Reconstructing Evaporation over Lake Erie During the Historic November 2014 Lake Effect Snow Event

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Introduction
• The purpose of this study was to assess how state-of-the-art numerical models perform in simulating turbulent heat fluxes over the Great Lakes, which is tied to evaporation.

Method
Water vapor budget equation:
\[ P = E - \frac{dQ}{dt} \]
where \( P \) is precipitation, \( E \) is evaporation, \( F_v \) is divergence of water vapor and \( dQ/dt \) is the change in water vapor mass over time.

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• Heat fluxes were reconstructed using nine FVCOM model runs.

• Simulated heat fluxes were validated at two eddy covariance stations: Long Point Lighthouse and the Toledo crib intake (Perms2).

• Meteorological forcing elements were validated using observational data from three buoy sites (Fig. 3a-c).

• 3D mean water temperature was calculated to show corresponding lake heat content (Fig. 3d).

• Observational data from SNODAS shows an increase of SWE along the east of Lake Erie during the duration of the LES event.

• These increases were somewhat captured by the CFSv2 and NAM but both missed the intensity observed in the Buffalo area.

Analysis
• All the model runs captured the sharp rise in LE and H on the 17th.

• NAM and CFSv2 significantly overestimated, likely due to their coarser spatial resolution.

• Lake-wide LE and H averages were calculated across Lake Erie and translated into cumulative evaporation.

Conclusion
• The FVCOM-simulated LE and H agreed with direct flux measurements better than other models.

• This study emphasized the importance of accurate simulation of turbulent heat fluxes to better predict these intense LES events in the Great Lakes region.

Acknowledgements & References
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