

Experimental Lake Erie Hypoxia Forecasting for Public Water Systems Decision Support

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Photo: Gus Chan, The Plain Dealer



Operational Lake Erie Hypoxia Forecasting for Public Water Systems Decision Support

Project goal

Develop a model that can forecast episodes of hypoxia at water intakes on Lake Erie that is suitable for transition to operational use at NOAA

Project period

2017-2021

University of Michigan, Cooperative Institute for Great Lakes Research (CIGLR)

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NOAA GLERL

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Collaborators

Scott Moegling

Cleveland Division of Water

Paris D. Collingsworth

Purdue University

Richard T. Kraus

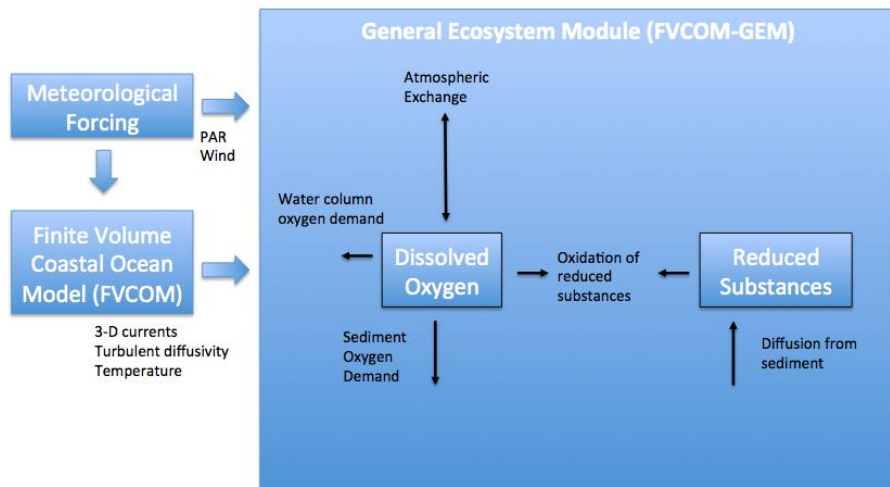
US Geological Survey

This research is funded by the National Oceanic and Atmospheric Administration National Centers for Coastal Ocean Science Center for Sponsored Coastal Ocean Research under award NA16NOS4780209 to University of Michigan and NOAA GLERL

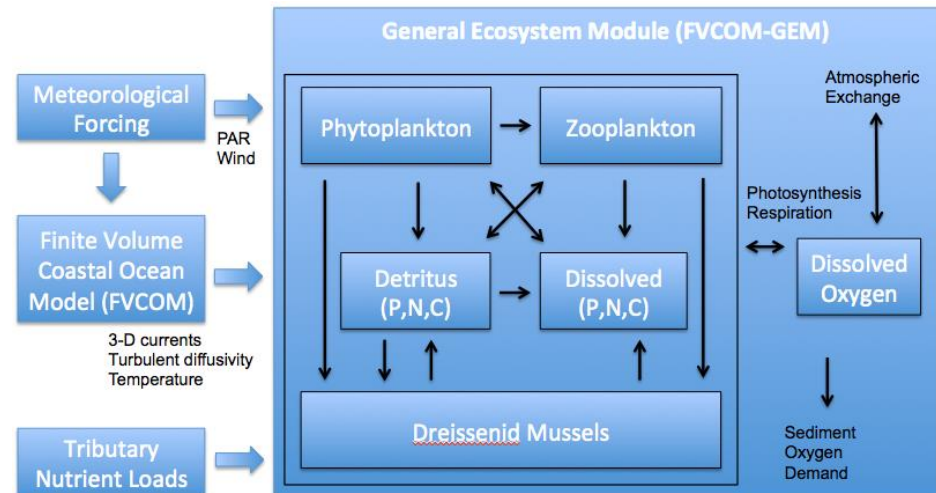
Proposed work

Develop two dissolved oxygen models using the FVCOM-GEM framework

Physical dissolved oxygen model



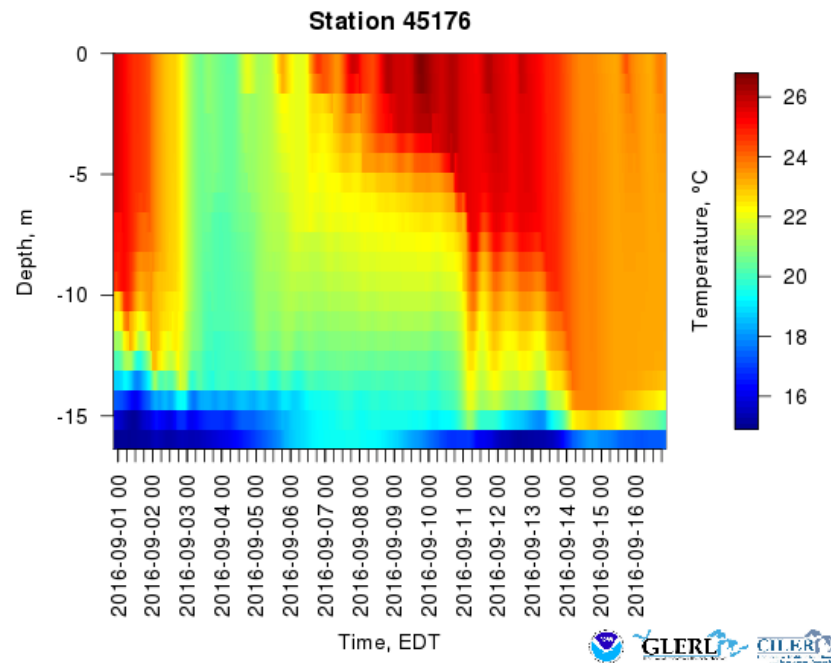
Biophysical dissolved oxygen model



Proposed work

Further refinement of the FVCOM-based LEOFS hydrodynamic model

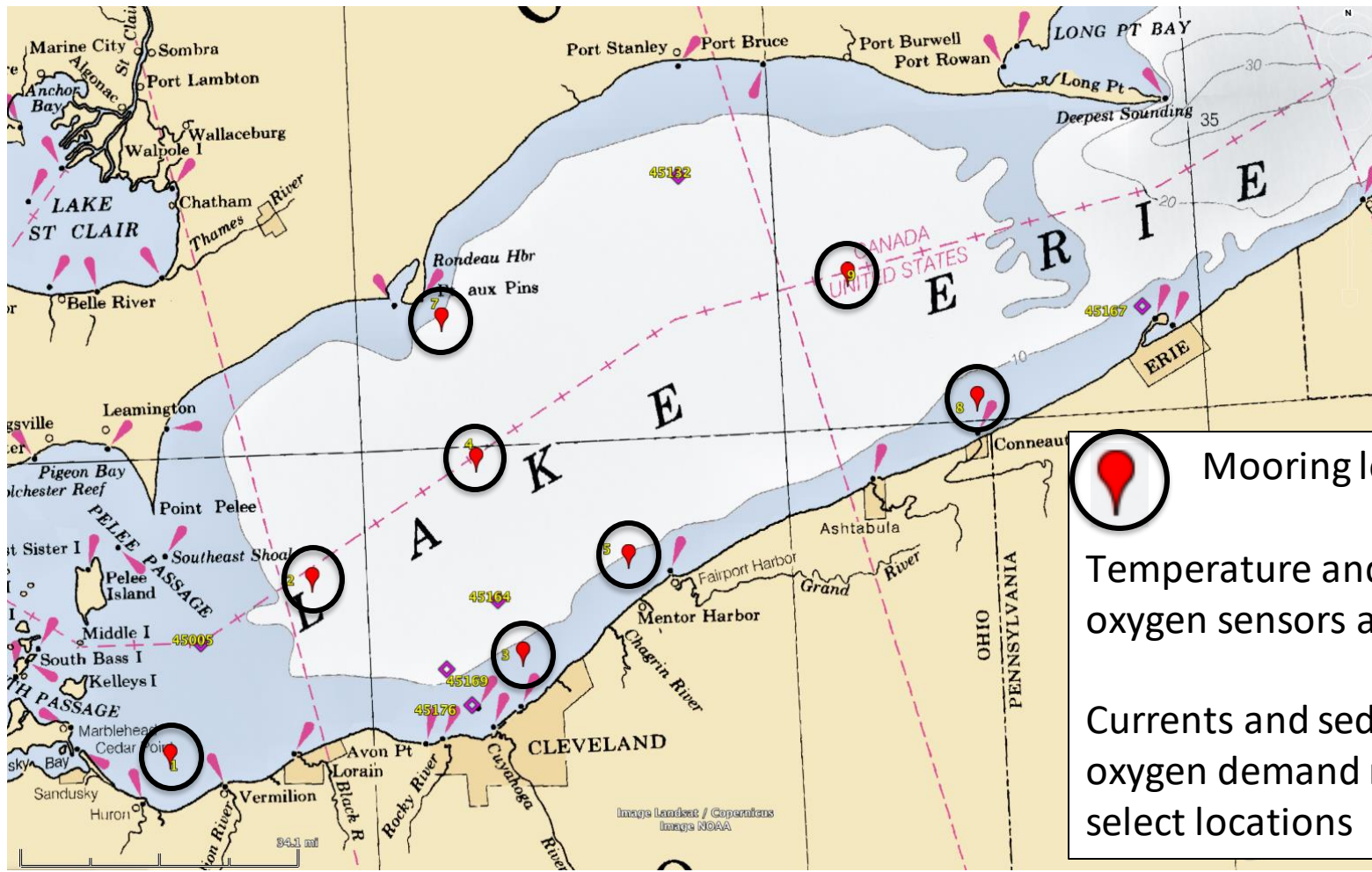
- Sub-surface temperature simulation
- Physical drivers of short-term hypoxia dynamics



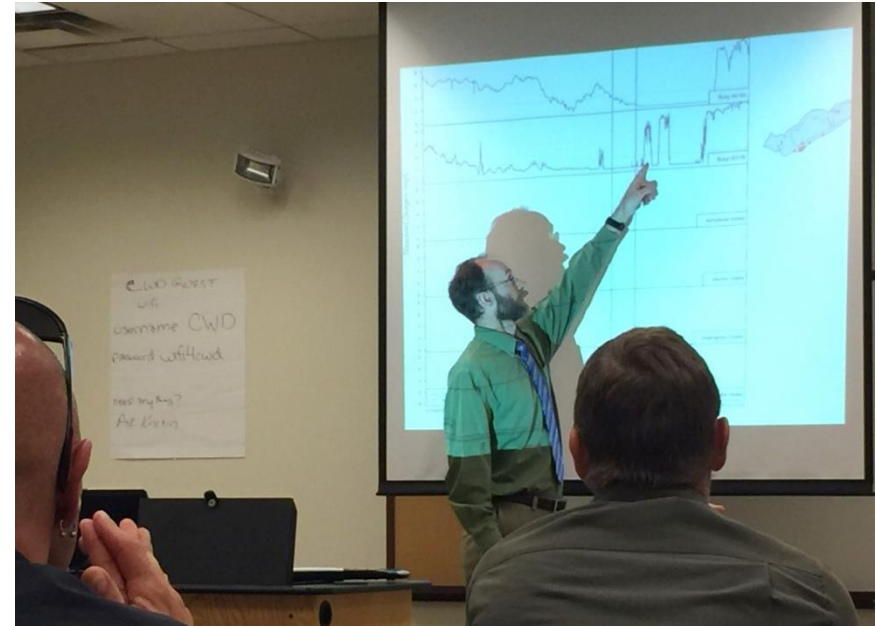
Proposed work

Field observations (2017-2019)

- 3D array of continuous logging DO sensors at nine locations
- Sediment and water column biochemical oxygen demand



Proposed work



Stakeholder and MTAG meeting, May 2017 at Cleveland Baldwin drinking water treatment plant

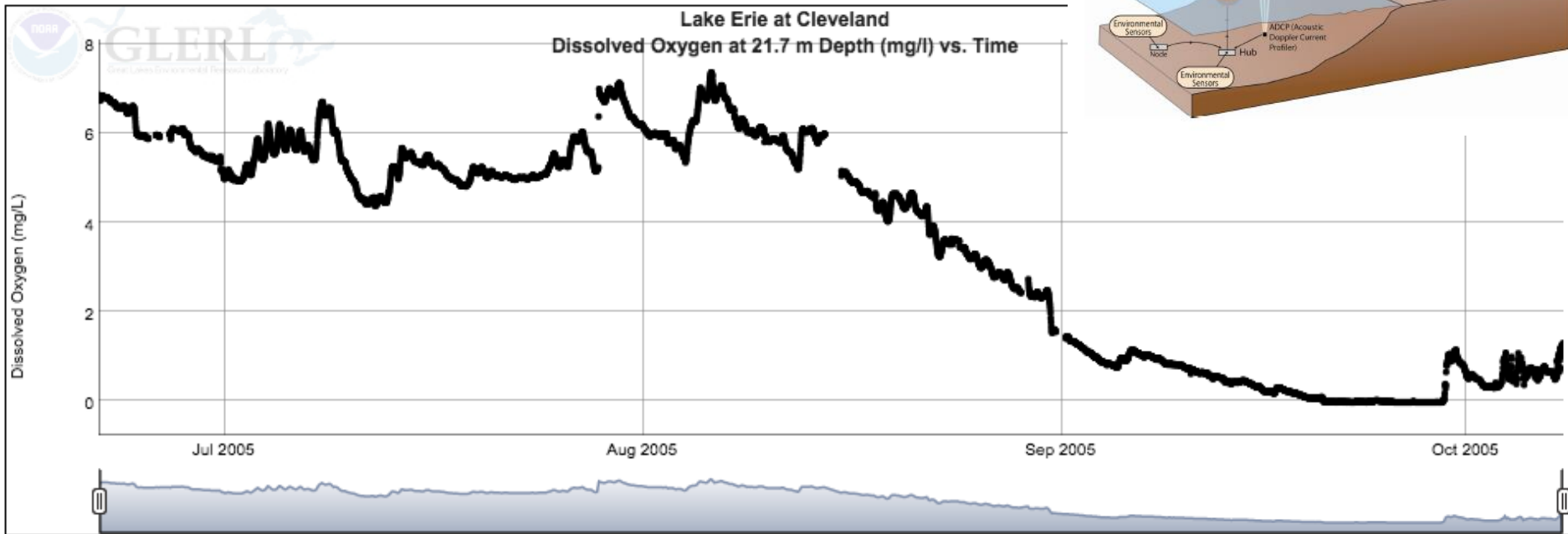
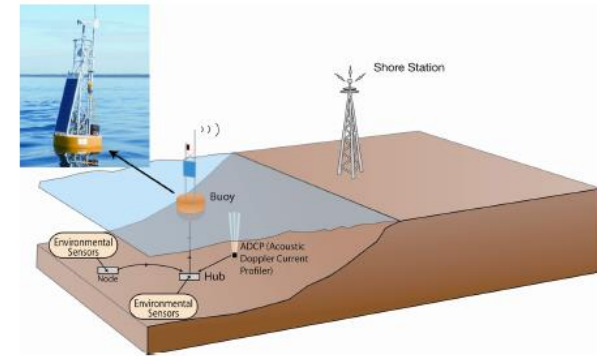
Involving end users in co-design of research

- Annual meetings with the Management Transition Advisory Group (MTAG)
 - Guiding model development to meet stakeholder needs
 - Scott Moegling (chair), Cleveland Water
 - Greg Yuronich, Avon Lake Regional Water
 - Ruth Briland, Ohio EPA
 - Kelli Page, Great Lakes Observing System
 - Aijun Zhang, NOAA COOPS
- Stakeholder workshops and focus groups

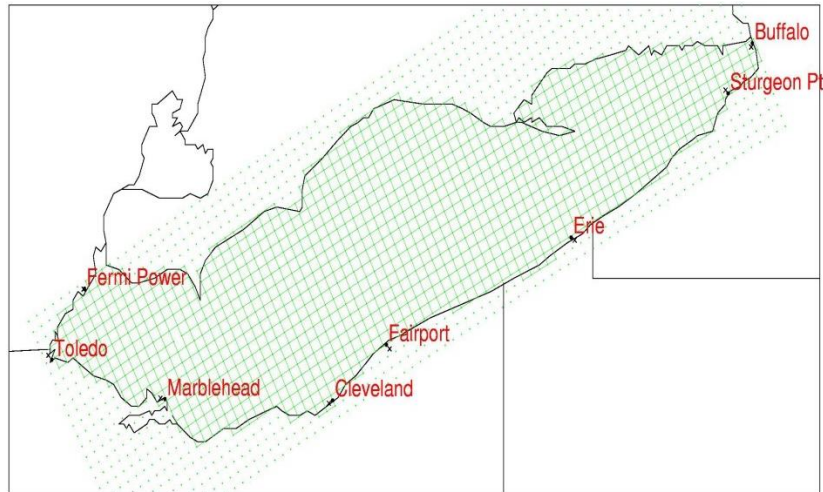
NOAA GLERL Experimental Hypoxia Warning System

Hypoxia Warning System - Lake Erie at Cleveland, OH

*** **EXPERIMENTAL** ***



NOAA Lake Erie Operational Forecast System (LEOFS) Upgraded in 2016

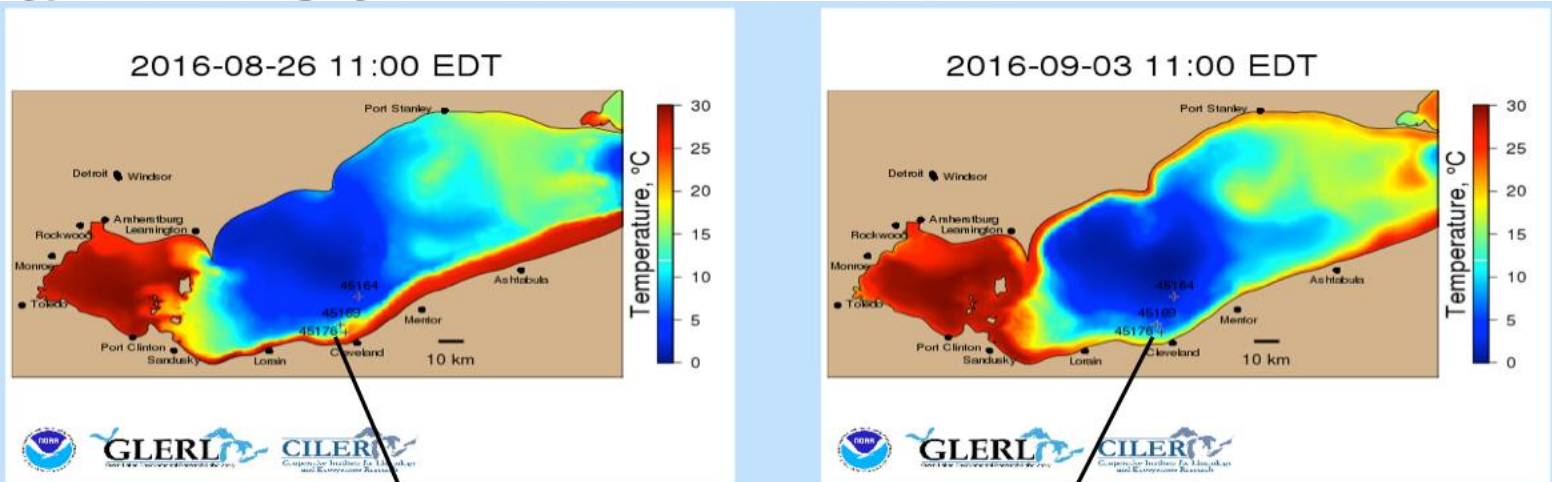


- POM-Based
- Grid Dimension 81x24
- Grid Size: 5km
- Vertical Layers: 10
- No Lateral boundary forcing

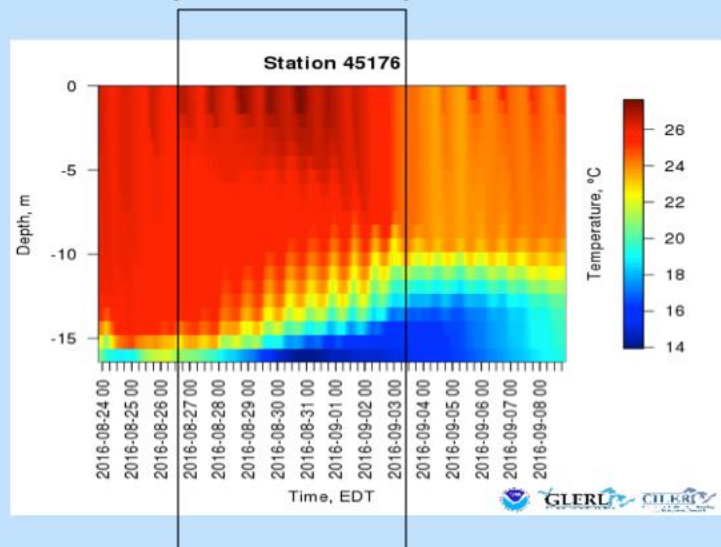


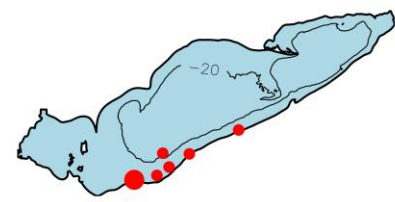
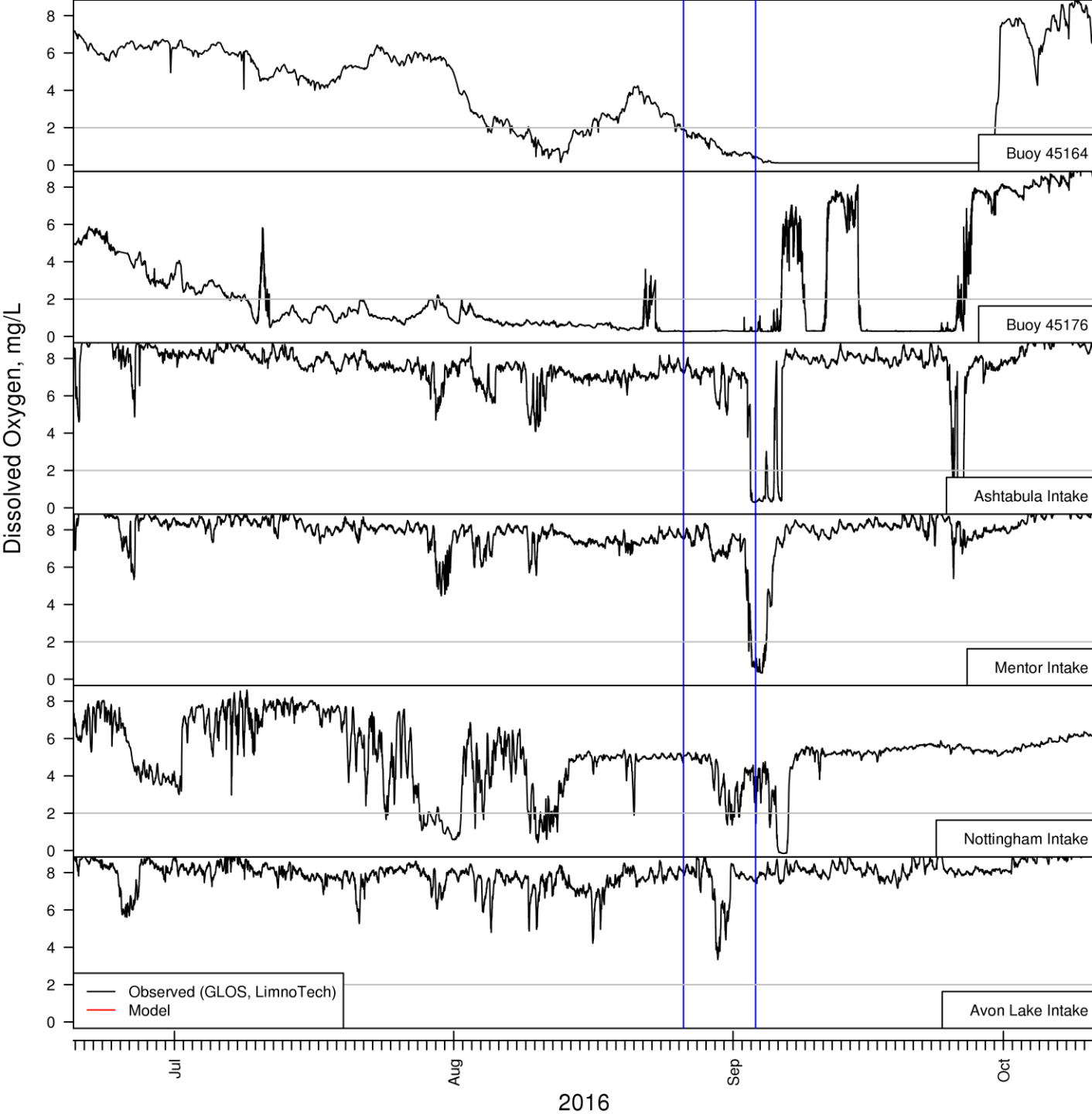
- FVCOM-Based
- 6106 Nodes, 11509 Elements
- Grid Size: 400m – 3.5km
- Vertical Layers: 20
- Open boundary at Detroit River and Niagara River

Hypoxia Warning System - Lake Erie at Cleveland, OH



Bottom water temperature forecast predicted upwelling near Cleveland, Aug 26 – Sep 3, 2016

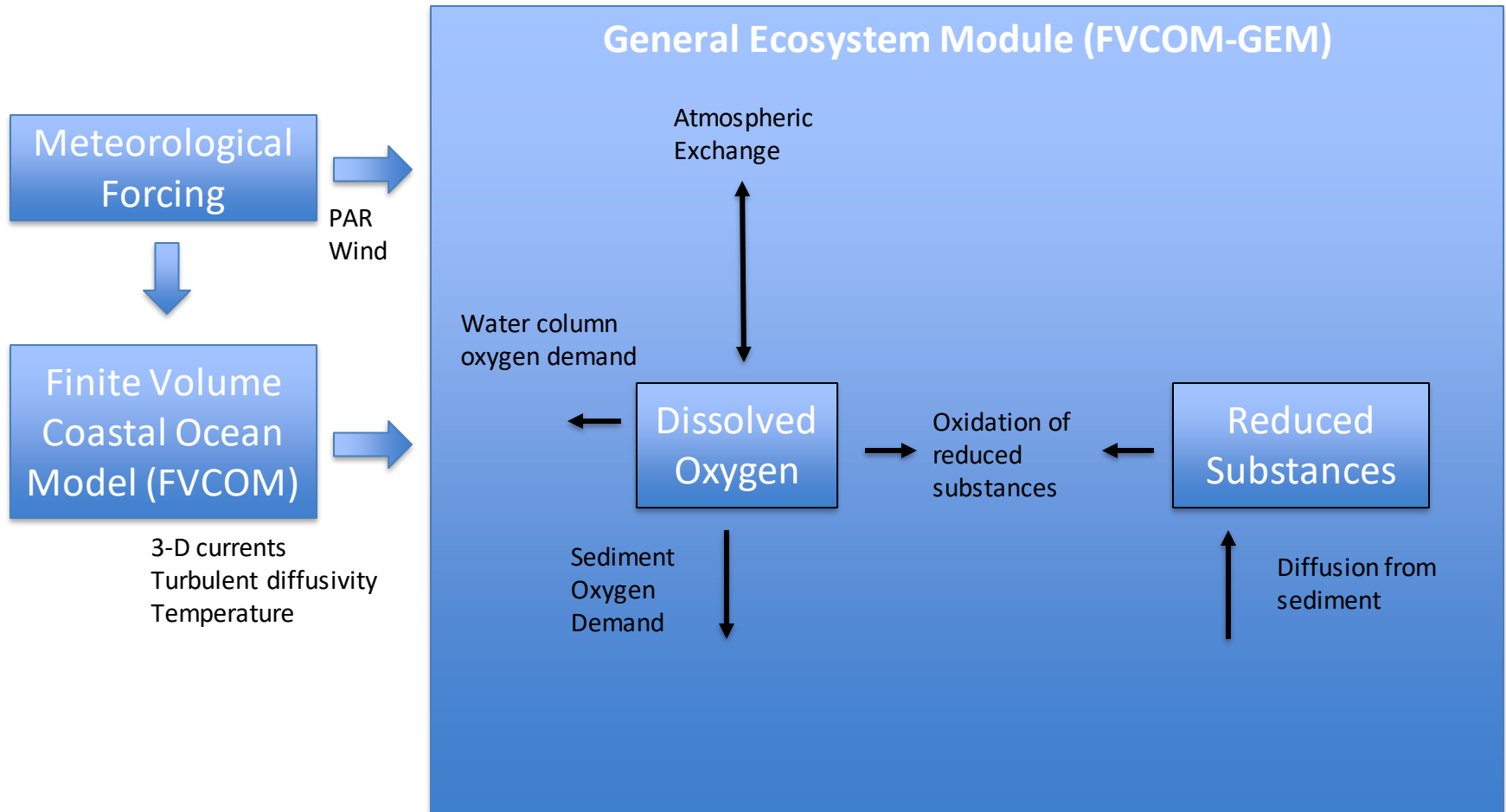




Analysis of 2017 hypoxia event

July 30

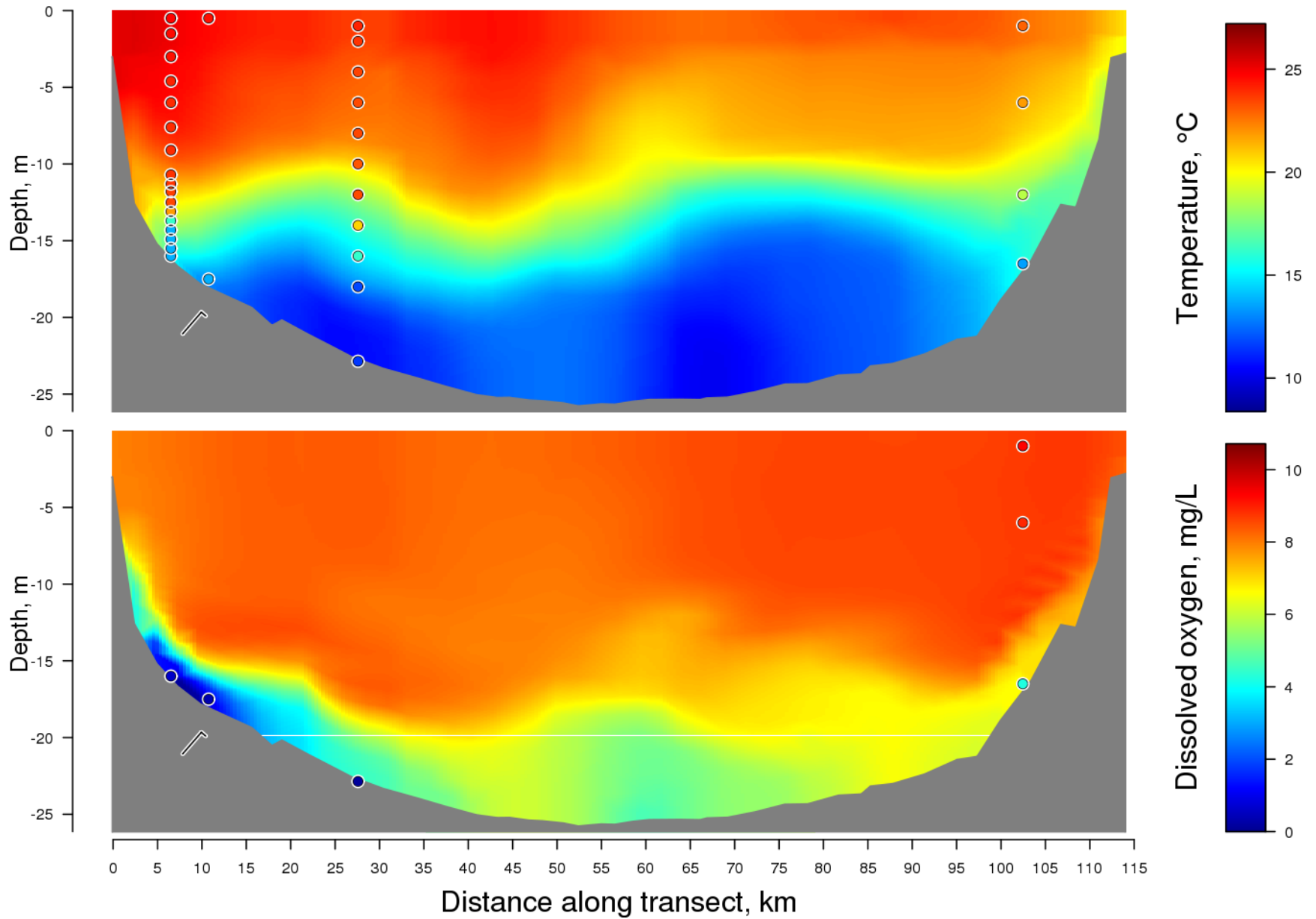
Physical dissolved oxygen model



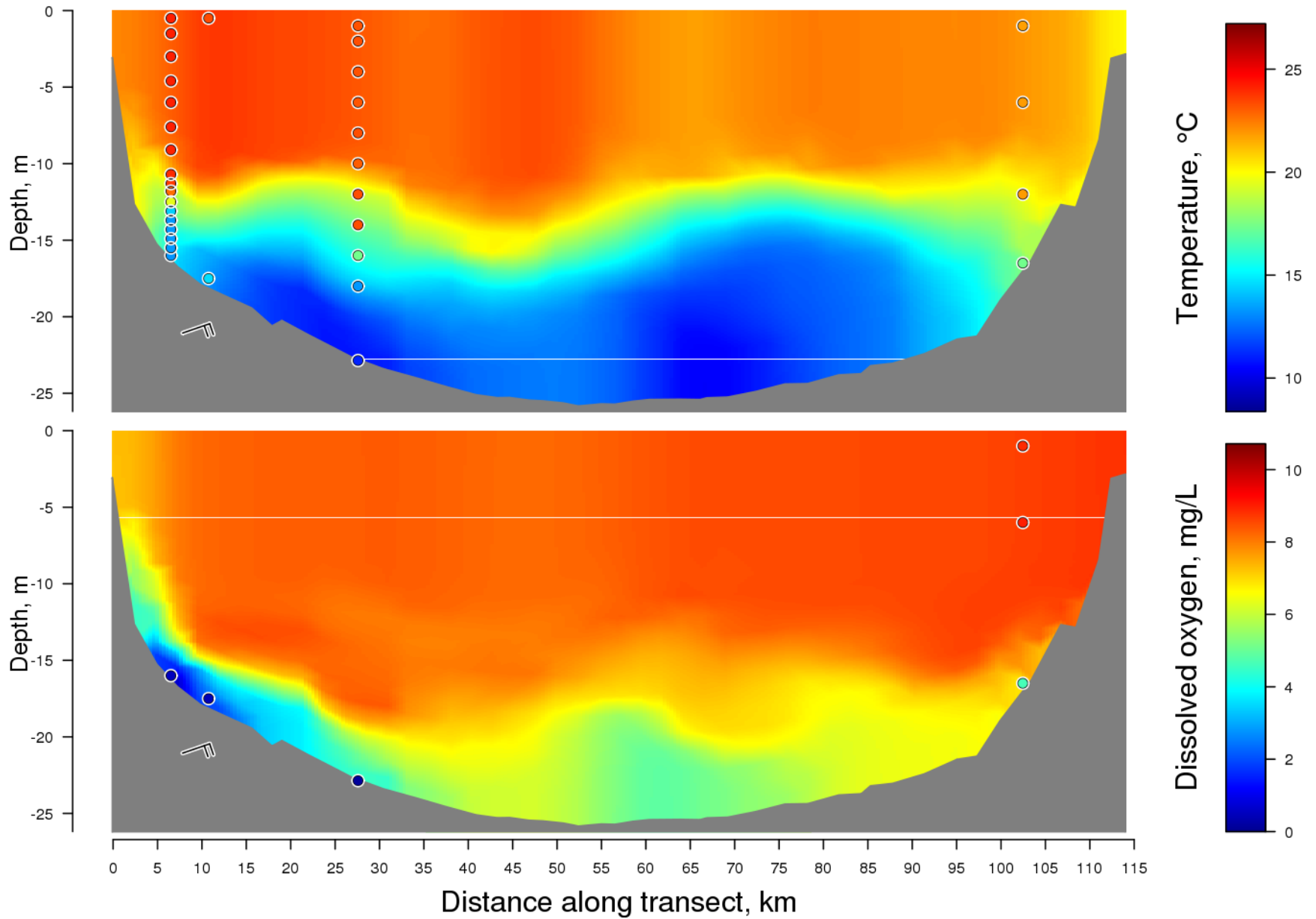
2016: hindcast skill assessment

2017: running real-time nowcast/forecast simulations

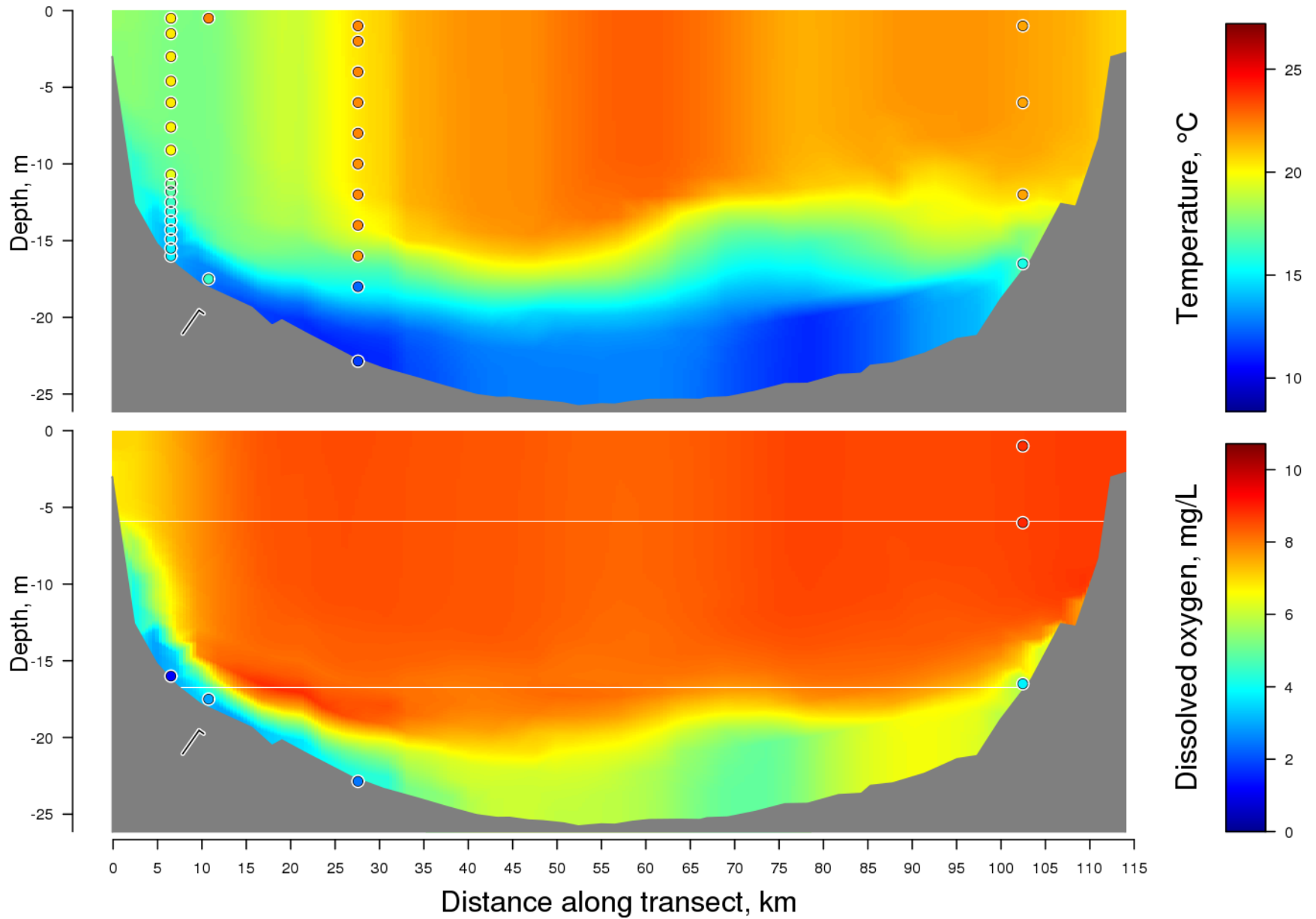
2017-07-28 01 GMT



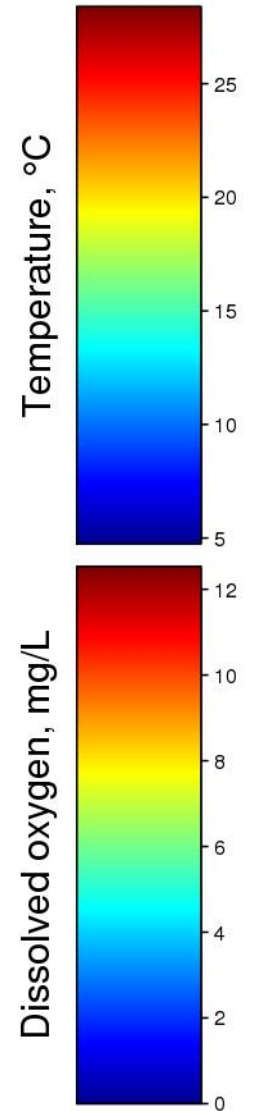
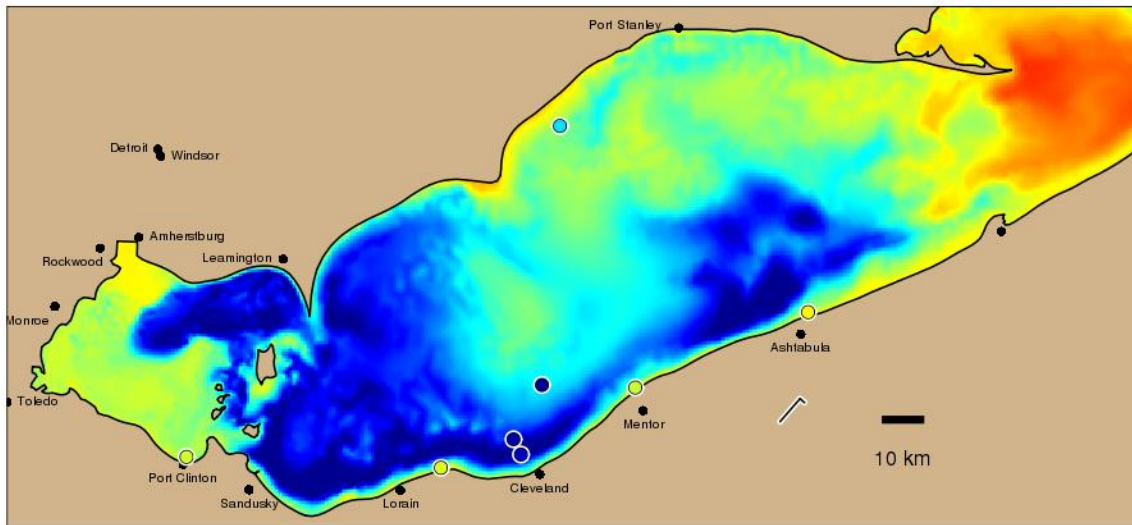
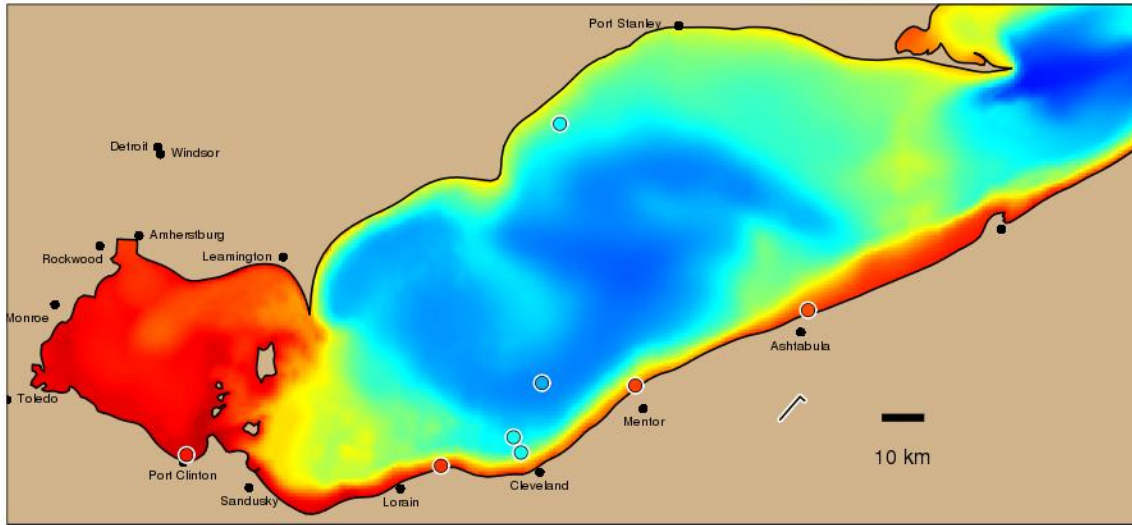
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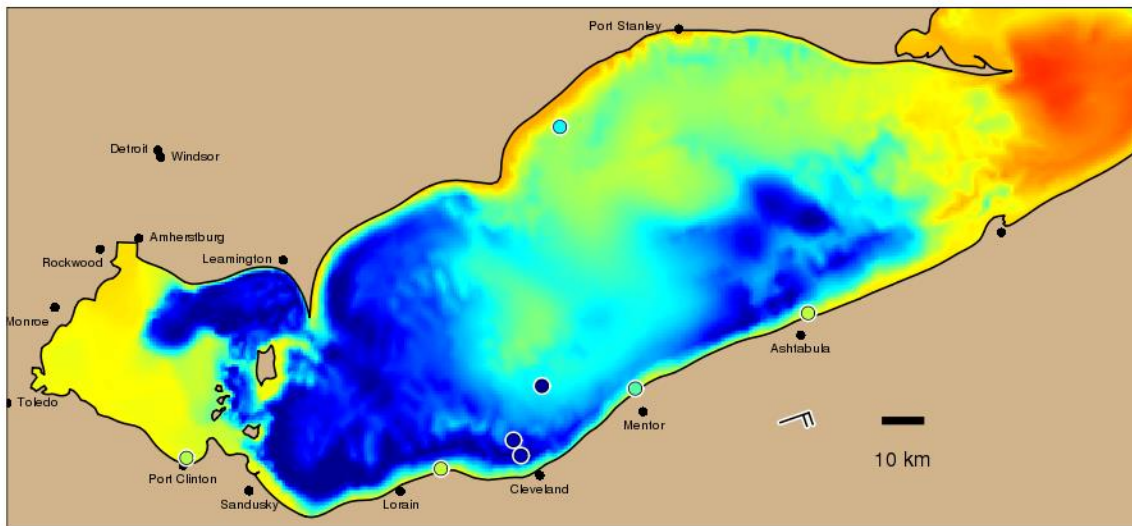
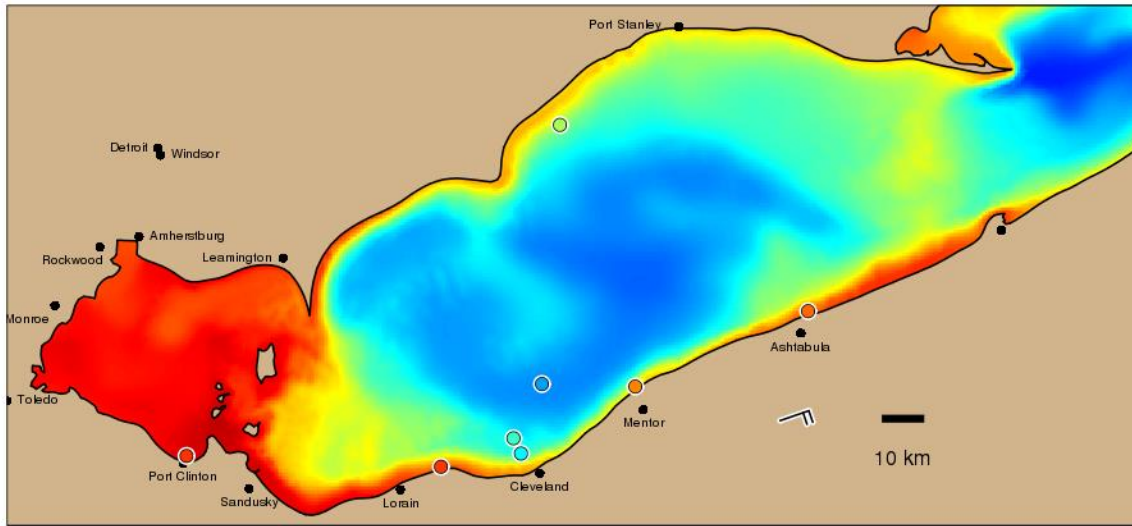
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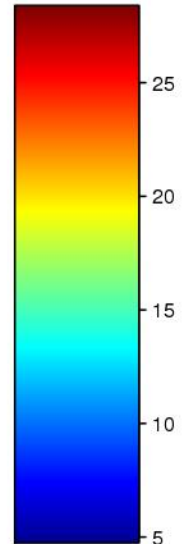
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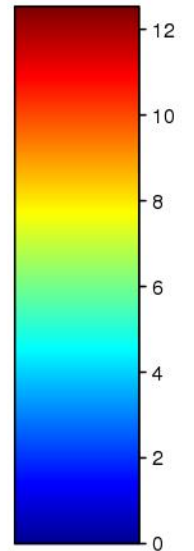
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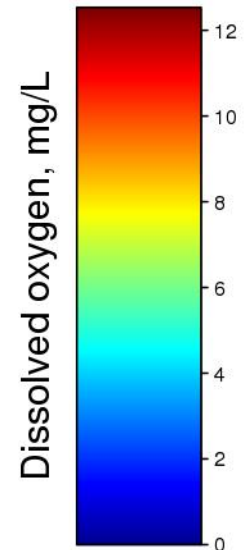
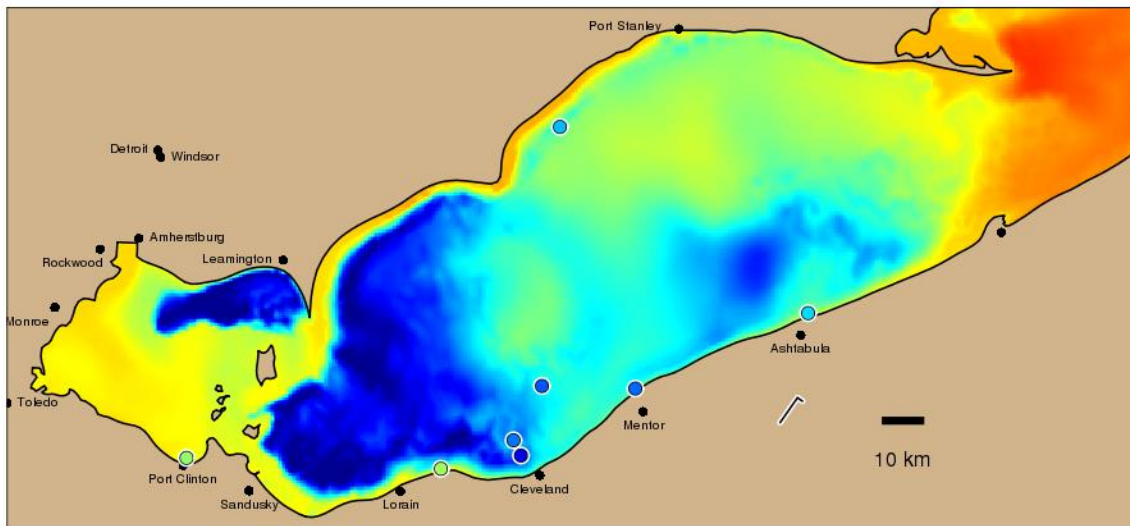
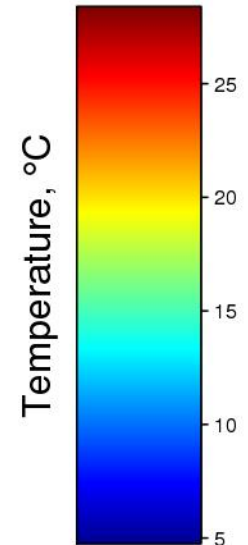
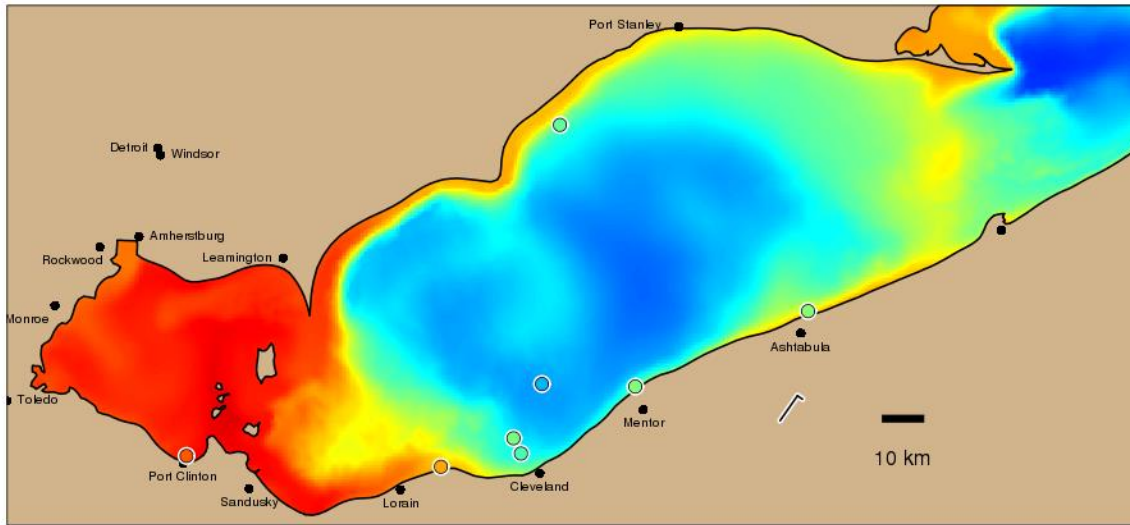
Temperature, °C



Dissolved oxygen, mg/L

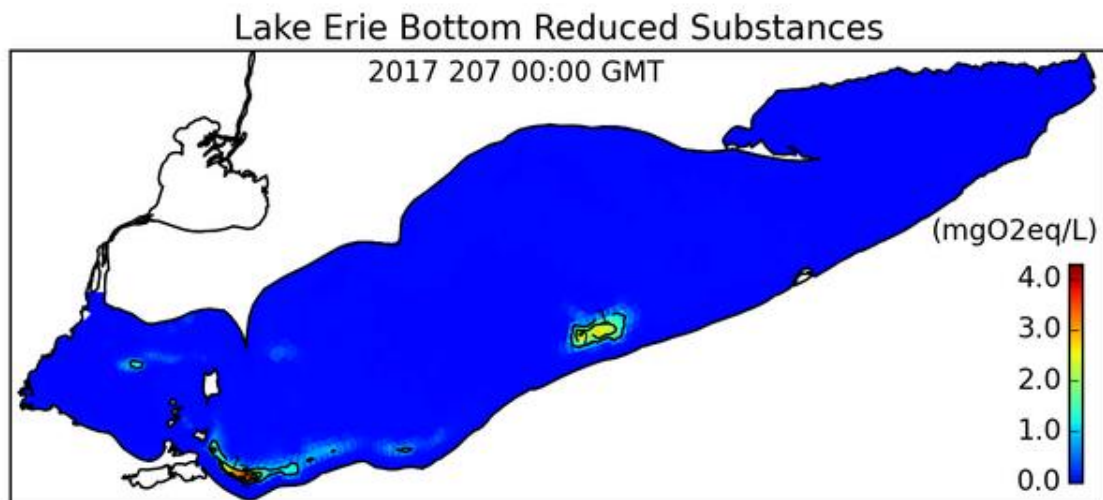
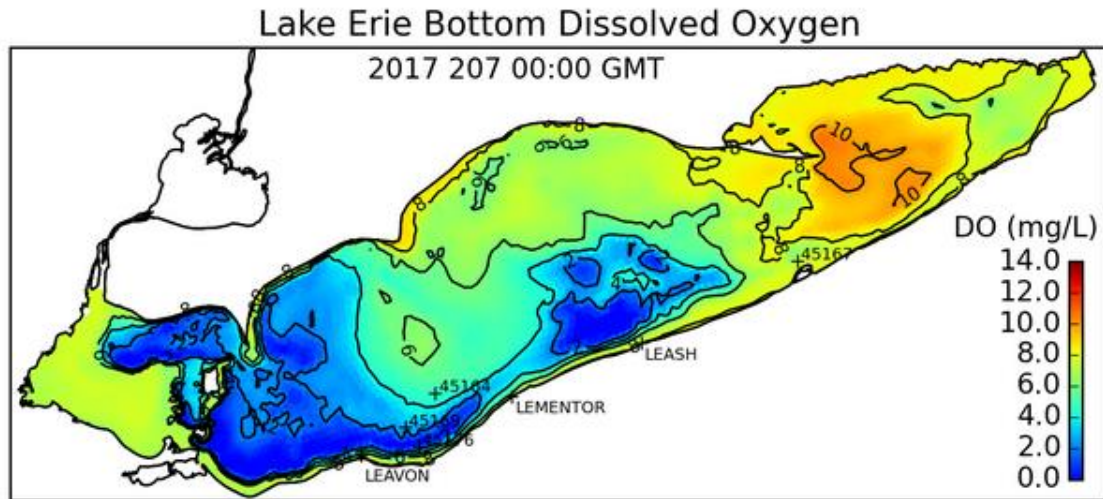


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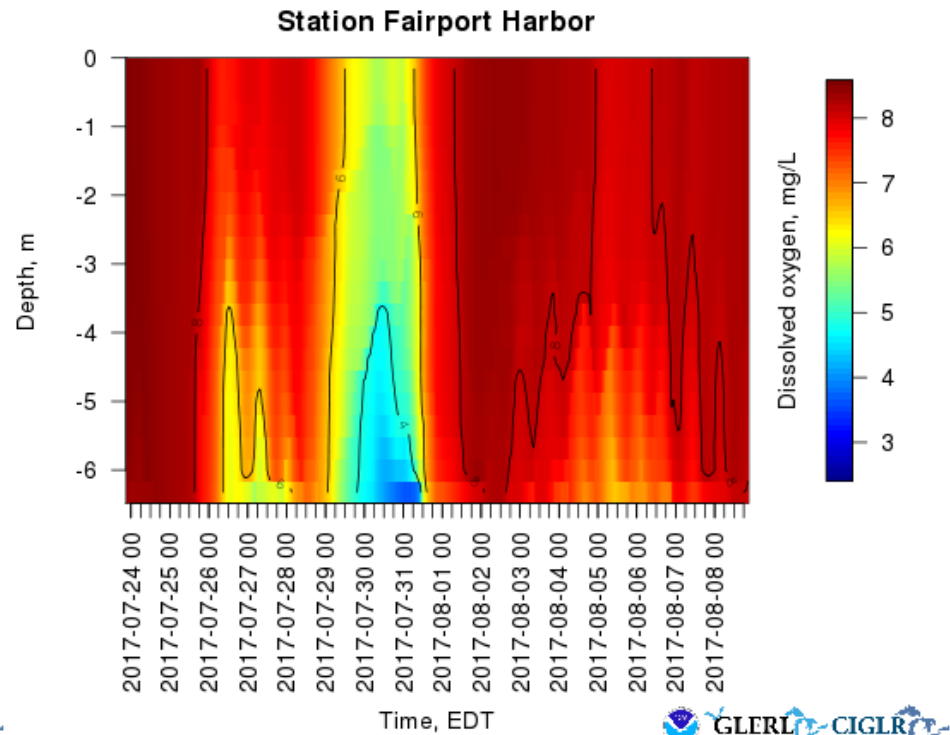
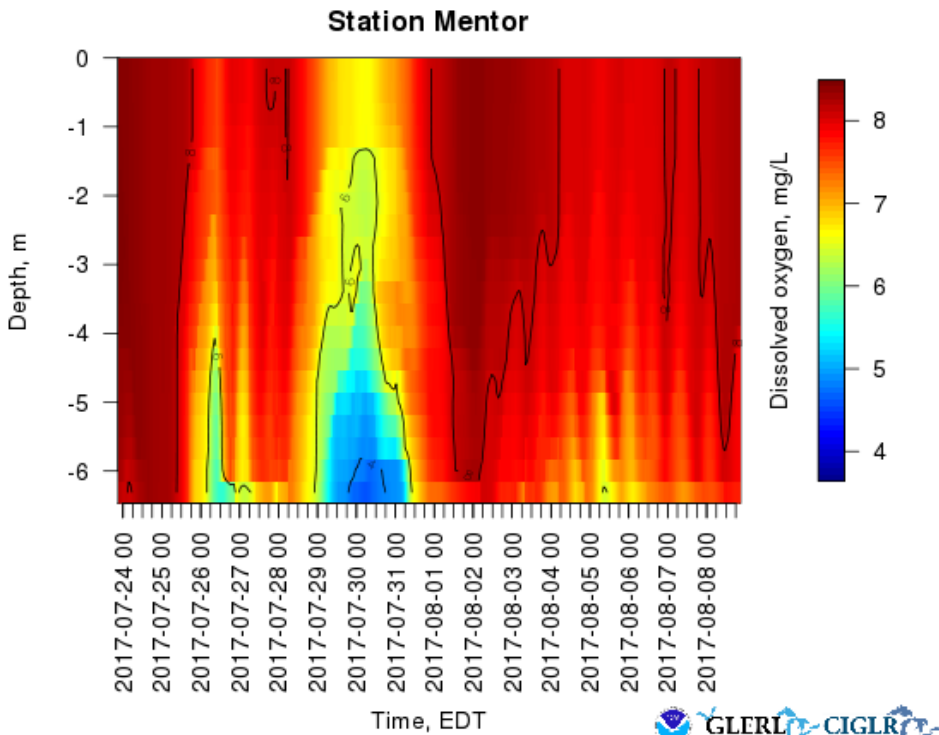


Dissolved oxygen dropped < 2 mg/L at Mentor intake sensor
Cleveland Baldwin raw water pH dropped to 7.1-7.3 (Scott Moegling)

Nowcast of experimental LEOFS-hypoxia model provided by email on July 26



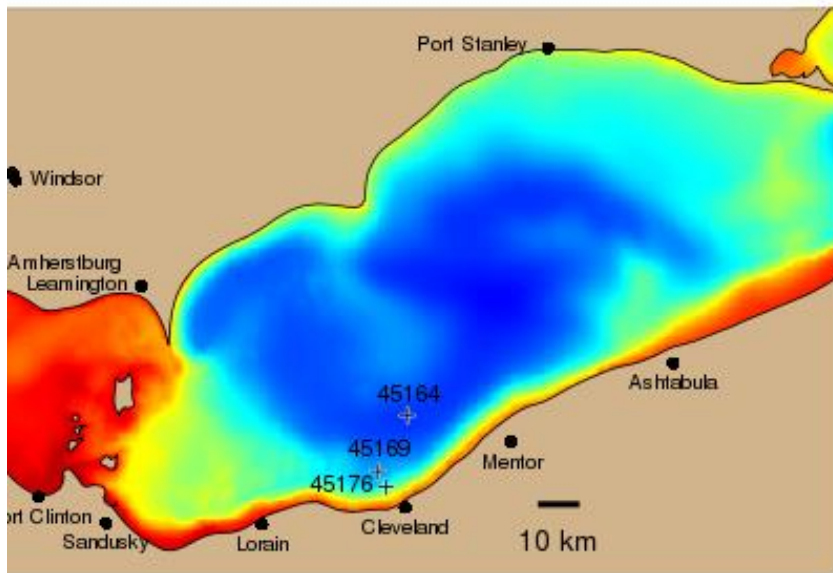
Forecast of July 30 upwelling event provided by email on July 26



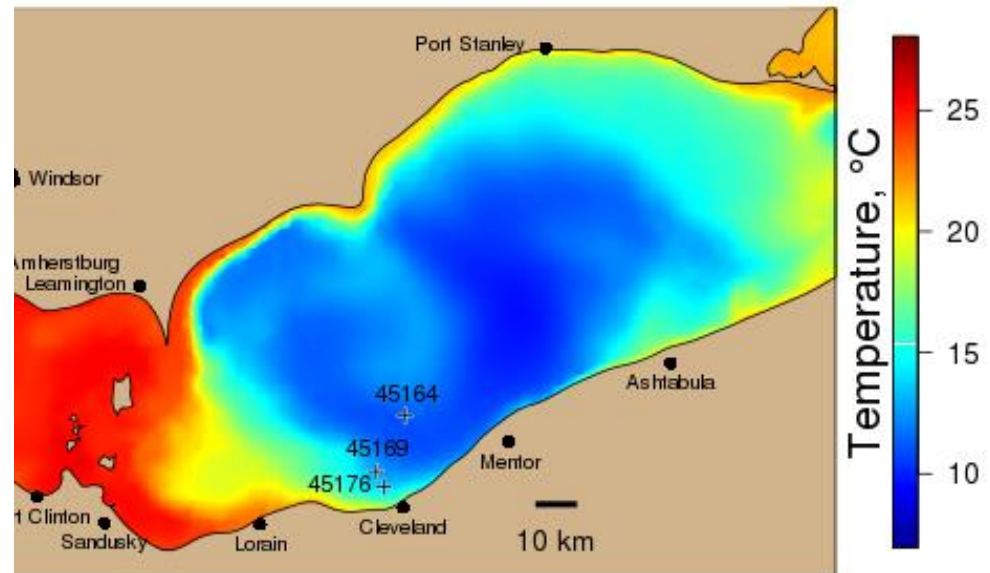
Forecast of July 30 upwelling event provided on July 29

https://www.glerl.noaa.gov/res/HABs_and_Hypoxia/hypoxiaWarningSystem.html

2017-07-28 01:00 EDT



2017-07-30 19:00 EDT



Forecast of July 30 upwelling event provided on July 29

https://www.glerl.noaa.gov//res/HABs_and_Hypoxia/hypoxiaWarningSystem.html

