

Modeling Mixing Dynamics of the Salton Sea

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Introduction

The Salton Sea is a man-made lake in Southern California that suffers from environmental degradation due to agricultural runoff. Though it has been hypothesized that less hydrogen sulfide will be produced as the lake shrinks, hydrogen sulfide measurements show that levels regularly exceed acceptable thresholds. **My objective** is to refine the current understanding of the Salton Sea's mixing, predicting how it, and thus the release of hydrogen sulfide, will change as the lake continues to shrink.

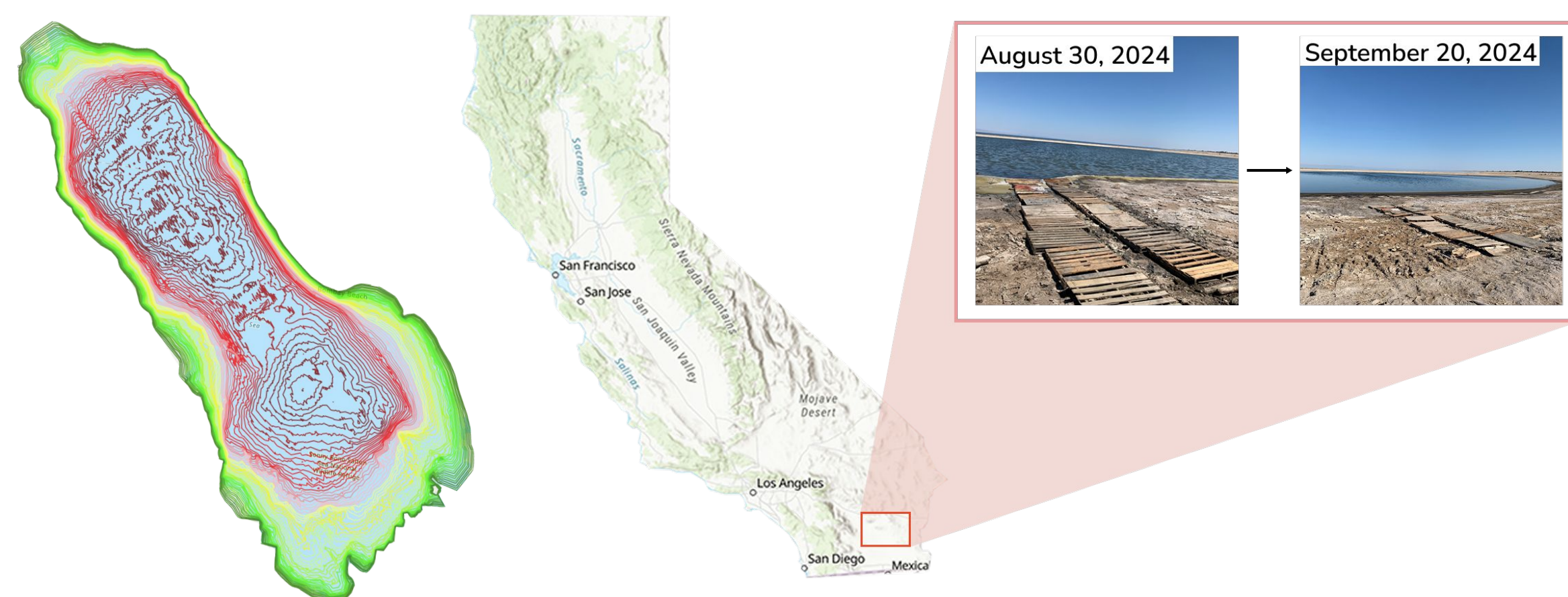


Figure 1: A bathymetry map of the Salton Sea provided by the California Department of Fish and Wildlife

Figure 2: A map showing the location of the Salton Sea, and the rapid shrinking of its coastline

Methods

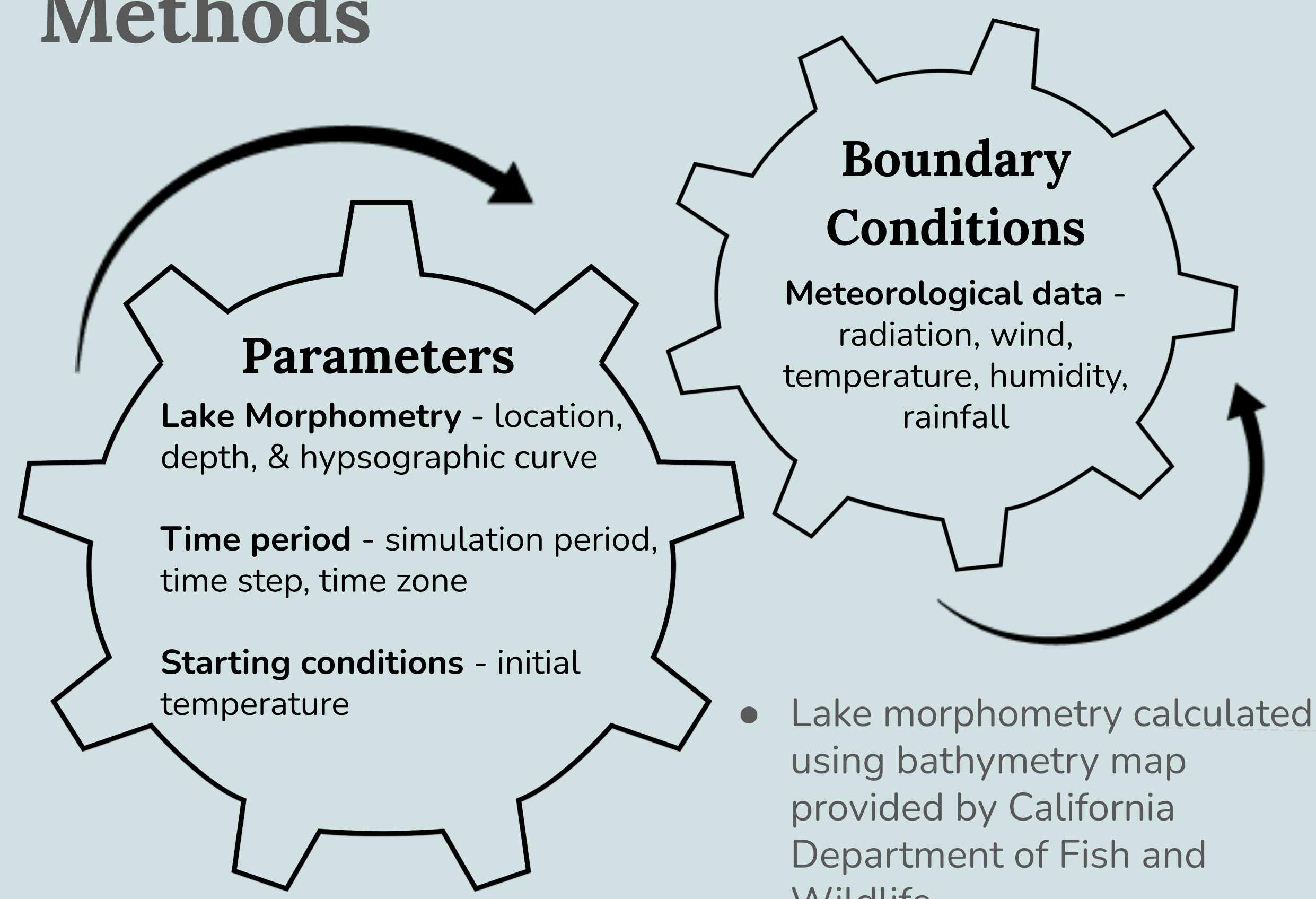


Figure 3: A schematic showing the framework of the General Lake Model



- Lake morphometry calculated using bathymetry map provided by California Department of Fish and Wildlife
- Meteorological data from combination of community monitoring and ERA5 dataset

Results

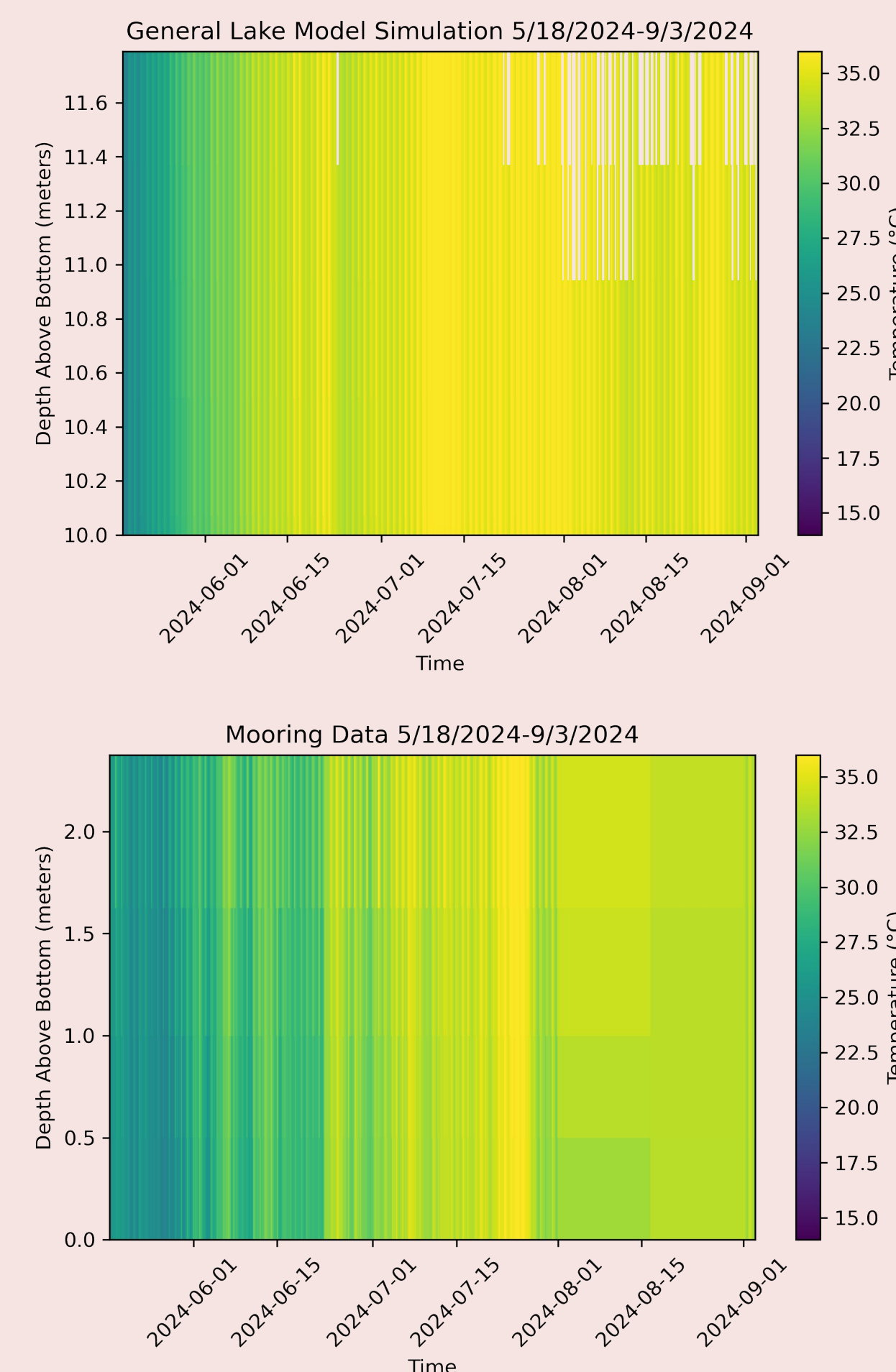


Figure 4: A comparison of the temperature by depth graph produced by the GLM to a graph showing actual temperature data collected from a mooring in the Salton Sea. Though the model generally does a good job of modeling temperature fluctuations, it is limited by its assumption of horizontal homogeneity. This limitation, however, provides insight into processes of the Salton Sea.

- Overestimation of temperature by 2m model and underestimation of temperature by 12m model suggests cooler water from deeper parts of the lake are mixing with warmer water from shallower parts
- 50-year simulation suggests layers will become less stratified, leading to more mixing and thus more frequent release of hydrogen sulfide

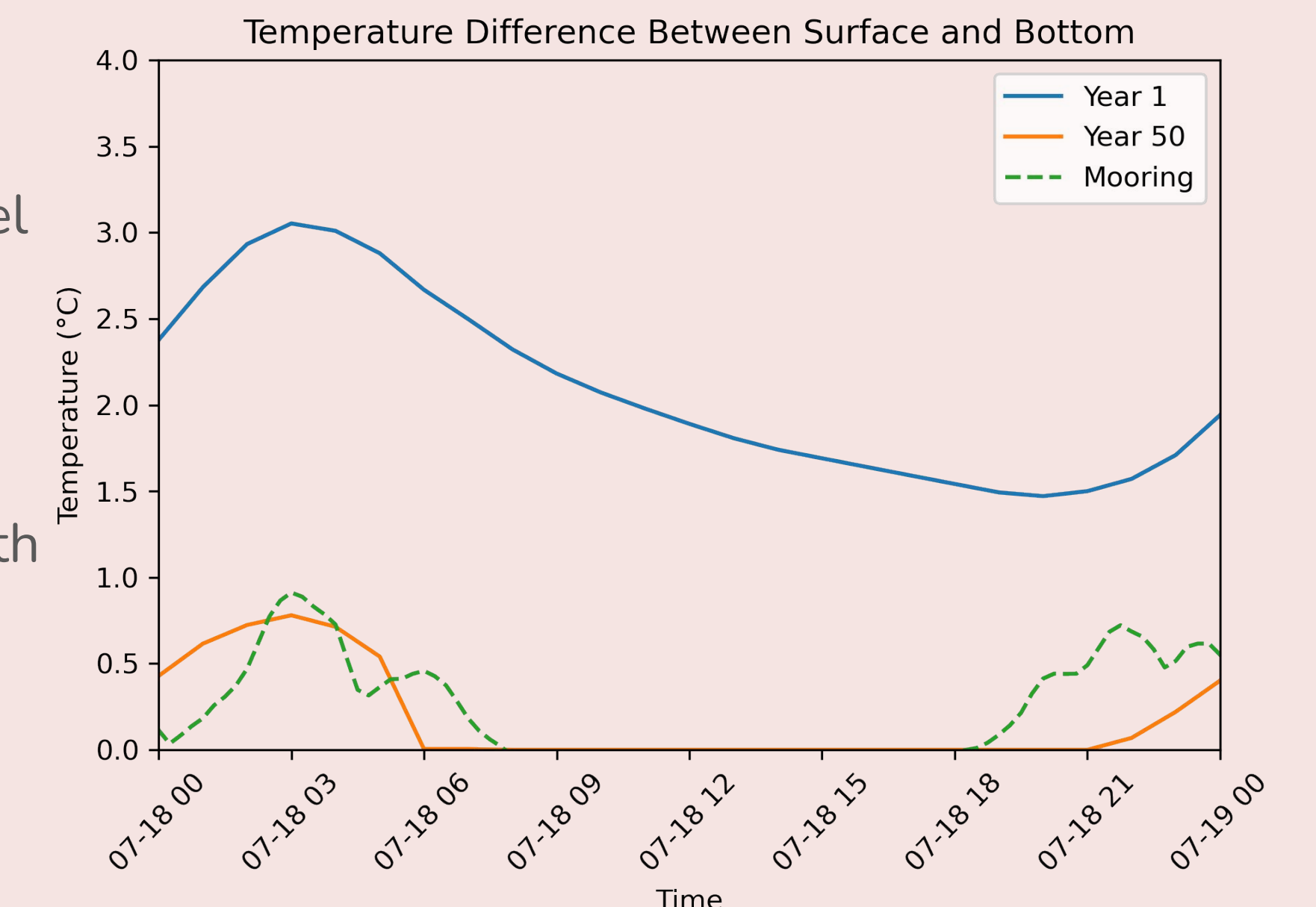


Figure 5: Simulation results demonstrating the effect of the progression of lake volume loss on temperature differences in the Salton Sea. The temperature difference between surface and bottom layers of the lake will decrease as the lake shrinks. The simulation was run assuming the current rate of decrease in the Salton Sea's shoreline.

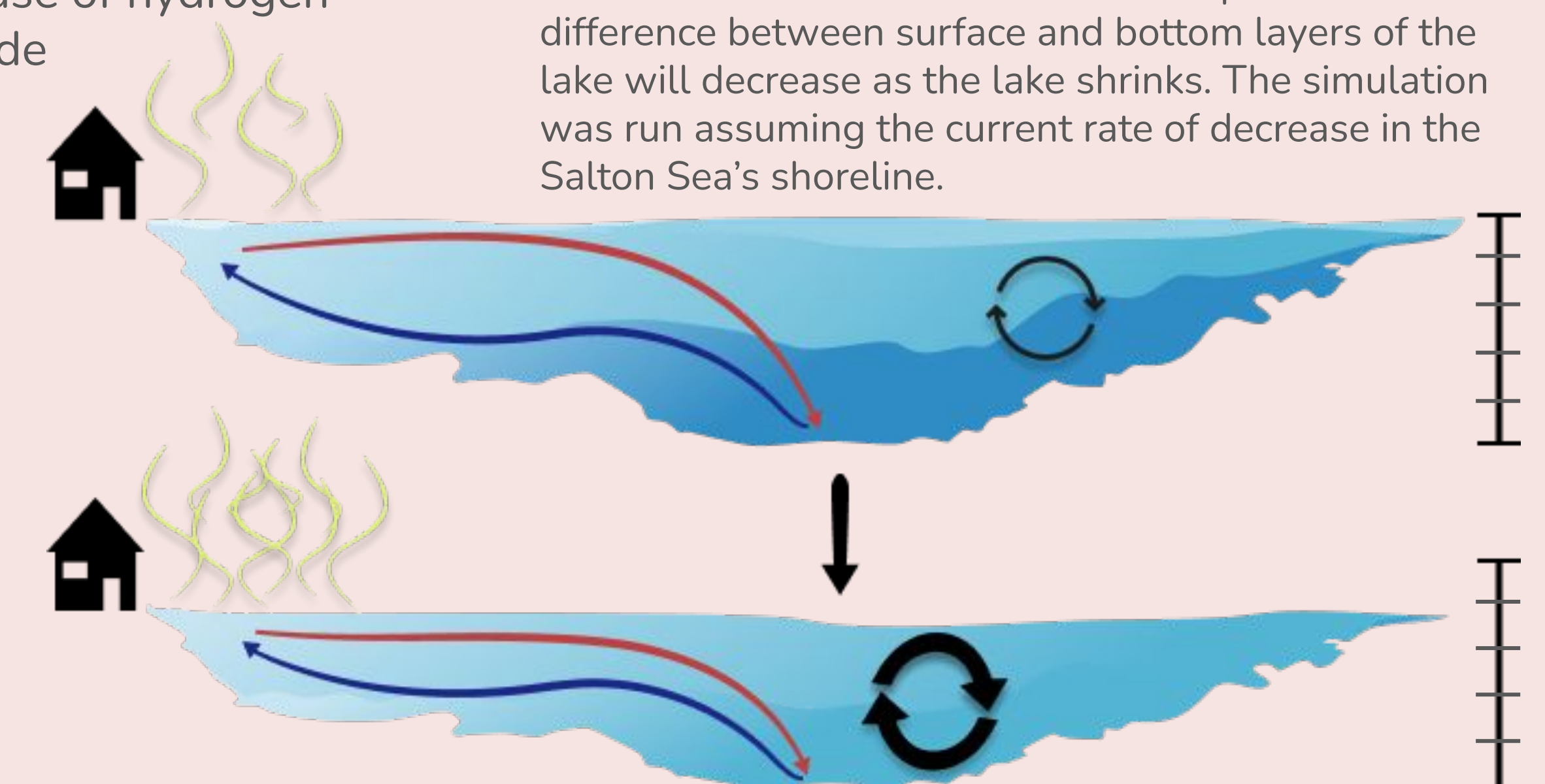


Figure 6: Schematic showing how physical dynamics within the Salton Sea change as it shrinks. Notably, mixing and the release of hydrogen sulfide become more frequent as the layers become less stratified

Community Science

This research is part of a much larger community science effort organized by Alianza Coachella Valley. Though much of this work is focused on understanding the physical and biogeochemical drivers behind the release of hydrogen sulfide from the Salton Sea, a vital aspect of the project at large is community and political engagement: communicating the science in a way that motivates the people who live around the Salton Sea and organizing for healthier and more just environmental regulations and protections. This requires not only understanding the science, but also the history and structures that shape the Salton Sea and its surrounding community: one that has experienced settler-colonialism, capitalism, agriculture, and environmental degradation.

Next Steps

- Integrate physical model with biogeochemical model created by fellow researcher, Remy Dufresne
- Make research accessible to community members living around the Salton Sea
- Look into and work with model that can support multi-dimensional simulations of lake dynamics