



Supplement of

Enhancing winter climate simulations of the Great Lakes: insights from a new coupled lake–ice–atmosphere (CLIAv1) system on the importance of integrating 3D hydrodynamics with a regional climate model

Pengfei Xue et al.

Correspondence to: Pengfei Xue (pexue@mtu.edu)

The copyright of individual parts of the supplement might differ from the article licence.

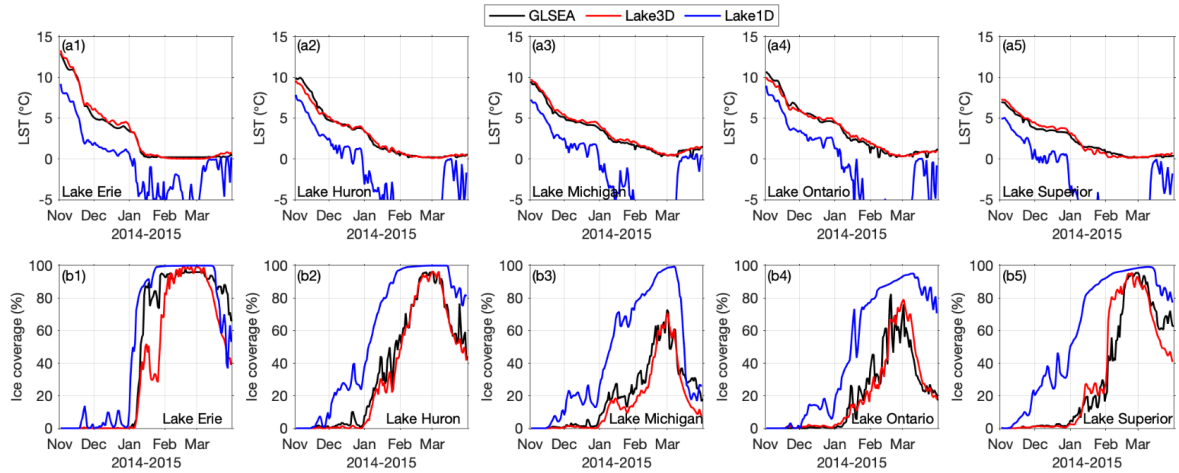


Figure S1. Time series of daily lake-averaged LST ($^{\circ}\text{C}$.) and percent ice cover for the five lakes from GLSEA data (black lines) and NU-WRF/FVCOM 3D lake model simulations (red lines) and NUWRF/LSSS (reproduced in Notaro et al. (2021; Figs. 12 and 13)) during the simulation period of November 2014–March 2015.

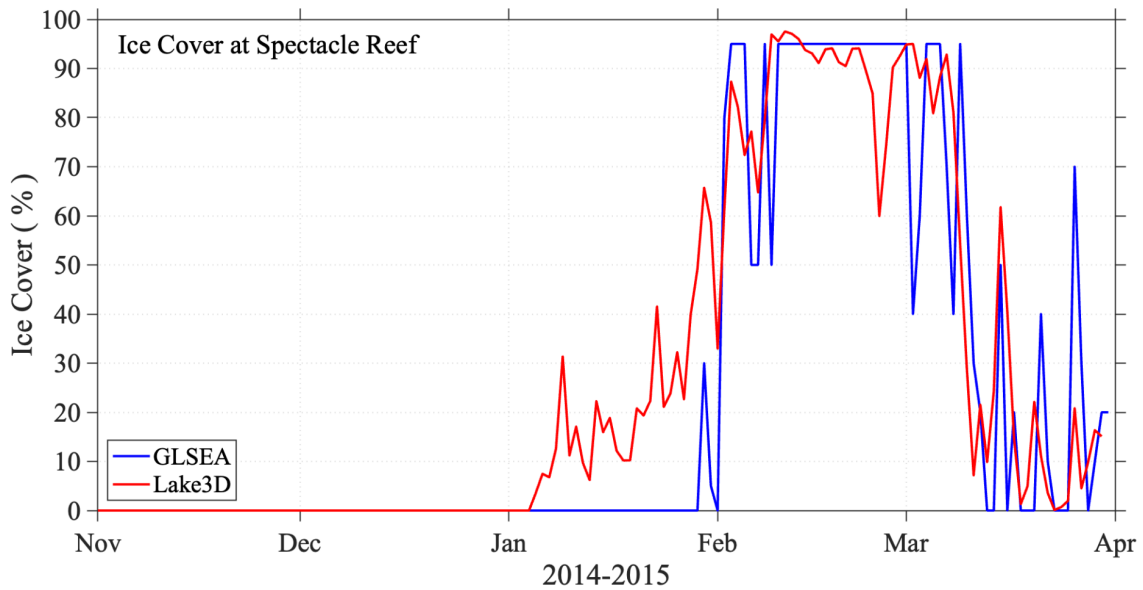


Figure S2. Time series of ice cover at Spectacle Reef for the 2014–2015 winter season, comparing observations from the Great Lakes Surface Environmental Analysis (GLSEA, blue, which has ice data sourced from the National Ice Center) with the Lake3D model simulation (red).

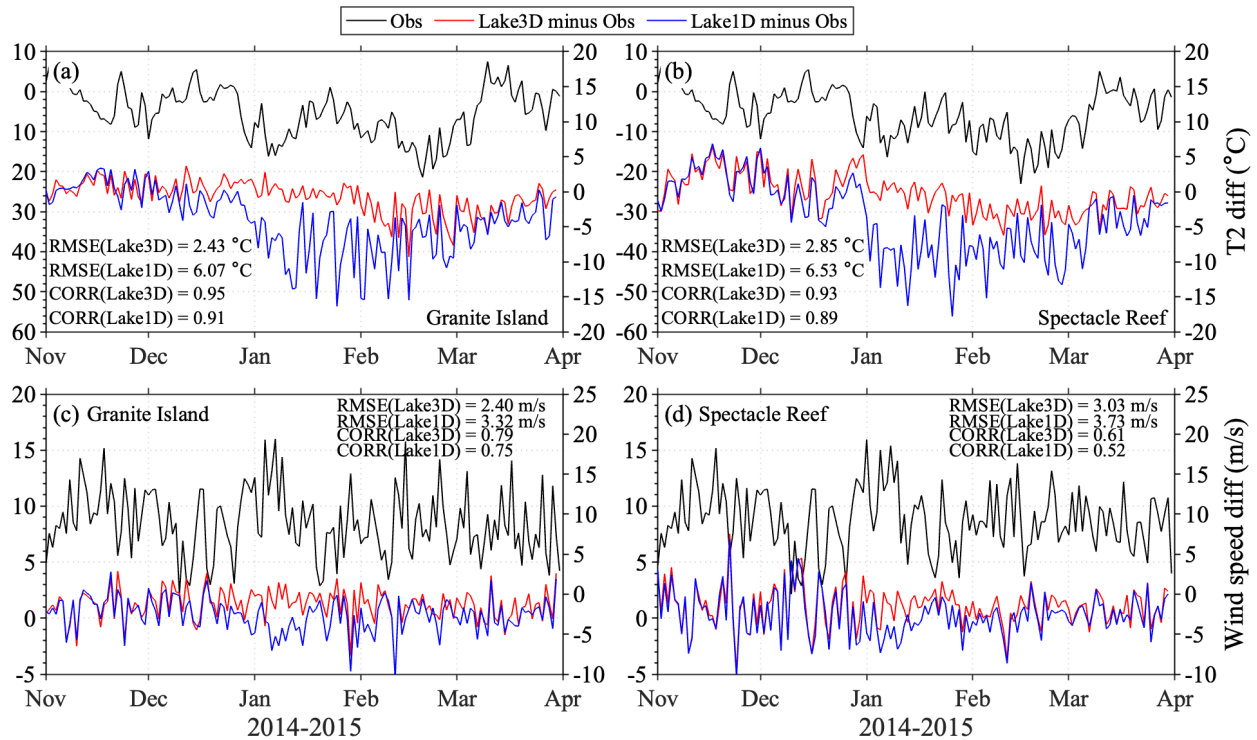


Figure S3. Time series of daily 2-meter air temperature (°C; upper panels: a, b) and wind speed (m/s; lower panels: c, d) from GLEN observations (black lines, left y-axis) at Granite Island (Lake Superior) and Spectacle Reef (Lake Huron) during November 2014 to March 2015. Model biases relative to observations are shown on the right y-axis for the NU-WRF/FVCOM simulation with the 3D lake model (red lines) and the NU-WRF/LISSS simulation with the 1D lake model (blue lines).

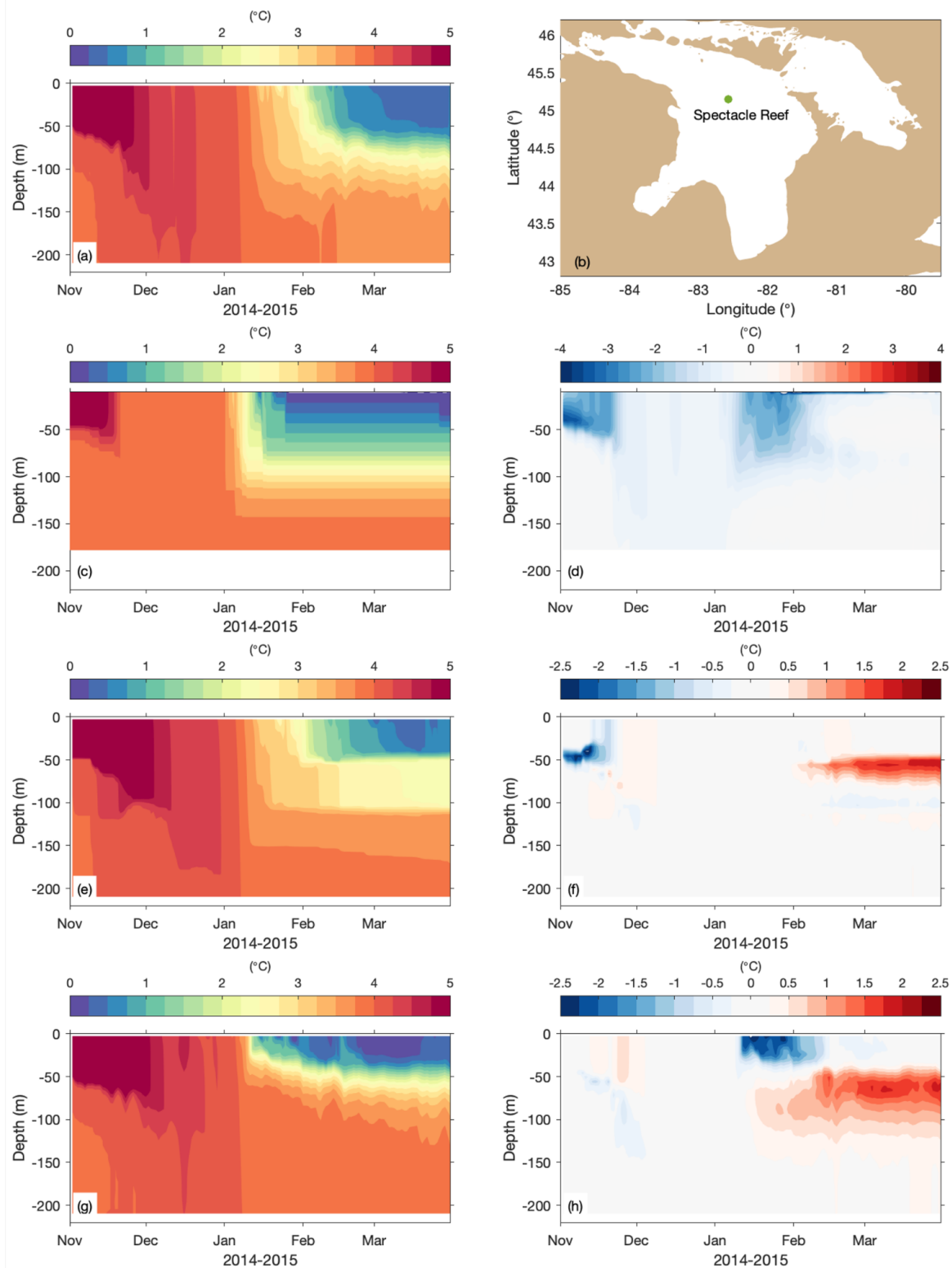


Fig. S4. Mean vertical temperature (°C) profile at central Lake Huron from a): case C1-1 (Lake3D) standard run and b): thermistor observation site at central Lake Huron; c): case C1-2 (Lake1D) and d): its difference relative to case C1-1; e): case C2-2 (NoHeatAdv) and f): its difference relative to case C1-1; g): case C2-3 (NoShearProd) and h): its difference relative to case C1-1.

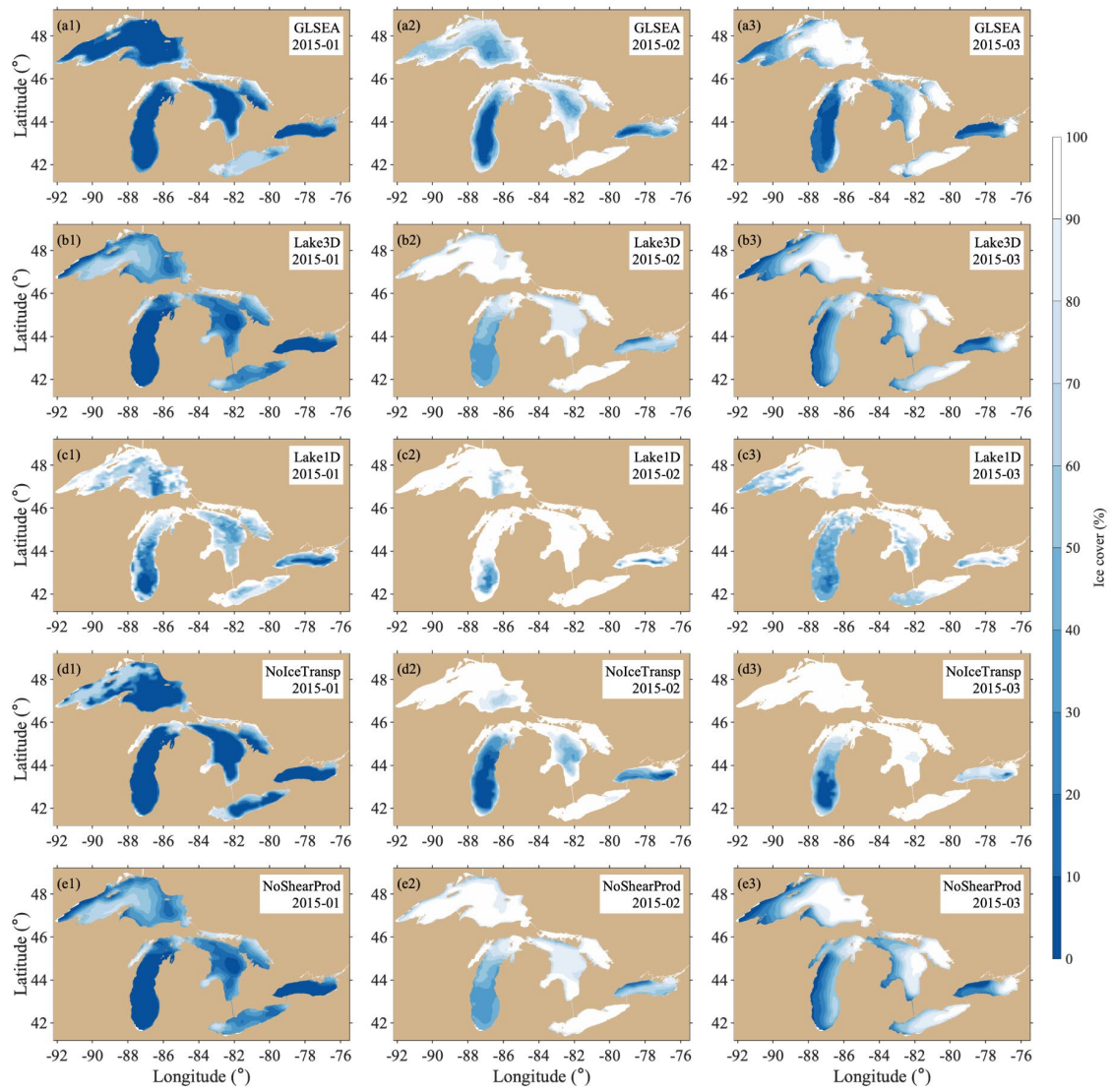


Fig. S5. Spatial patterns of mean percent lake ice cover from GLSEA data (a1- a3), NU-WRF/FVCOM 3D lake model simulations (b1-b3), and NU-WRF/LISSSS 1D lake model simulations (c1-c3); case C2-1 (NoIceTransp) simulations (d1-d3) and case C2-3 (NoShearProd) simulations (e1-e3) for January 2015, February 2015, and March 2015.