

## Review Comments

Xue et al. developed a coupled lake-ice-atmosphere modeling system of NU-WRF/FVCOM. The new model demonstrates clear advantages over the 1D lake model (LISSS). The authors also address a crucial question regarding the key processes influencing lake thermal structure and ice cover in 3D lake models through well-designed numerical experiments. The overall work is strong, and the process analysis is comprehensive. The manuscript requires adjustments to its structure and presentation for clarity and consistency. Below are specific comments and suggestions for improvement:

1. On Line 30, add the full name of “LSTs” (presumably “lake surface temperatures”) upon first mention for clarity.
2. In Figure 1, the blue line for “FVCOM mesh” does not appear to be visible in panel (a). Consider using blue in panel (b) instead of red to clearly show the FVCOM mesh. Additionally, add the names of the lakes to panel (b) for better context.
3. For all figures, it is standard practice to label subplots with (a), (b), (c), etc. Please add these labels to improve readability.
4. In Section 3.2, clarify whether the NU-WRF/LISSS configuration uses the same lake mesh as shown in Figure 1b (like NU-WRF/FVCOM). This will help readers understand the setup differences between the two models.
5. In Figure 2, observations from GLSEA show some spikes in temperature and ice cover time series (e.g., Lake Ontario’s low-temperature spike in February and ice cover spike in February), but the simulations appear smoother. Could the authors explain this discrepancy? Is it due to model limitations or data processing?
6. In Figure 3, while Lake3D performs much better than Lake1D, the spatial pattern in GLSEA observational data is still more heterogeneous compared to the Lake3D simulation. What are the potential reasons for this? Additionally, were any parameters tuned, or initial conditions adjusted to improve the Lake3D simulation compared to Lake1D? If so, please clarify.
7. In Figure 6, what are the potential reasons for the underestimation of latent heat flux by Lake3D over Spectacle Reef? Please discuss possible causes.
8. The C2-related analysis is currently included in the discussion section (Section 5), which is unusual. This content should be moved to the results section. The discussion section should focus on synthesizing findings from both C1 and C2 experiments rather than presenting new results. The C2 experiments are important and should not be overlooked or buried in the discussion.
9. The explanation of equations in Section 5.2/5.3 would be better placed in the methods section, maybe in the experiment design subsection for C2 experiments. This would improve the flow and readability of the manuscript.
10. For the C2 experiments, it would be valuable to include analysis of sensible/latent heat, T2, and wind speed comparisons for the different physics turnoff experiments. This would provide a more comprehensive understanding of the impacts on lake-atmosphere interactions. If space is limited, consider adding this analysis as supplementary material.