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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Evaluating and improving modeled turbulent heat fluxes across the North American Great Lakes" *by* Umarporn Charusombat et al.

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Indeed, using the satellite-derived water surface temperature (GLSEA) would be the most significant source of simulation errors. As described in Section 2.1.2, it is a composite analysis using cloud-free portions of satellite imageries and therefore the accuracy tends to be lower on cloudy days (discussed in Section 4). However, we confirmed that the GLSEA water surface temperature agreed reasonably with offshore buoy measurements during these periods. Even though offshore buoy sites are not collocated with the stations for eddy covariance measurements and buoy data are typically not available during December-March (mainly due to ice cover), the agreement

between the GLSEA water surface temperature and buoy measurements provides us some confidence in the accuracy in the GLSEA water surface temperature. A recent study by Moukomla and Blanken (2016) tested an experimental method to derive water surface temperature from MODIS (or Moderate Resolution Imaging Spectroradiometer) for all-sky conditions. Such a product may also be tested in the future. This point will be added in the revision process. However, as described in Section 4, in-situ measurements (e.g. thermistor) are desired for a more reliable simulation.

As for the concern in using daily water surface temperature along with half-hourly meteorological variables, the only hydrodynamic process that can cause rapid and sub-daily changes in the water surface temperature is upwelling, which are readily found in nearshore waters but not at the offshore locations of the eddy covariance stations. If the commenter is referring to deepwater mixing during fall overturn, that generally does not cause rapid temperature changes that would require sub-daily resolution. Therefore, daily water temperature would be sufficient for this study.

As for the note on the roughness length scale treatment in CLM4.5, this indeed needs to be mentioned in the manuscript so that it clarifies in CLM4.5 z_0 is updated dynamically and is not equal to $z_{0T,q}$. On the other hand, in the WRF application, at least in the latest version of 3.9.1, z_0 is still constant 0.001 m for unfrozen lake and $z_{0T,q}$ are set as equal to z_0. In the revision process, we will make sure that these points are made clear.

Moukomla, S. and Blanken, P. D.: Remote sensing of the North American Laurentian Great Lakes' surface temperature, Remote Sens., 8(4), 1–15, doi:10.3390/rs8040286, 2016.

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