Physical Exchange Processes in Emerald Bay Lake Tahoe, CA-NV

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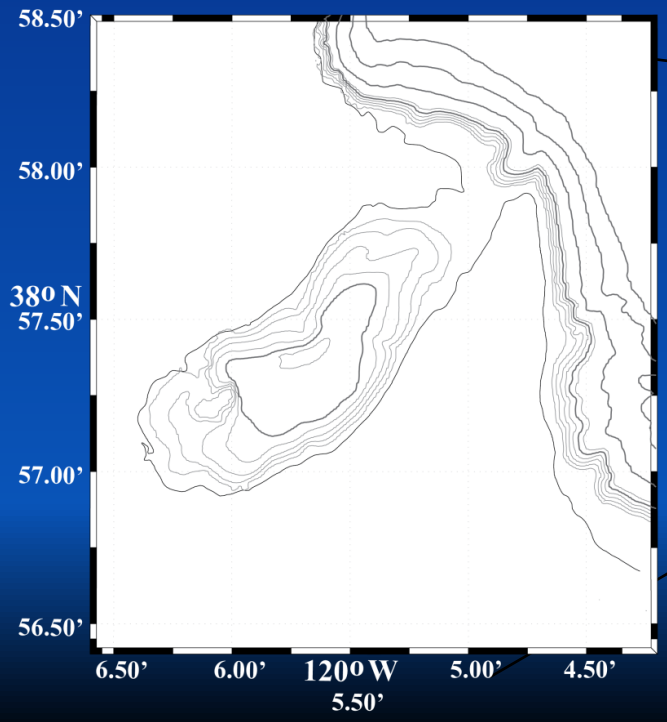
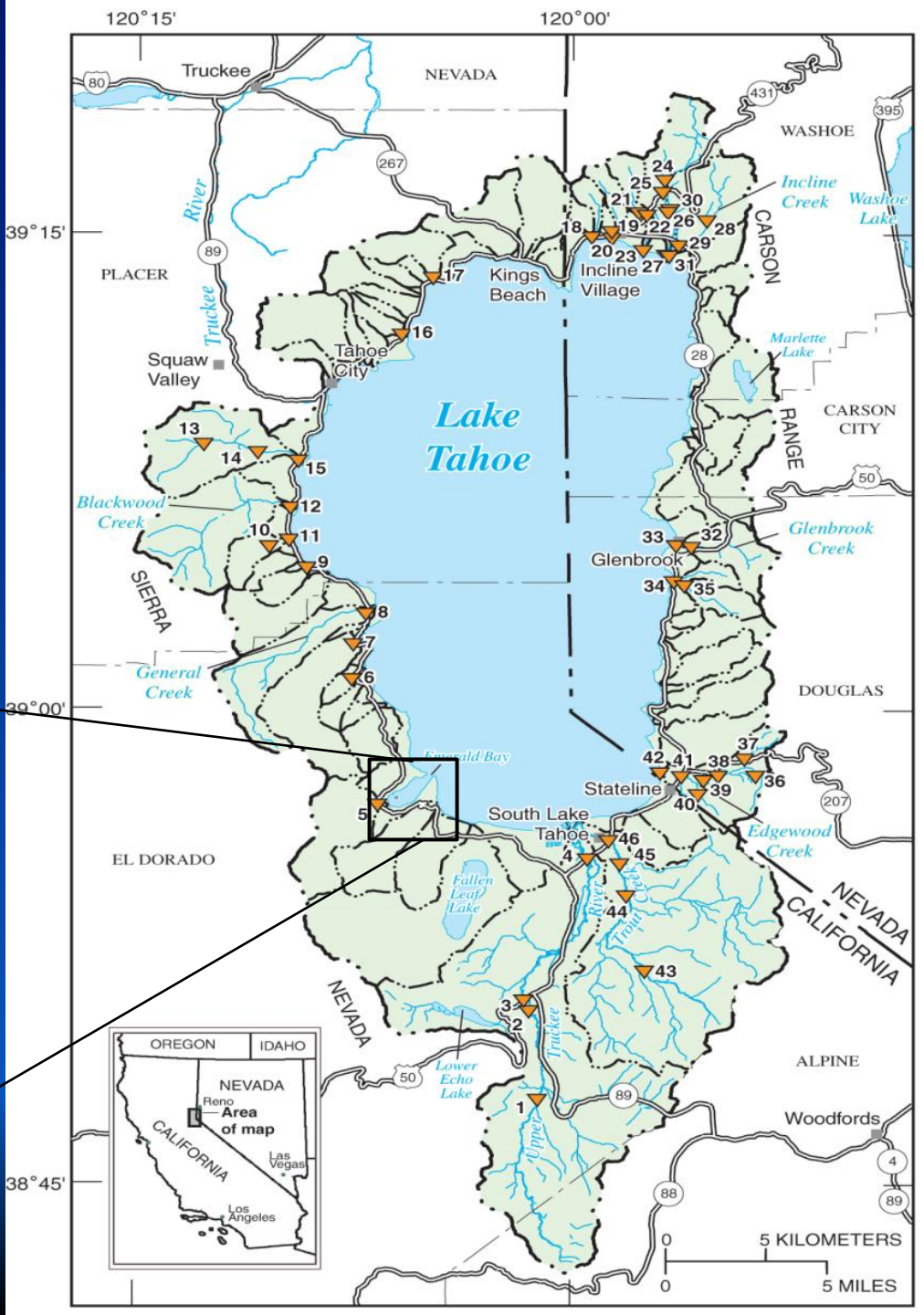
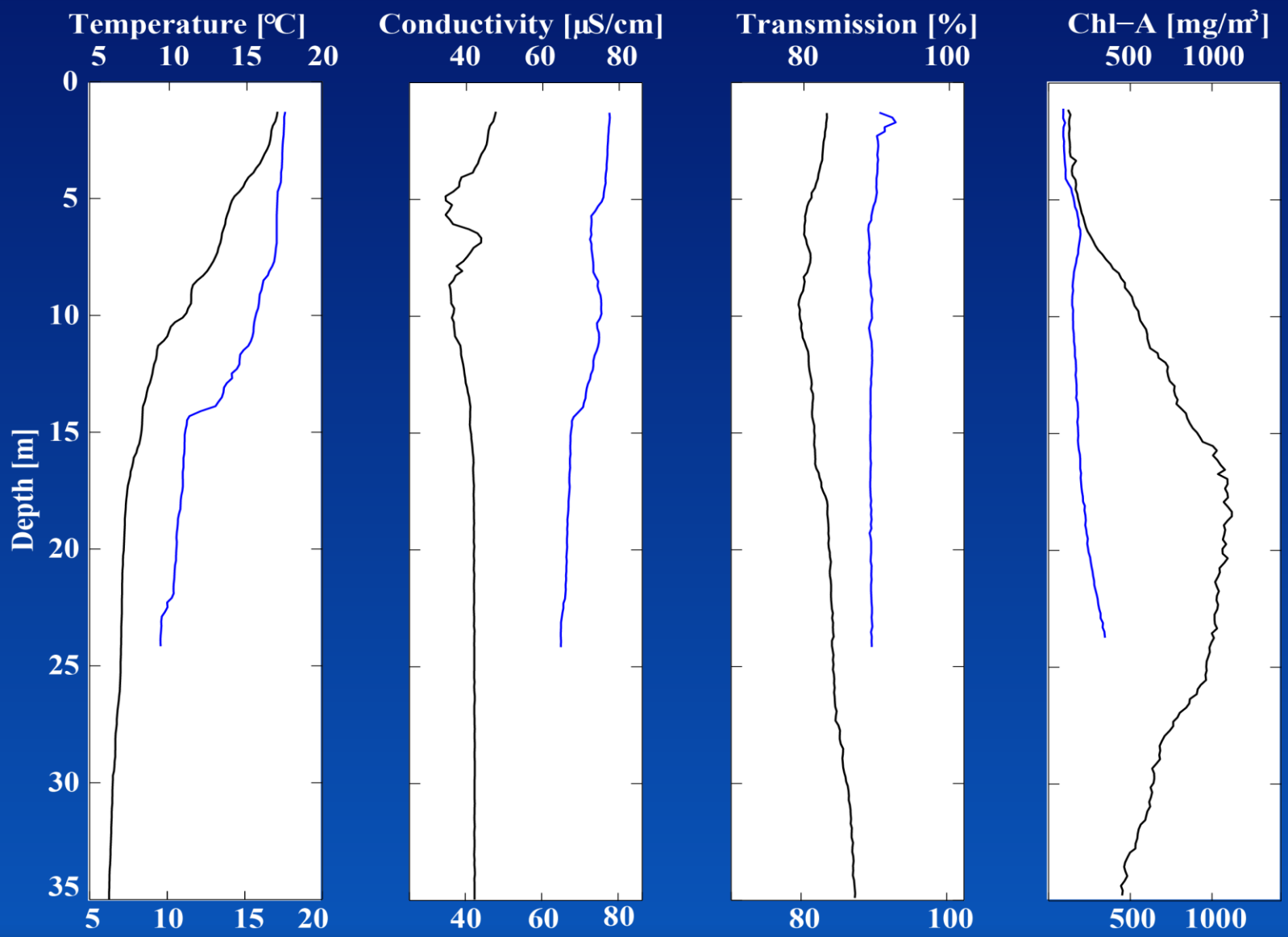
Emerald Bay

- Small Embayment ~ 0.097 km^3
- Lake Tahoe ~ 150 km^3
- Sill formed by glacial moraine separates EB and Lake Tahoe
- Water Characteristics (particulates, dissolved matter, etc.) different than Lake Tahoe







July 22, 2011 @ 1300

Study Motivation

- **Pilot Study - rubber bottom barriers to control *Corbicula Fluminea* (Asian Clams)***
- **Dissolved Oxygen (DO) did not reach near anoxic condition under barriers***
  - **20 – 80 % saturation for study duration**
- **Investigate Processes behind Observations**
  - **Field Experiment May – September 2011**
  - **Investigations Ongoing**

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*Gamble, Allison. Asian Clam Populations in Emerald Bay: Initial Ecology Results and Future Investigations

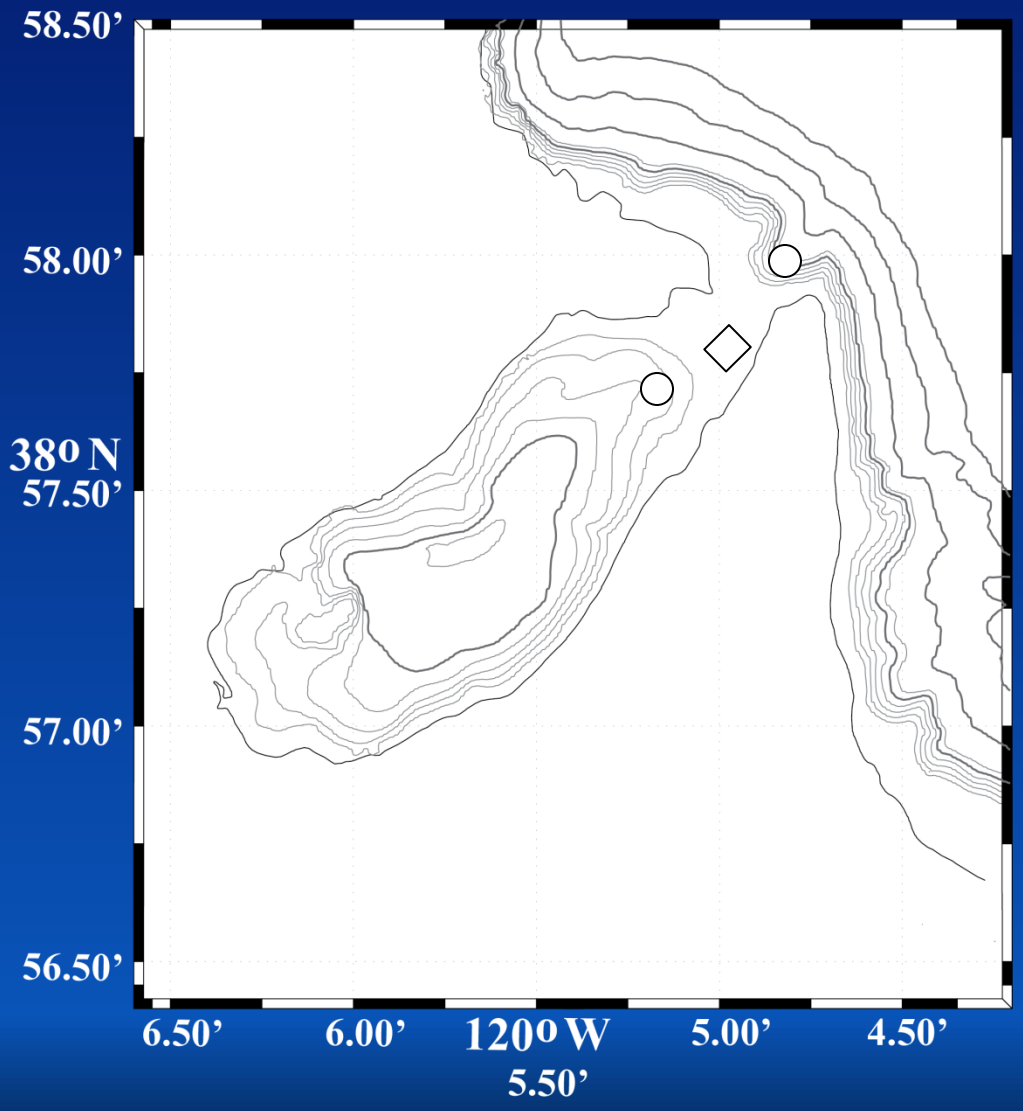
Emerald Bay Field Experiment

2 Moorings - Inside (~15m) and Outside (~30m) of EB

- **Acoustic Doppler Current Profiles (ADCP's)**
- **Thermistor Chains**

At the sill (3m)

- **Acoustic Doppler Velocimeter (ADV)**
- **Pressure Sensor**
- **DO sensors above and below barrier mat**



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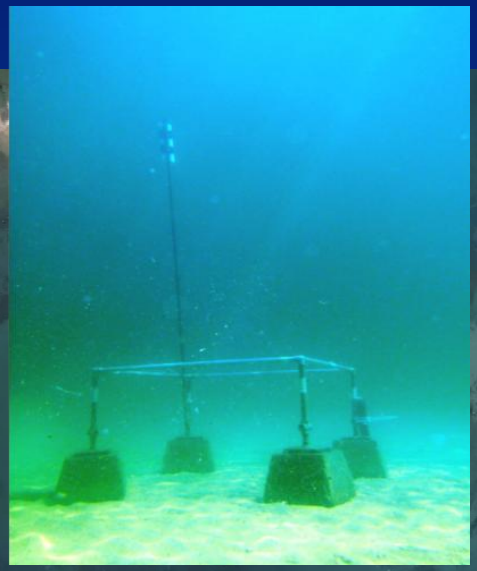
Emerald Bay Field Experiment



Underwater Photo: Courtesy of Brant Allen

Hypotheses for Observed DO

1. Exchange of water increases DO under barrier
   - Flow directly under mat
   - Flow initiates substrate (hyporheic) flow

2. Wave Pumping due to High Boat Traffic or Daily Winds

3. Eagle Creek run-off displaces water at sill

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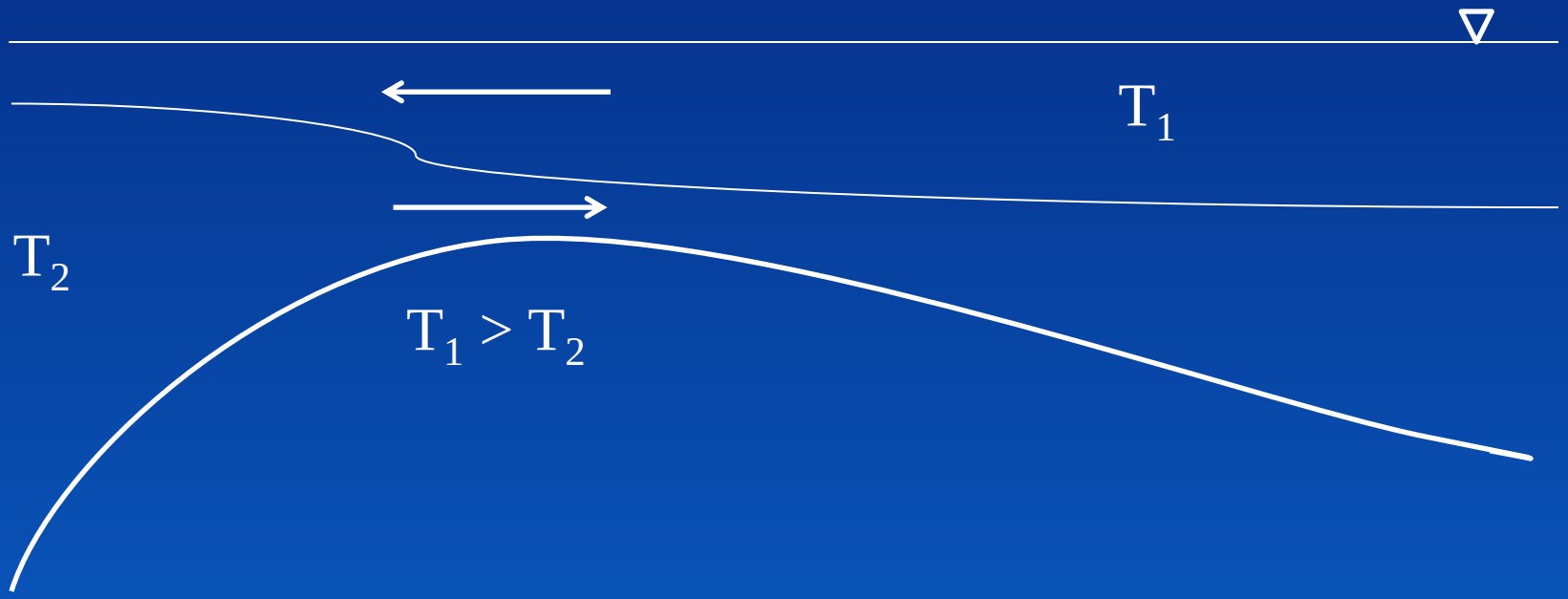
Exchange Flow Mechanisms

Horizontal Temperature Gradients

- **Differential heating and cooling**
- **Surface layer stirring by weak-moderate winds**



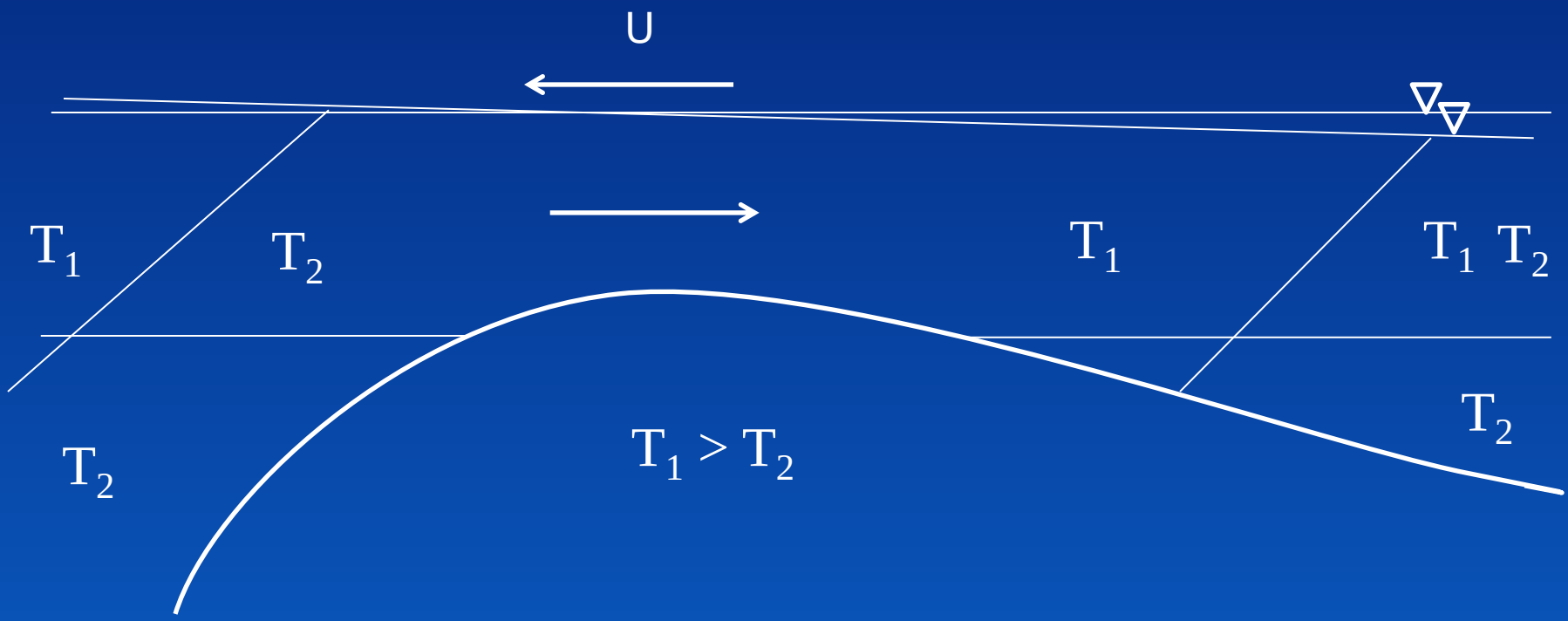
Lake Tahoe

Emerald Bay

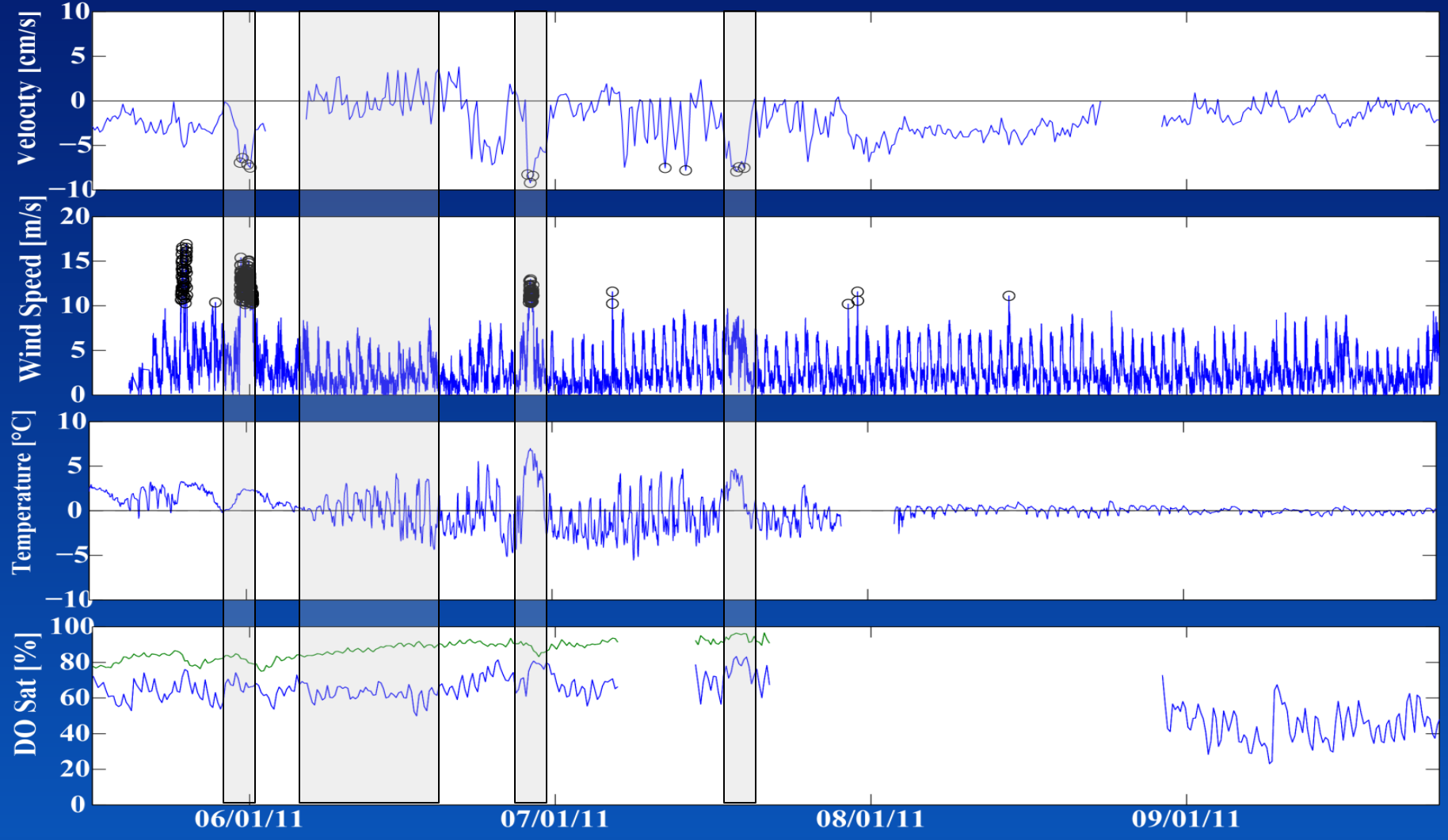
Exchange Flow Mechanisms

Strong Winds

- **Initially produces surface seiching**
- **Cooler water upwells outside of EB**



Field Observations



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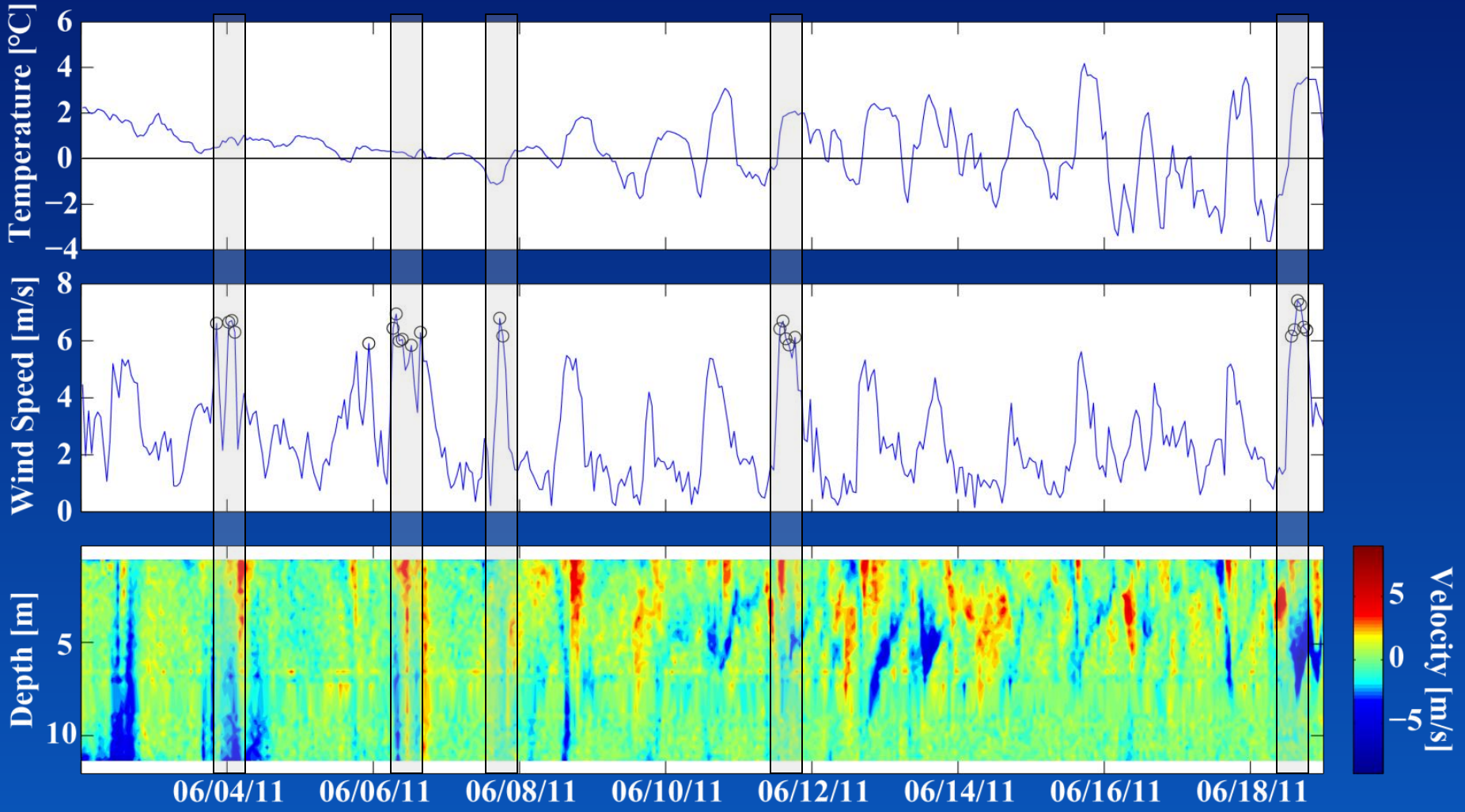
Exchange Mechanism –Temperature Gradients



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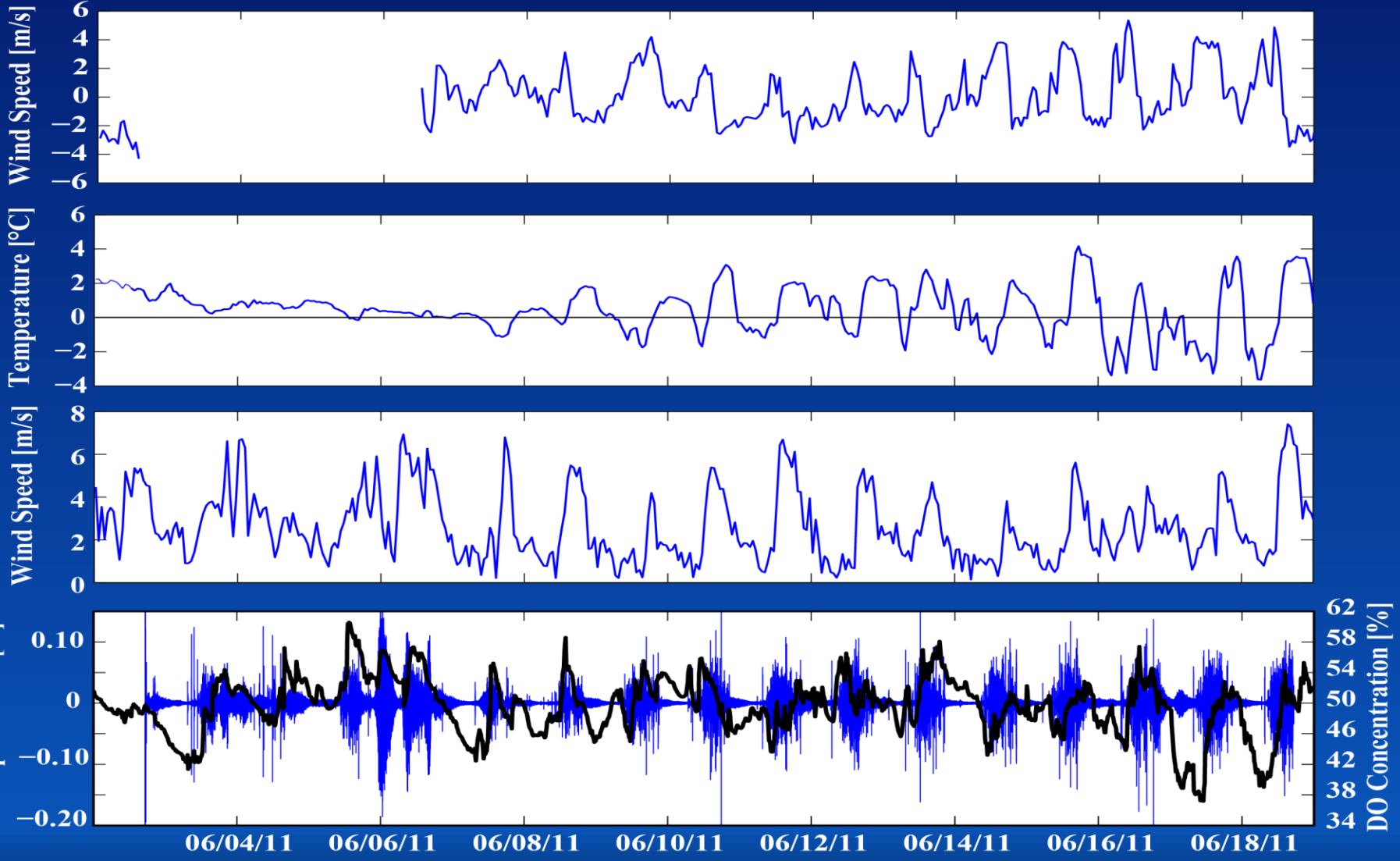
Diurnal DO Fluctuations



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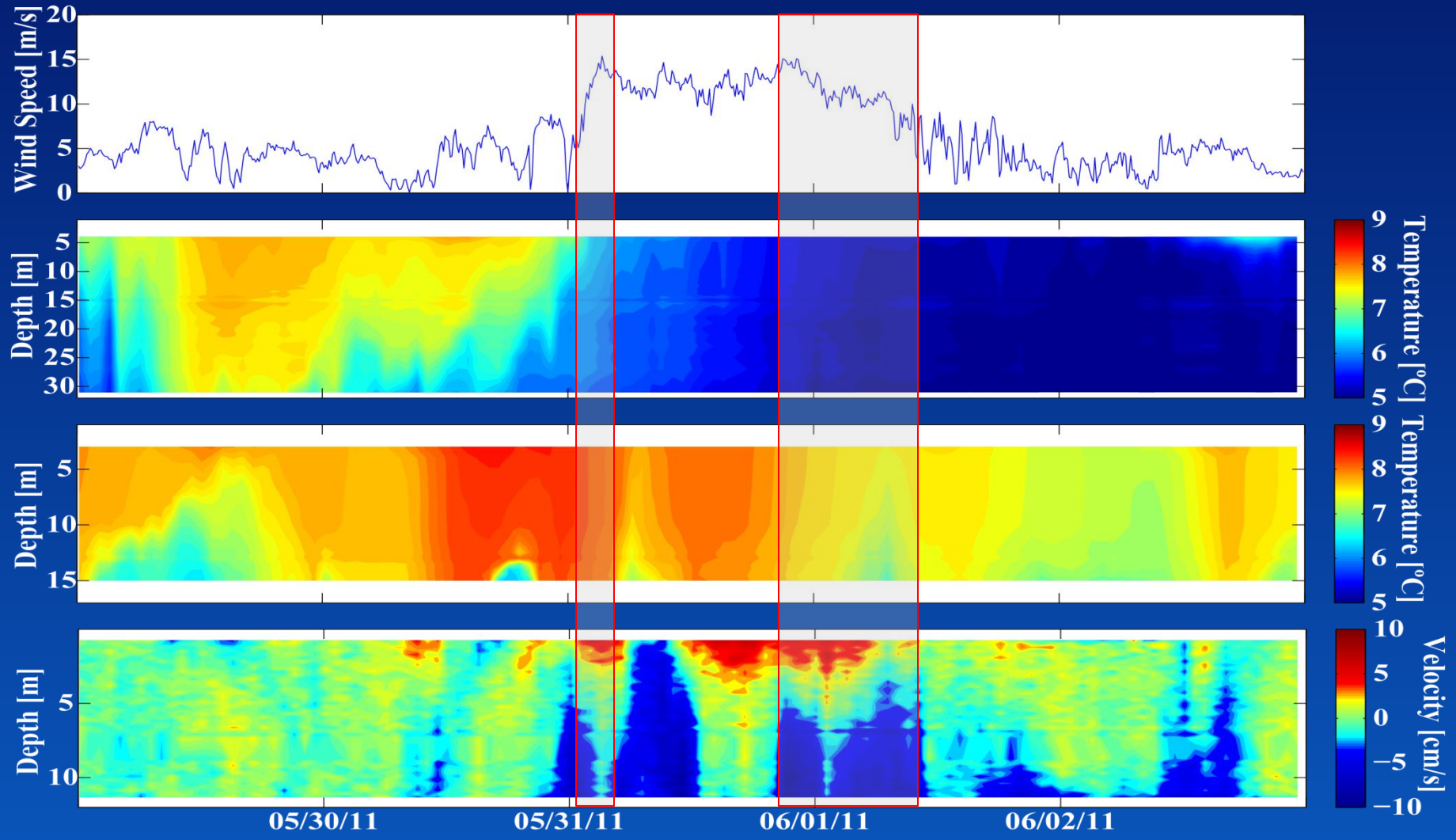
Exchange Mechanism - Upwelling



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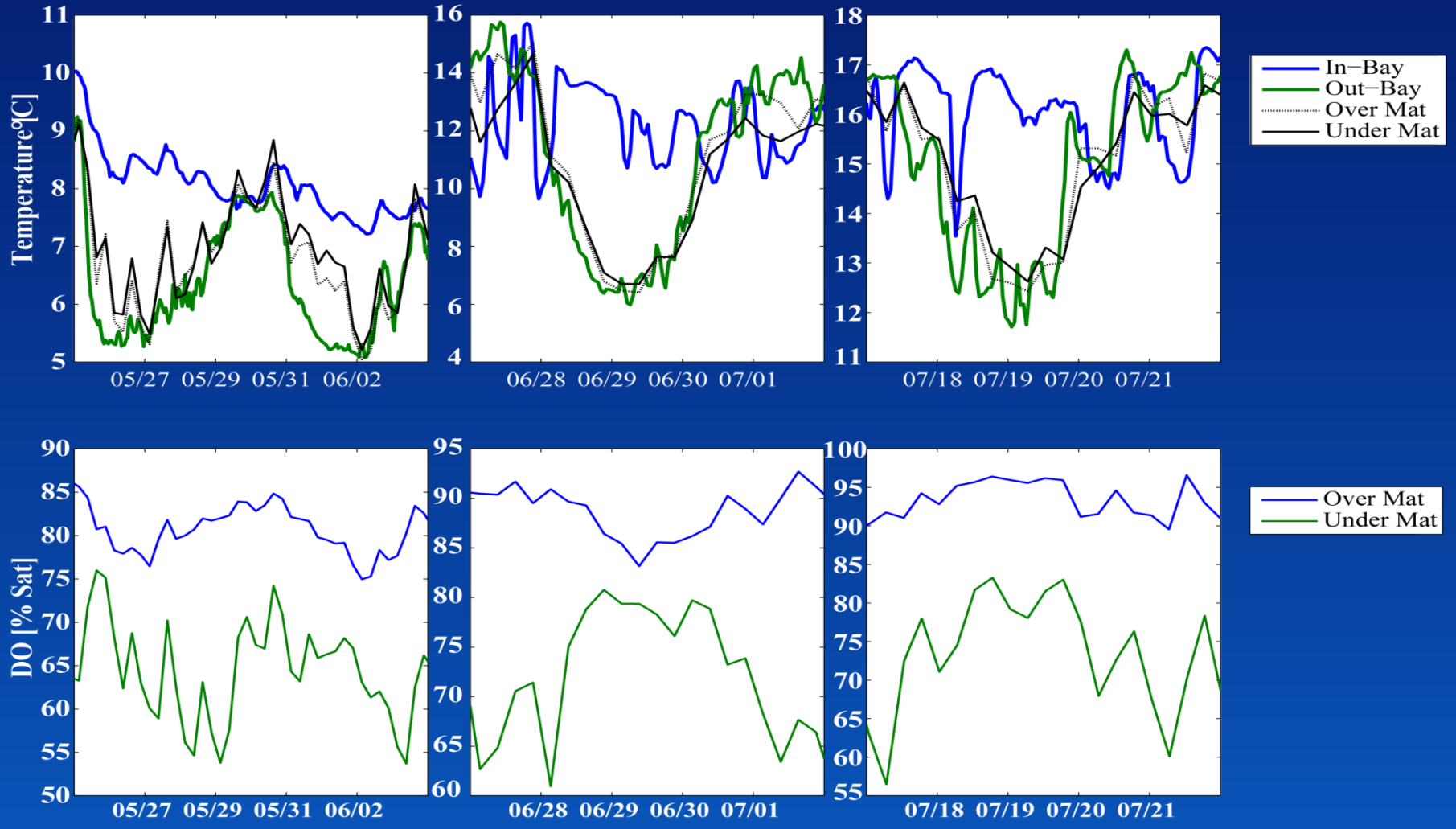
DO Supply from Upwelling Events



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Conclusions

- **Peaks in DO - Upwelling events initiate exchange flow and supply DO from Lake Tahoe to 80-85% saturation**
- **Diurnal DO Fluctuations - Daily boat traffic, winds, and exchange flows all contribute**
- **Flow pathways either directly under mat or through substrate – Still under investigation!**

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Acknowledgements

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