



Synthesizing High-Resolution Nutrient Data

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Matthew T. Duggan
SULI 2021 Summer intern



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Acknowledgements

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- Peter Regier
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- Dr. Nick Ward

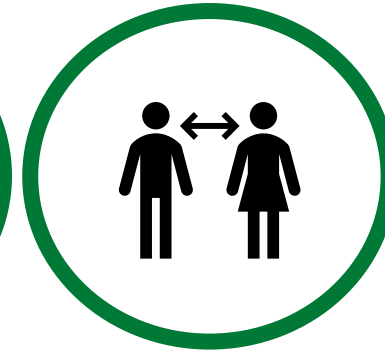
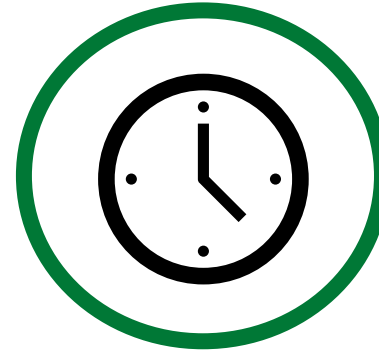
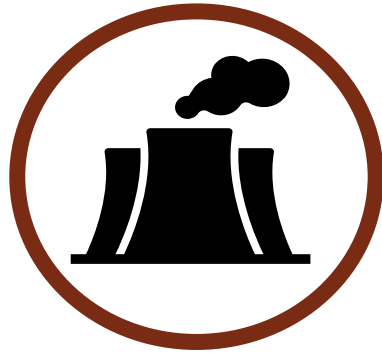


*Coastal Observations, Mechanisms, and
Predictions Across Systems and Scales - Field
Measurements and Experiments project*

Background

Estuaries

Vast Spatial & Temporal Timescales



Human

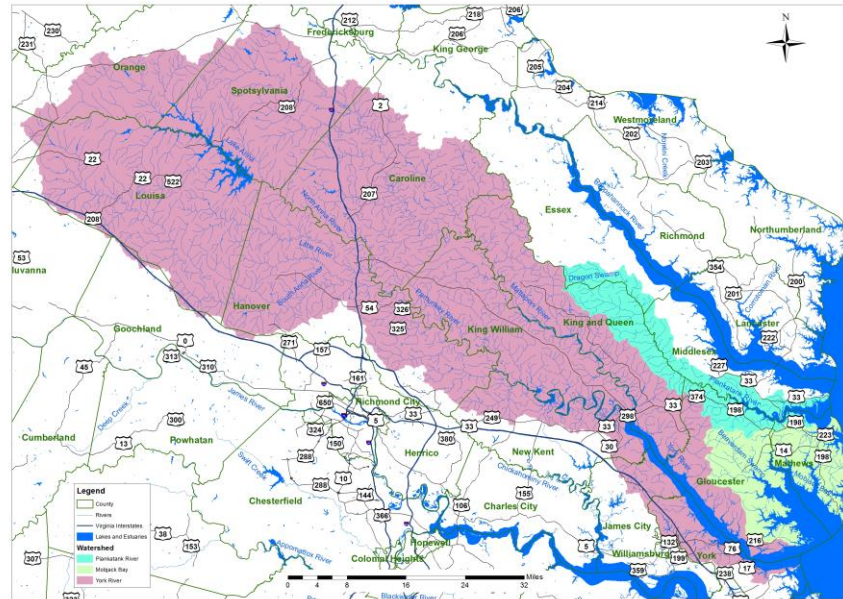


Figure 1. SCB RoundTable (2021)

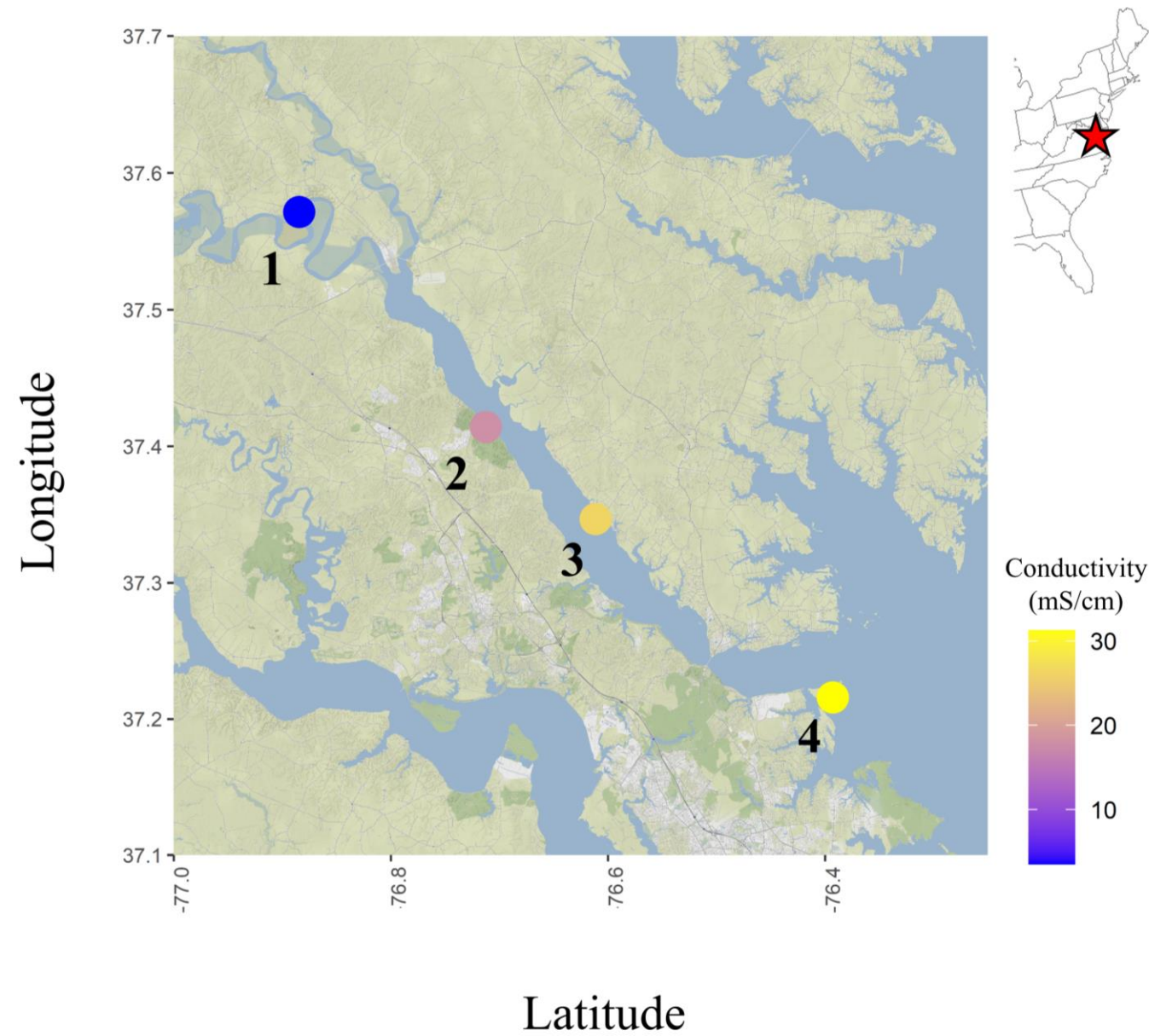


Nature

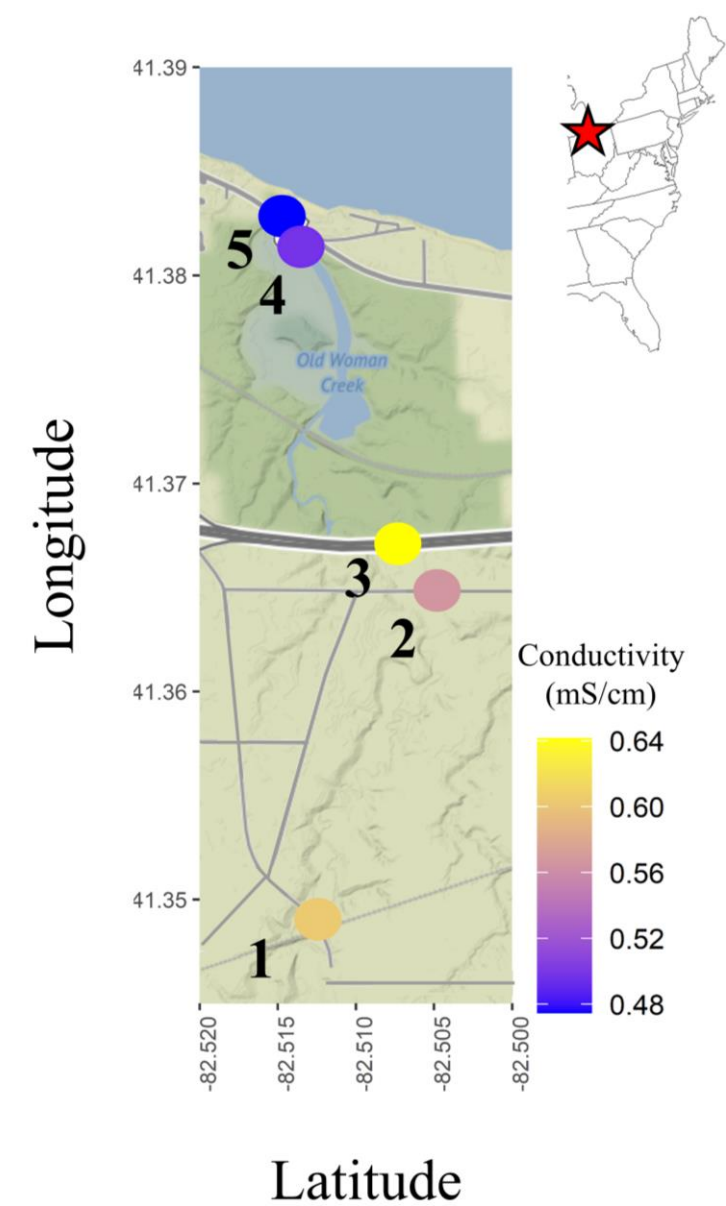


Study Sites

York Town Tributary



Old Woman Creek



Simplifying Big Data Challenges



Field Sensors

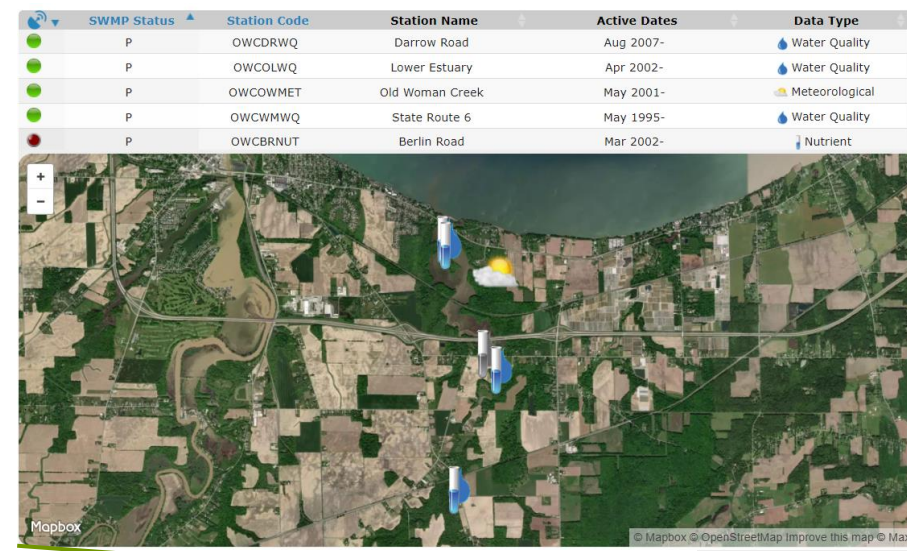
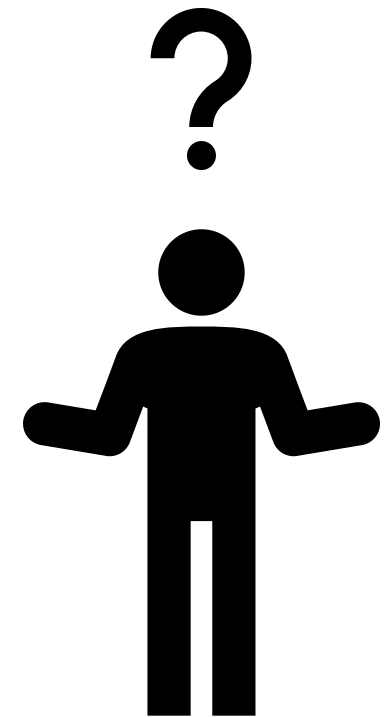


Figure 2. NERR (2021)



Figure 3. NERR (2021)

Big Data



What now...

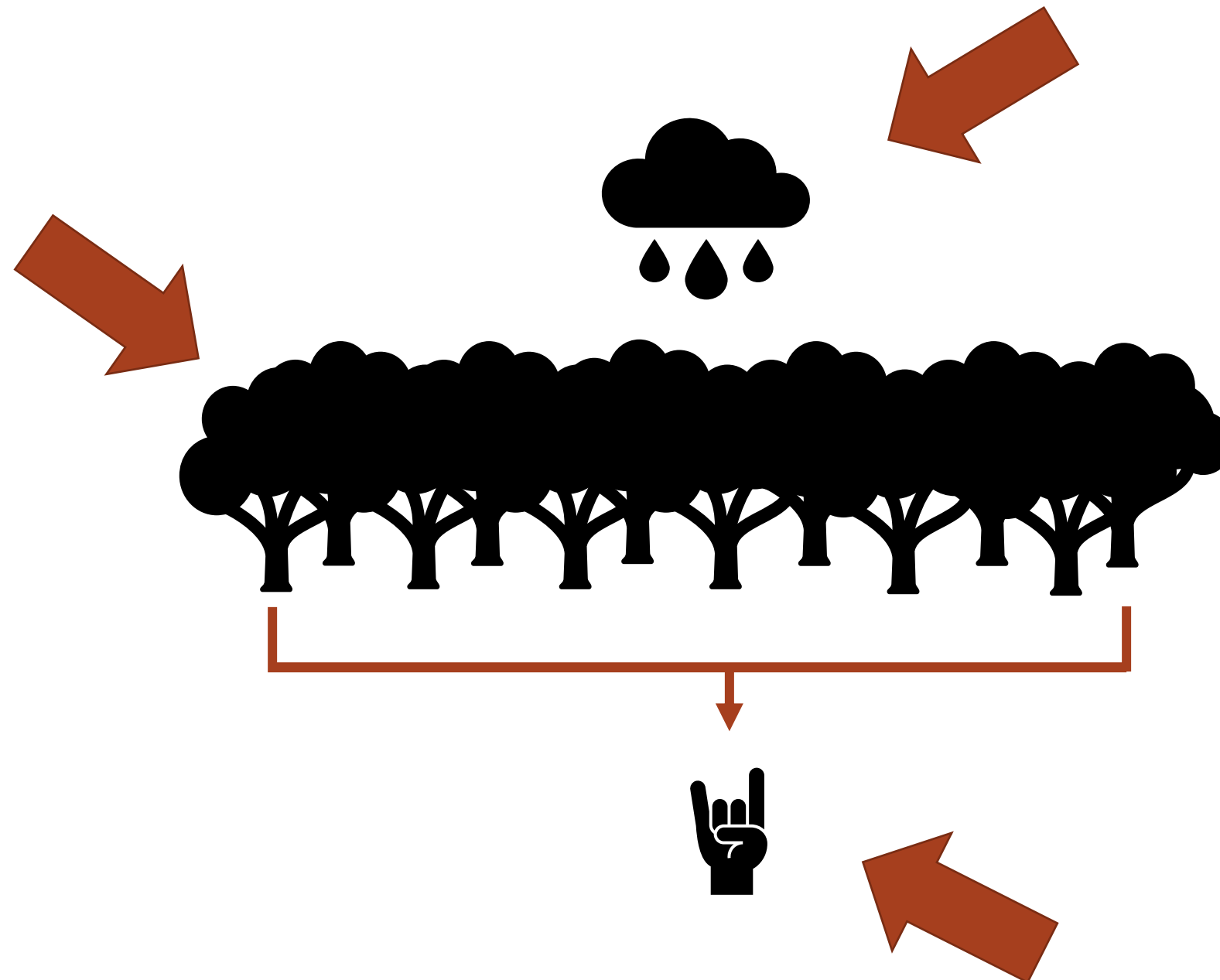
Classic Problems



- Human Bias
- Resource Limitations
 1. Time
 2. Staff
 3. Costs
- Inaccurate Predictions
- Low Resolution

Machine Learning

Random Forests



1. Water Quality Data

2. Decision Trees

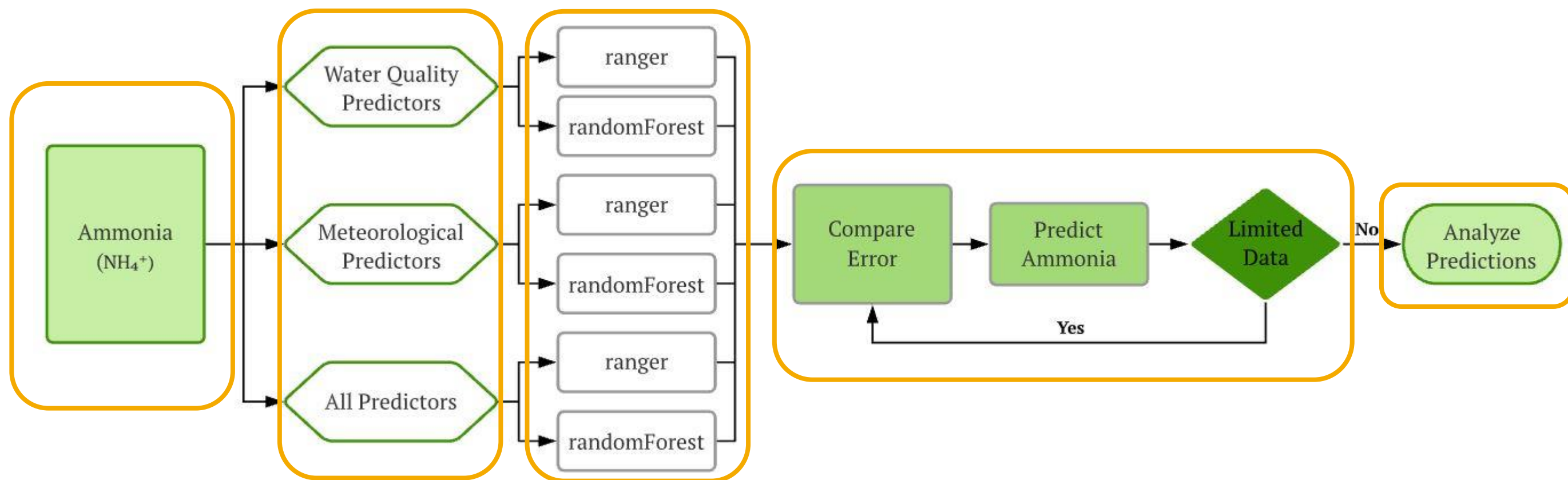
3. Ensemble Prediction

Workflow

Input Known
Data

Model
Architectures

Predict

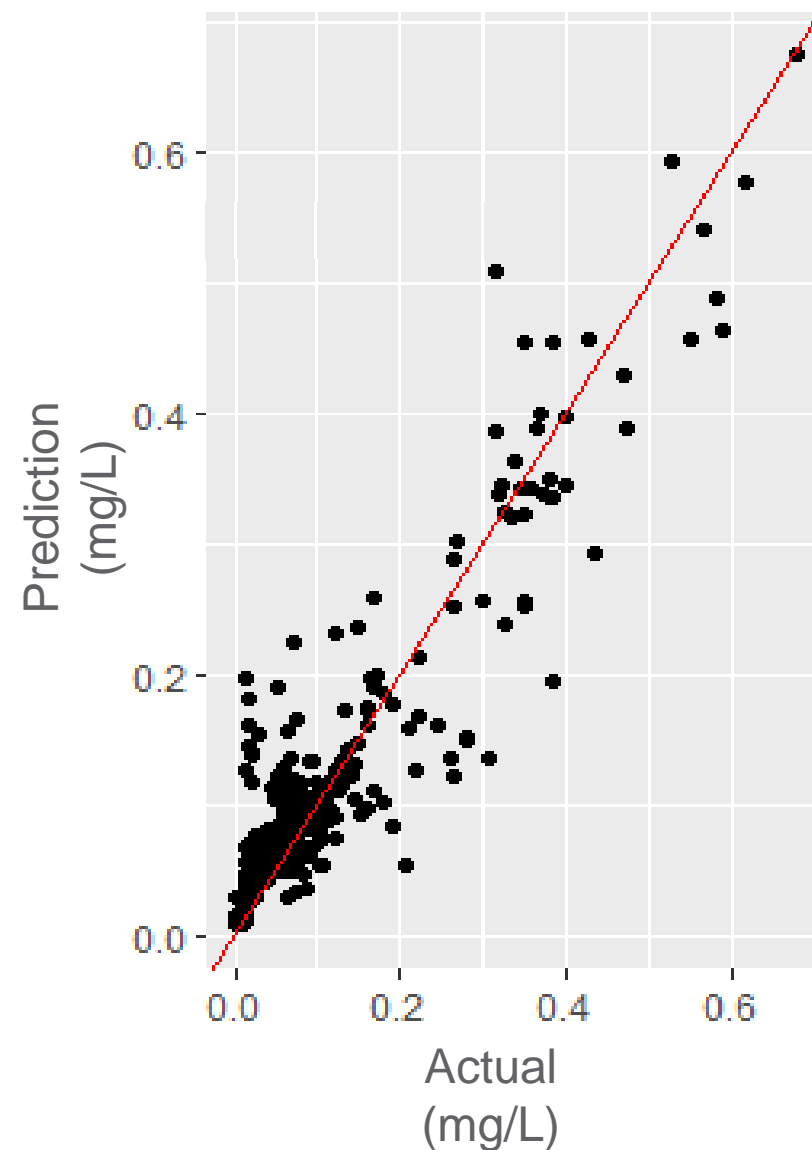


Combination of
Predictors

Analyze
model

Model Analysis

Chlorophyll-a



53-83% | Range of Nash-Sutcliffe efficiency coefficient

> 50% | *satisfactory fit*

> 64% | *good fit*

> 75% | *excellent fit*

(Moriassi et al. 2007)

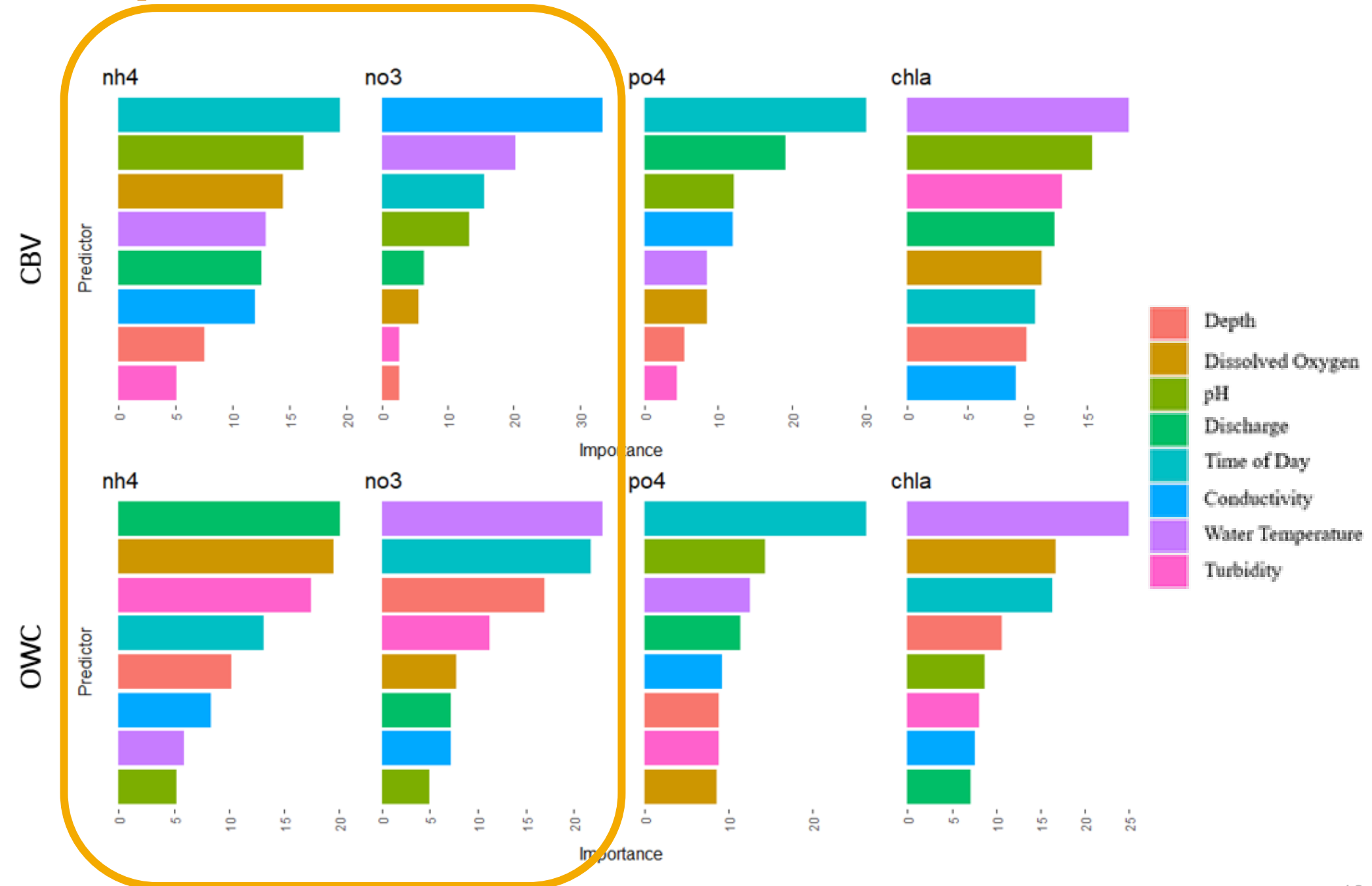
Feature Importance

Similarities

- Time of Day
- Water Temperature

Differences

- Depth
- pH

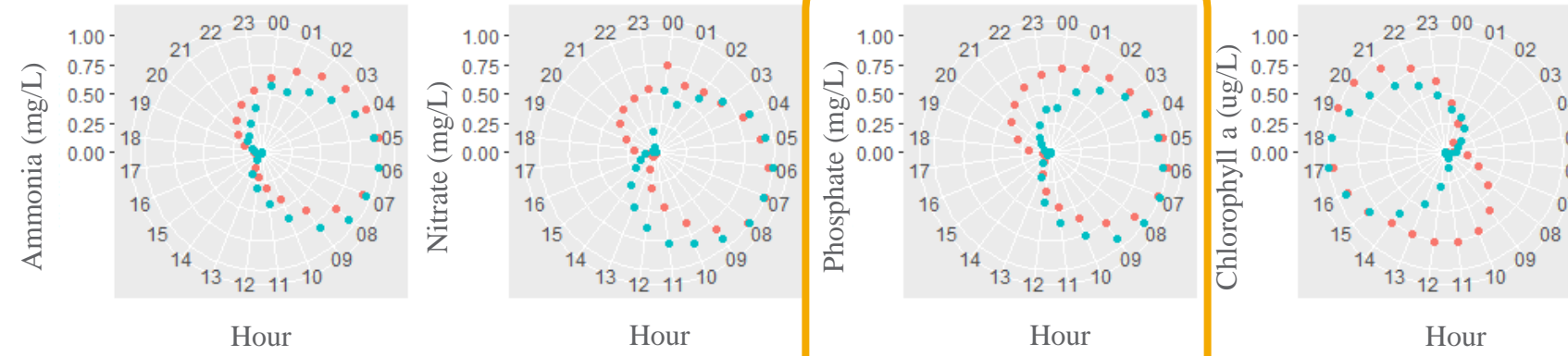


High Frequency Predictions

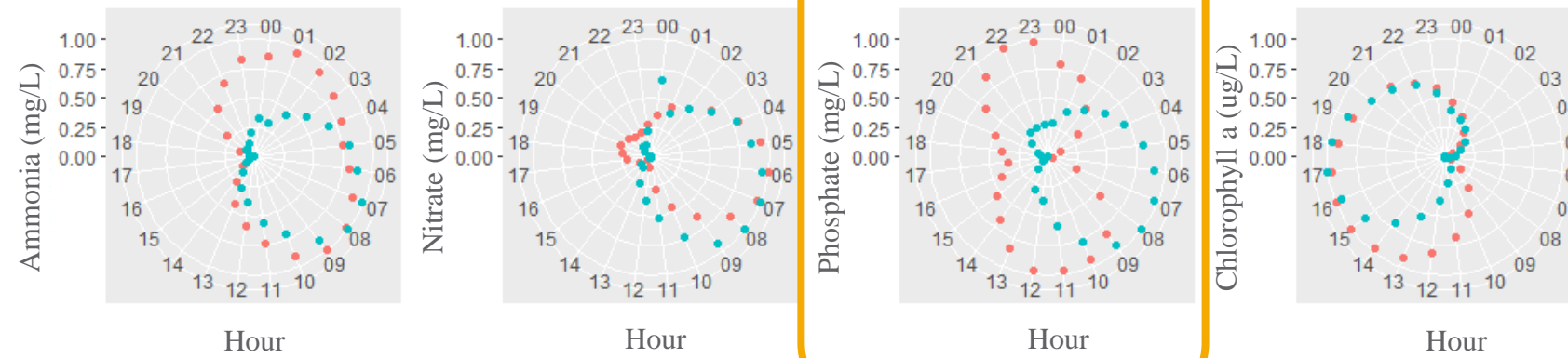
Diurnal Patterns

Data Subset

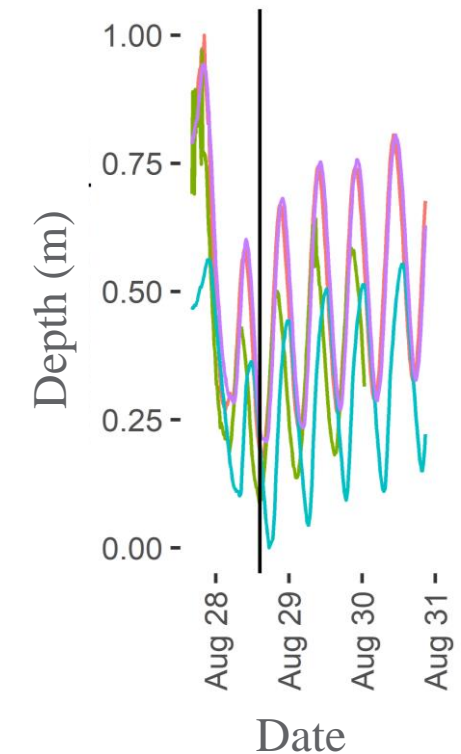
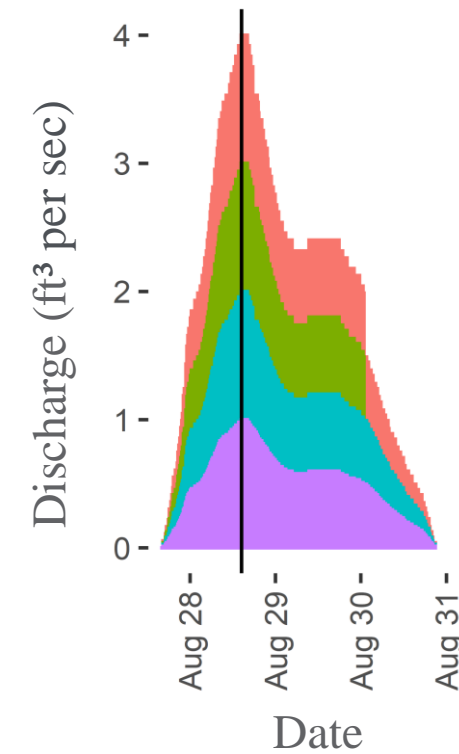
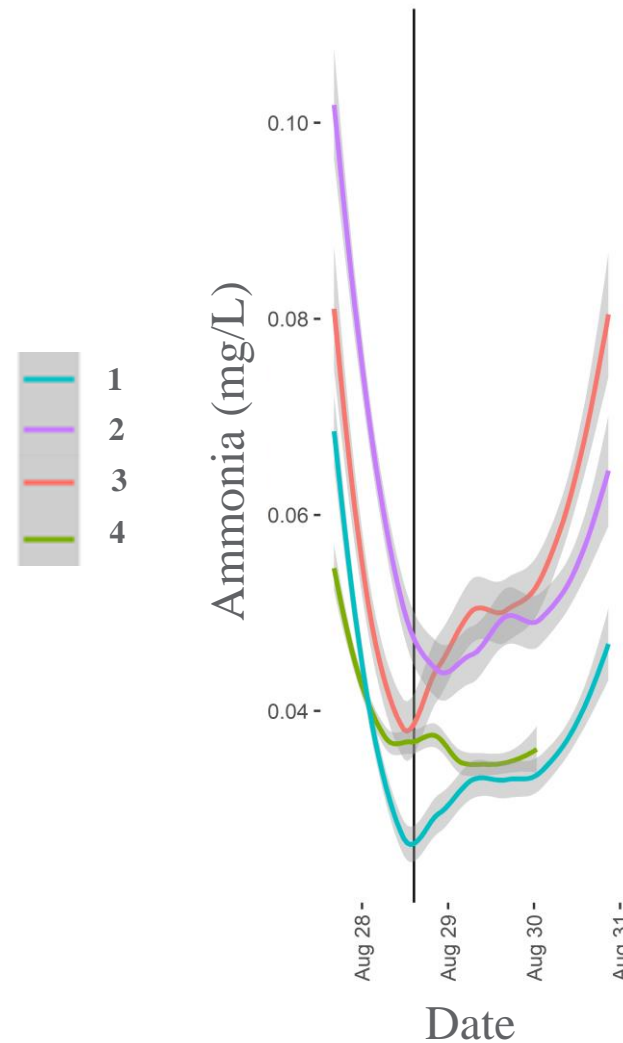
First



Second



CBV Hurricane Events



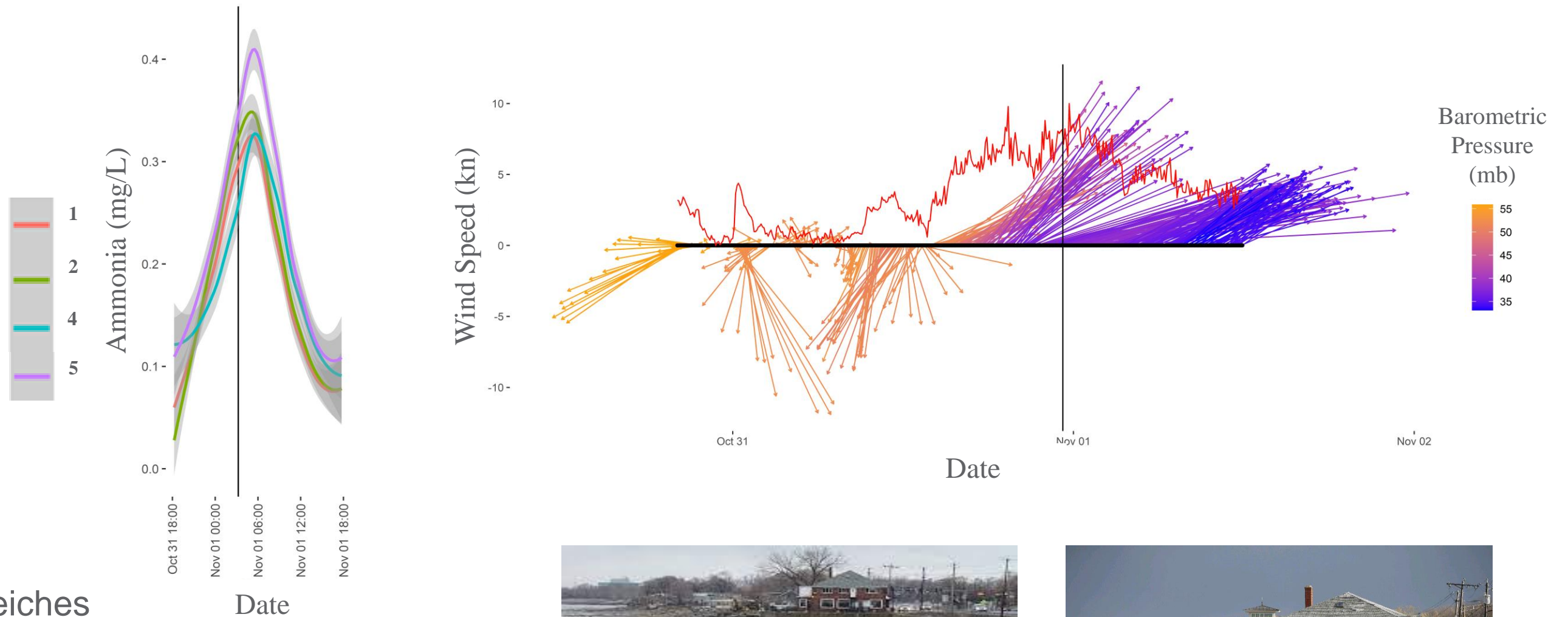
Hurricanes

- Form over warm water and air meeting cold air
- Continual switch of warm and cold air increases



Figure 5. Verge (2012)

OWC Seiche Events



Seiches

- Strong west wind
- Correlated with storm fronts
- Massive push of water



Figure 3. Ruger-Wightman, R. (2019)



Figure 4. Mulville, M. (2015)

Conclusion

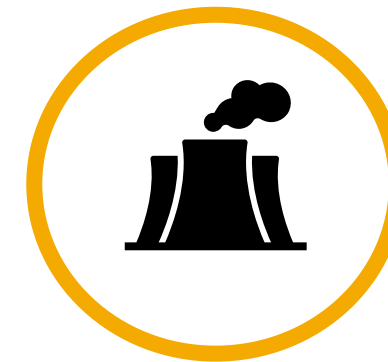


~~High Resolution~~



Uncertain
Predictions
Measurements

Pollution



Weather



Tailored
Management

Thank you



Questions

Additional Resources

- GitHub Link: https://github.com/COMPASS-DOE/bgc_synthesis