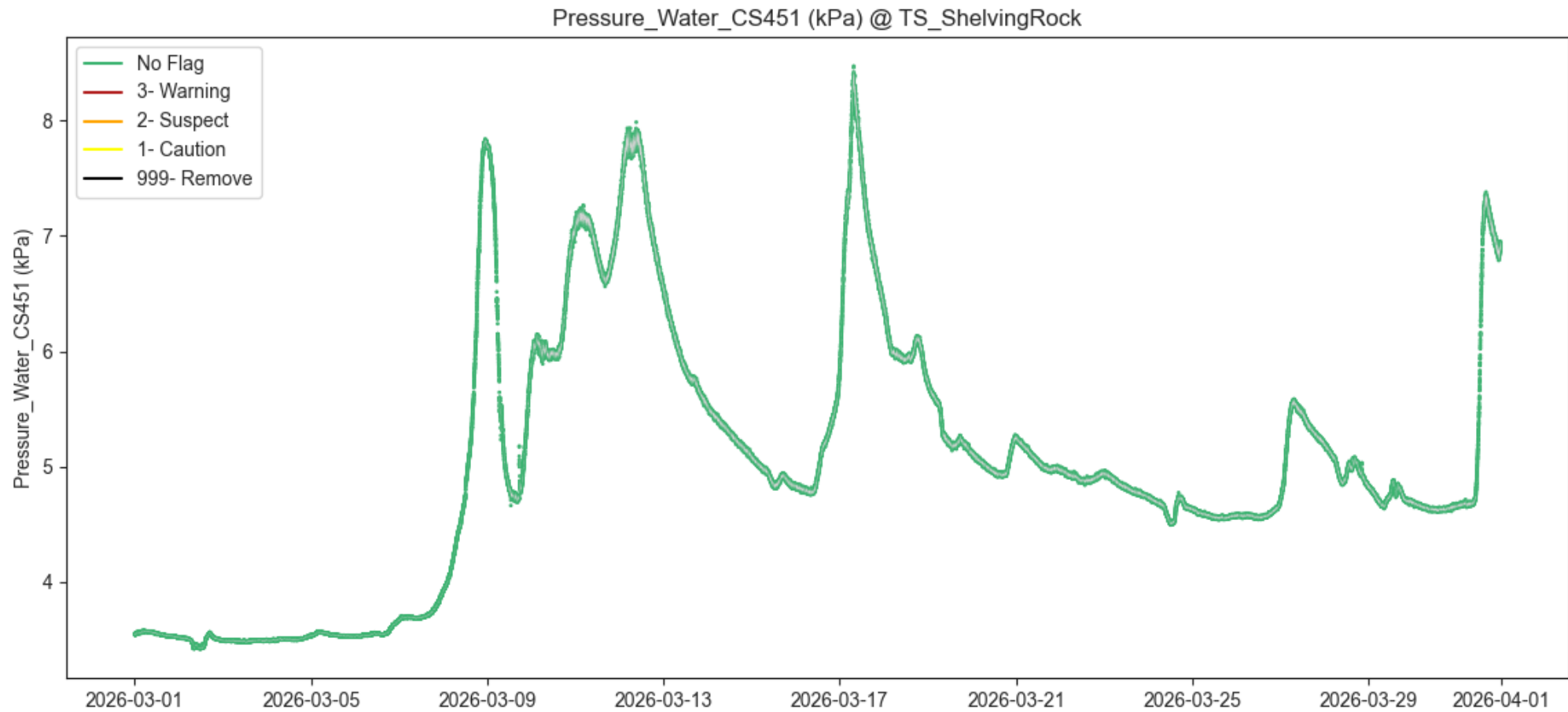


# Sensor Network Platforms: Tributary Stations

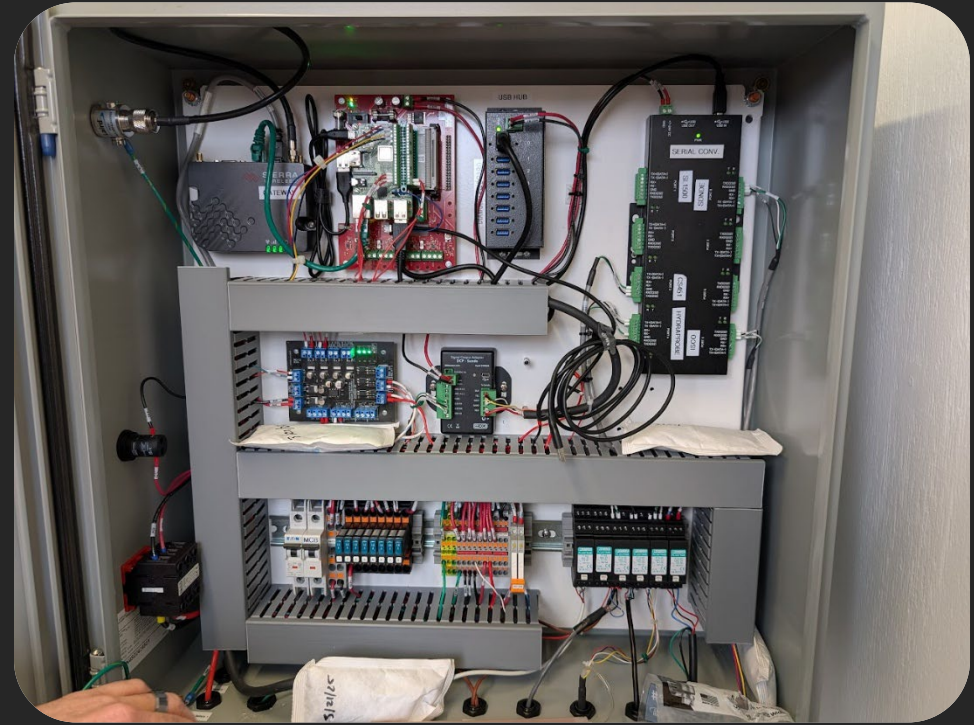
- Purpose/Function
  - Continuously monitor stream water quality
  - Nutrient loading, stormwater impacts, road salt dynamics...
- What sensors are on them
  - Water quality, stream depth, soil moisture/conductivity
  - Remote controlled stormwater sampler
- Take Home
  - Still requires traditional monitoring for sensor validation
  - .....High resolution data allows more accurate modeling
    - Again – I know!



# Water Pressure in Shelving Rock Stream



# Now and Later



- Upgrades to electrical cabinet
- Higher quality structure
- Bigger and better!



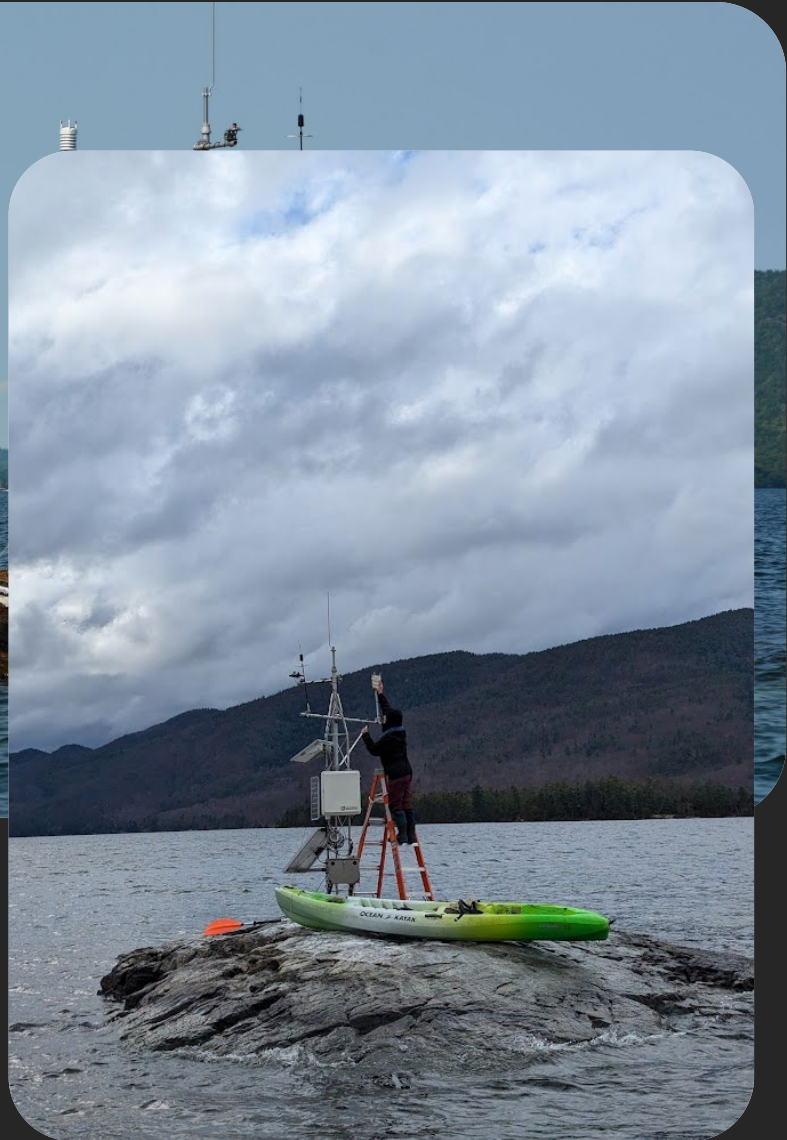
# Weather Stations

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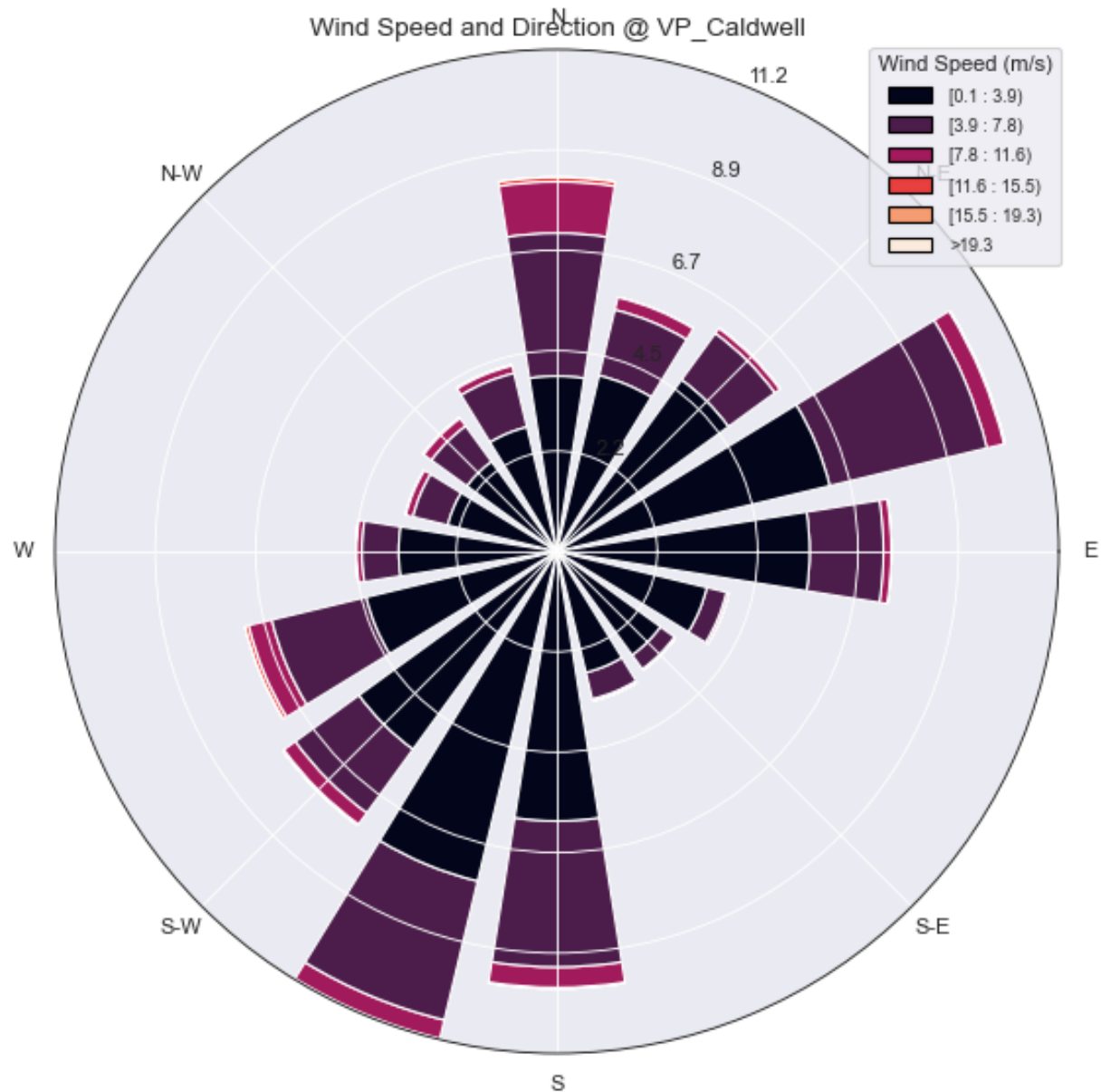


# Sensor Network Platforms: Weather Stations

- Purpose/Function
  - Continuously monitor atmospheric weather conditions
  - High resolution localized weather forecasts, tracking storms, wind effects on circulation...
- What sensors are on them
  - Vaisala weather sensors, solar radiation
- Take Home
  - Can be difficult to service in remote locations
  - .....High resolution data allows more accurate modeling
    - Is there an echo in here?



# Wind Speed and Direction at Lake George



# Now and Later



- Collaboration with University at Albany's NYS Mesonet program
- 2 Stations at Chautauqua Lake, N/S
  - Major upgrade over current weather stations
  - Combined expertise to improve weather modeling and research efforts

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## New York State Mesonet Expands Weather Monitoring at Chautauqua Lake Through Jefferson Project Partnership

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For media inquiries, contact the Office of Communication and Marketing at [518-956-8150](tel:518-956-8150) or [email us](#). View our [Staff Directory](#).

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UAlbany Atmospheric Sciences Research Center Director Chris Thorncroft (left) and New York State Mesonet Director June Wang. (Photo by Patrick Dodson)

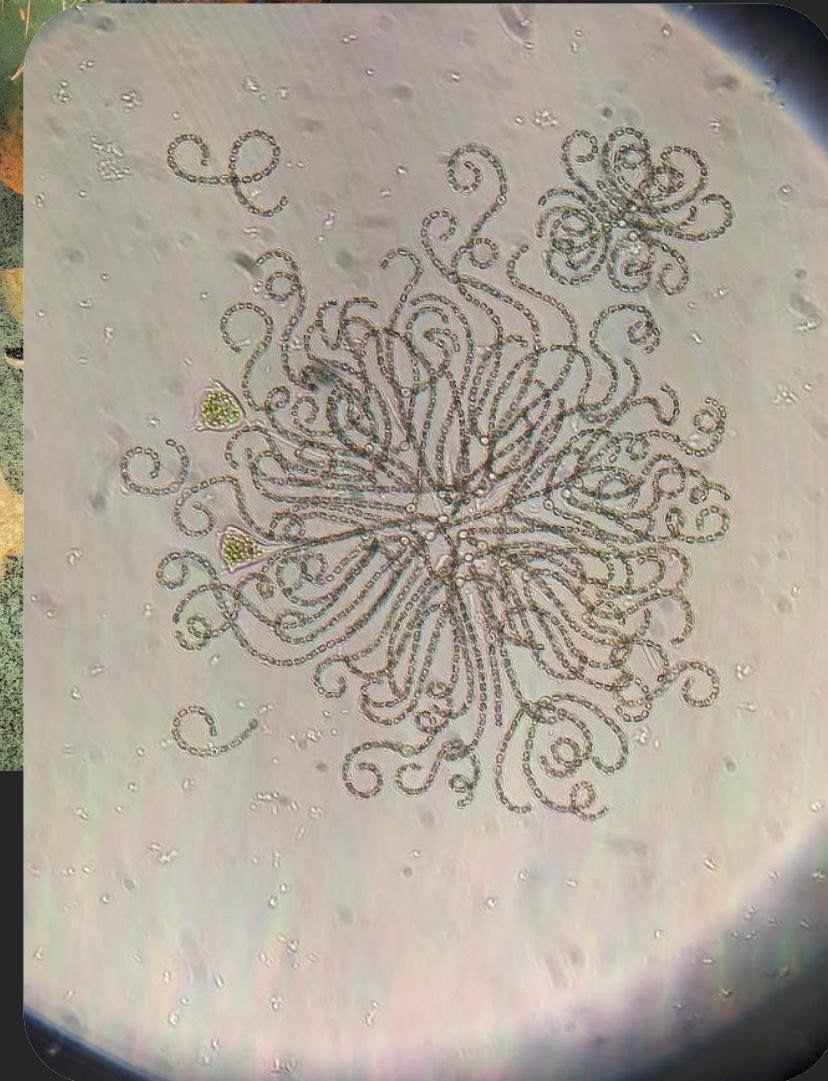
# Breakthrough 1: Harmful Algal Blooms

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# Harmful Algal Blooms

- Characterized the build-up to the first observed bloom at Lake George in 2020
  - October 2019 – 3 major storms increased the lake level by 10 inches (very large for LG), flushing sediments and feeding akinetes
  - November 2020 – A period of deep water mixing followed by unseasonably warm, calm weather. This brought nutrient rich waters from the bottom of the lake to the surface, allowing cyanobacteria to rapidly grow and aggregate on the surface
- VP's, trib stations, and weather stations!



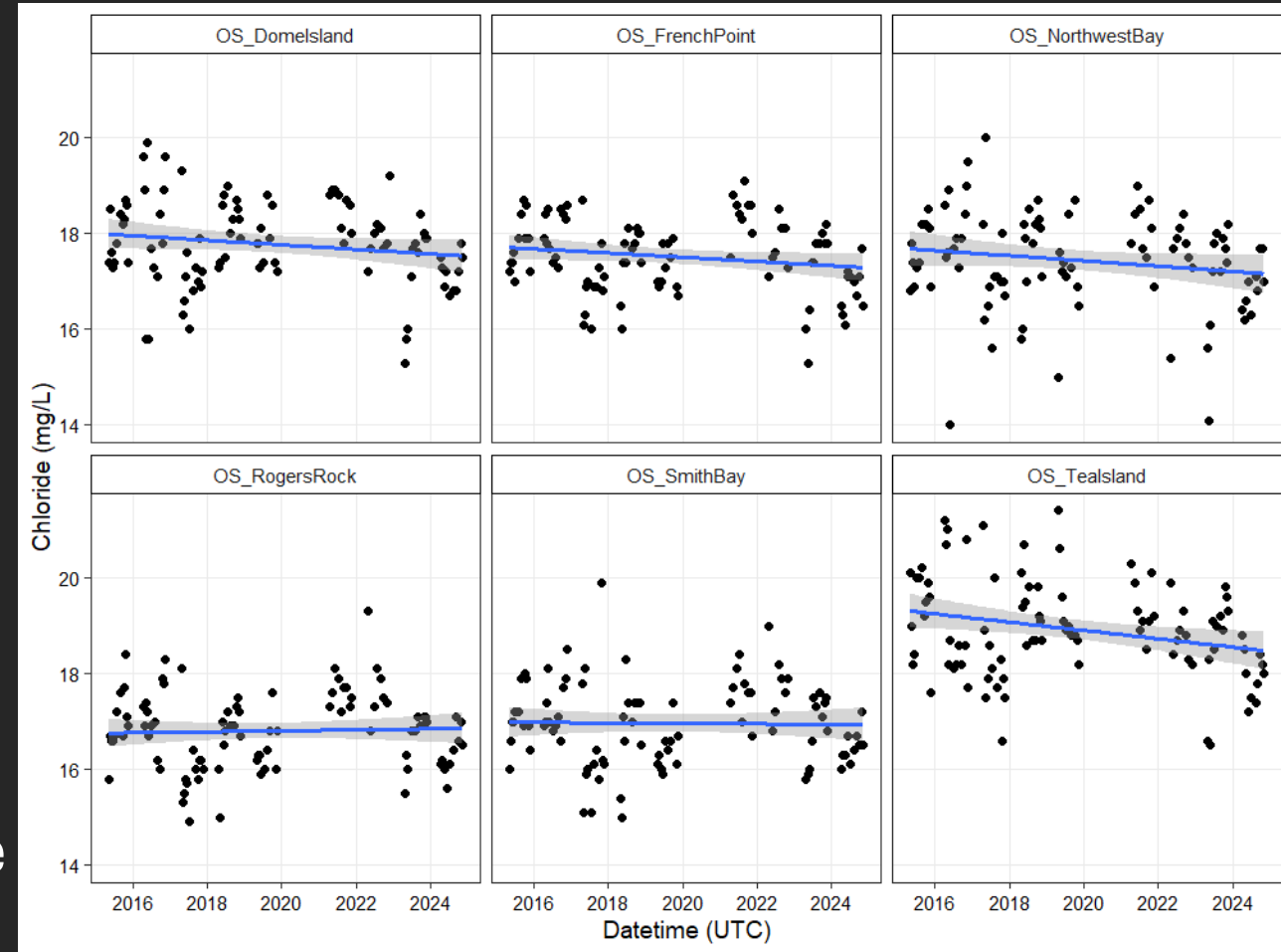


# Breakthrough 2: Salt Mitigation



# Salt Mitigation

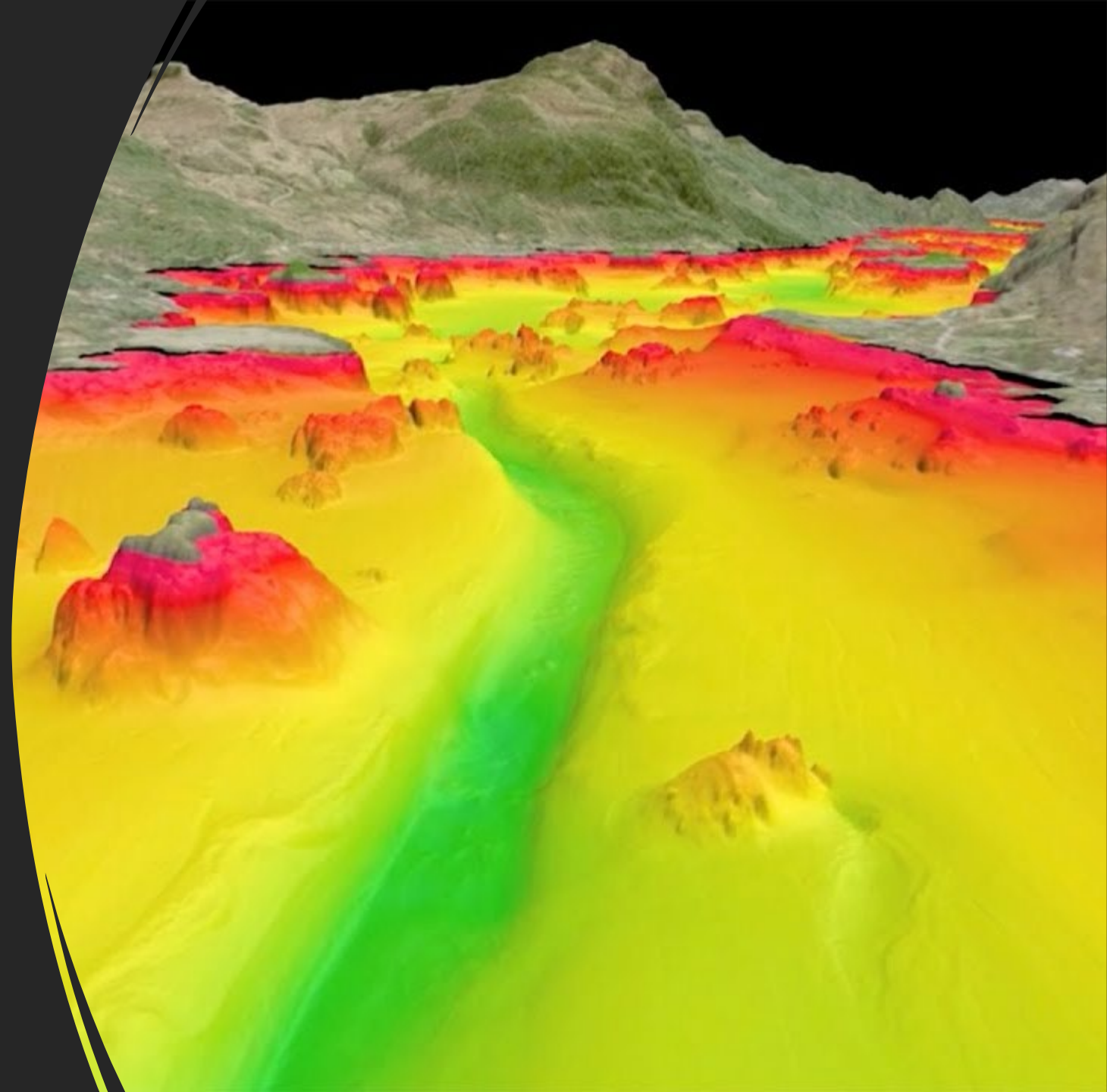
- Due to mitigation efforts connected to the LGA's Lake George Road Salt Initiative, salinity increases are leveling off
  - Lake Survey Monitoring data shows a very slight decrease in the past 10 years at several sites
- With further commitment to reducing salt usage, concentrations may decrease further in the future
- Towns and counties around Lake George have adopted new anti-icing strategies, such as applying brine before a storm hits. Live edge plows that fit to the curve of the road are more effective at removing snow and ice
- Weather stations, trib stations, lake monitoring



**Tiny decrease = Huge win!**

# Breakthrough 3: Lake Circulation

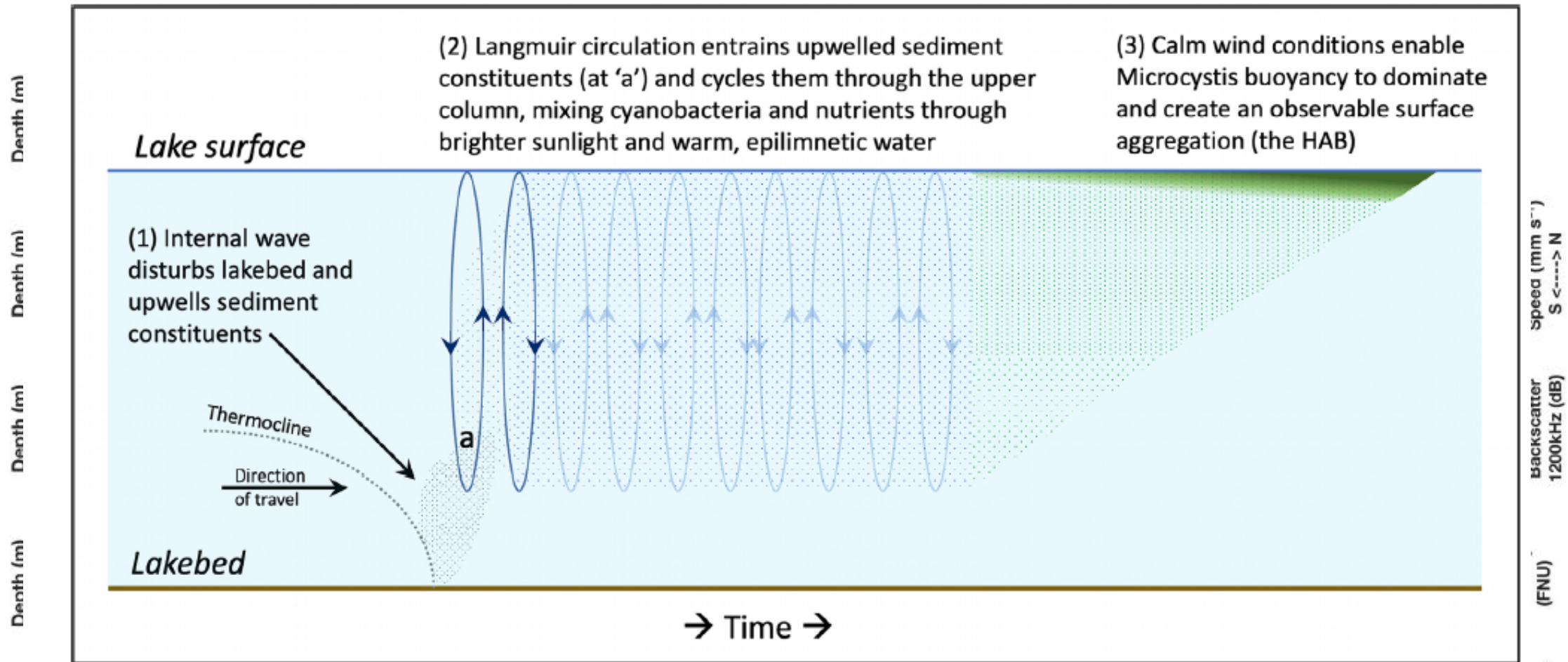
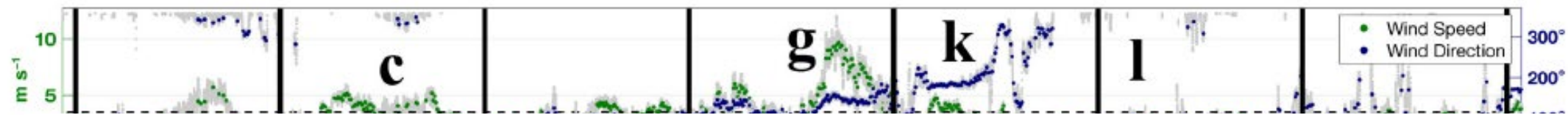
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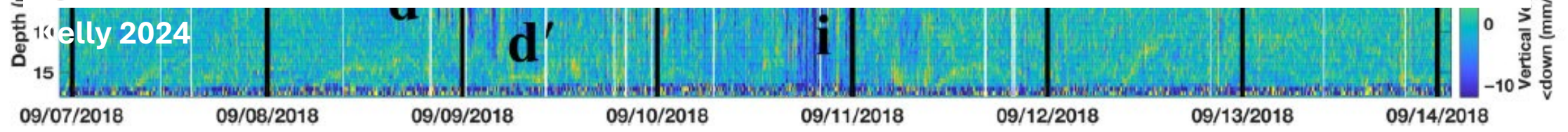
# Breakthrough 3: Lake Circulation

- 3D model of Lake George circulation patterns
  - Flow rate and direction at any point in the lake
  - Key point: Applicable to other lakes
- Use cases: Simulation work for representing the internal seiche observed in the North end of Skaneateles Lake. Model showed the interaction of the internal seiche with bottom of the lake at that location, confirming the link between internal waves and resuspension of sediment from the bottom to create a HAB
  - (next slide) (prepare yourself)





**Fig. 3.** The sequence of processes preceding each HAB on Skaneateles Lake in 2018.



July 2024



**Modeling brings everything together**

**Weather**

**Hydrodynamics**

**Watershed**

Model outputs are used to build a more complete picture of lake processes and health. They can also be used to forecast change over time.



# New Research Vessel – R/V Boylen

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# Where to Find Our Data

Contact me at:  
[mattes.brian@gmail.com](mailto:mattes.brian@gmail.com)

Also visit [jeffersonproject.live/](http://jeffersonproject.live/)

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**RPI**



# Acknowledgments





