Can phytoplankton weather the storm?
Assessing how phytoplankton communities change after storms

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1 Introduction

- Storms are expected to become more frequent and intense because of climate change.
- **Wind** and **rain** can **disturb** vertical gradients in temperature (Fig. 1), dissolved oxygen, light, and external nutrient and sediment loads.

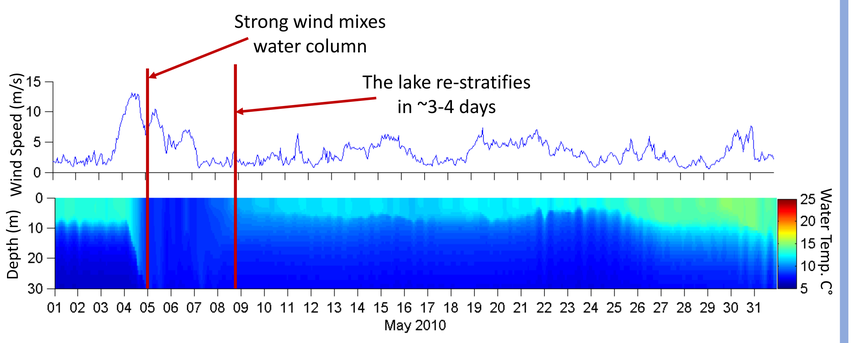

Fig. 1. Strong wind deepens and erodes thermocline in Lake Geneva.

- Storms can alter phytoplankton niche-space and community dynamics, but impacts likely depend on lake and watershed features.
- Our project develops theoretical links between storms, lake physics and the response of the phytoplankton community across a gradient of lake features.
- Use traditional long-term and novel high-frequency data (Fig. 2) to empirically test theories.

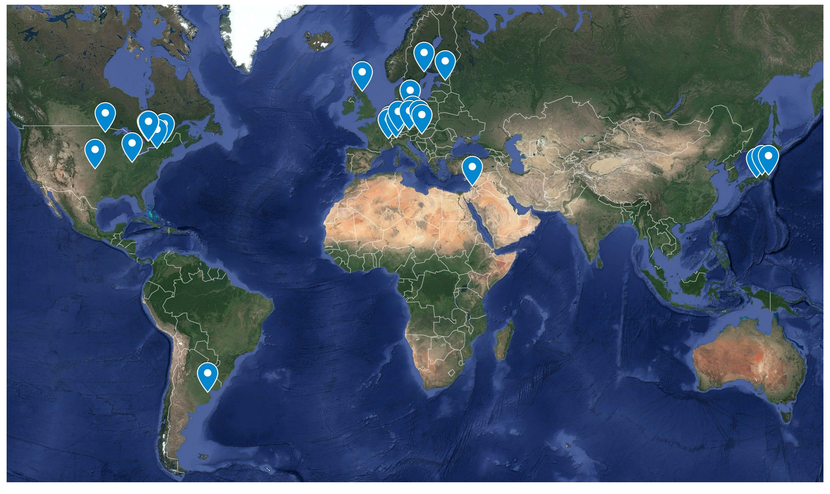

Fig. 2. Lake and weather data come from over 25 lakes across the globe.

2 Conceptual Model

- **Storm features** interact with **lake features** to create **lake conditions**, to which **phytoplankton respond** (Fig. 3).
- The conceptual model provides contrasts in phytoplankton responses across lake "types" (Fig. 4) based on functional traits (Fig. 3).
- Using this model we can generate expectations based on lake conditions created by interacting storm features and lake features.

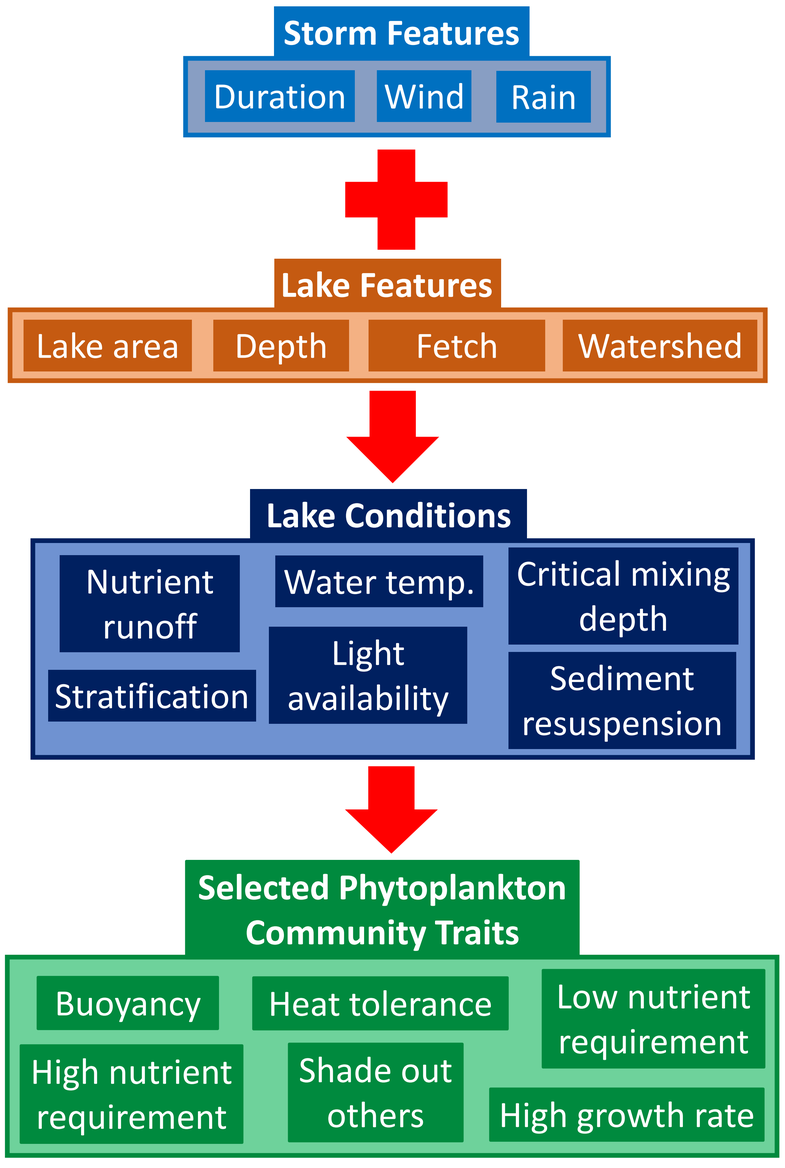

Fig. 3. Our conceptual model for how storm impacts phytoplankton.

3 Model Application

Wind interacts with a deep (1) or shallow (2) lake:

1) Epilimnion mixes and thermocline can deepen.
2) Mixing stirs up sediment, releases nutrients, raises Critical Mixing Depth (CMD).

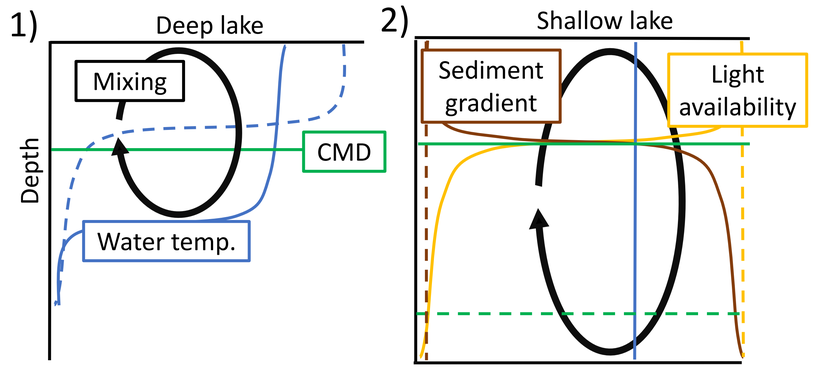

Fig. 4. Depth interacts with wind to create different lake conditions. Dashed lines show pre-wind lake conditions.

Phytoplankton Consequences:

1) Phytoplankton entrained in epilimnion. Buoyant phytoplankton stay above CMD if wind stops.
2) Release some phytoplankton from nutrient limitation. Low-light limited phytoplankton favored.

4 Stratification Scenarios

Three scenarios for how storms impact stratification

- 1 – Increased mixing in epilimnion
- 2 – Deepening of thermocline
- 3 – Homogenization of water column

How does stratification change along gradients of interacting storm and lake conditions?

- Which phytoplankton traits are selected?
- Are phytoplankton responses gradual or abrupt?

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