We sincerely appreciate the referees for their valuable and insightful comments on our manuscript. The feedback is instrumental in enhancing the quality and clarity of our research. These comments are not only valuable but also serve as a critical resource for improving various aspects of our article, including methodology, data interpretation, and overall presentation. We have taken each comment seriously and conducted a thorough review of our manuscript to ensure that we comprehensively address all concerns raised by the referees.

This response document provides a detailed account of the changes implemented in relation to each specific comment from the referee. For ease of reference, referee comments are presented in black, while authors' responses are provided in dark blue. The revised manuscript is highlighted in blue. The line numbers correspond to the revised version of the manuscript (track changed).

Reviewer #1

This paper integrates ELM v2.1 with the Weather Research and Forecasting (WRF) Model through a modified Lightweight Infrastructure for Land Atmosphere Coupling (LILAC) framework, enabling affordable high-resolution regional modeling by leveraging ELM's innovative features alongside WRF's diverse atmospheric parameterization options. High-resolution (4 km) WRF-ELM ensemble simulations over the Great Lakes Region (GLR) in the summer of 2018 are evaluated with observations, reanalysis data, and the WRF-CTSM. The manuscript is very well-written and has a very nice flow to it. I have some minor comments and suggestions to strengthen the manuscript:

1. Figure 6: The numbers on the top right of (c)-(f) indicate the spatial correlation coefficient between each reanalysis product and the two simulation results. However, the numbers and figure 6f are missing.

R: Thank you for pointing this out. We include fig (f) in caption by mistake. It has been removed in the text.

2. The partitioning of surface energy between latent and sensible heat fluxes plays an important role in regulating heat and water exchange between the land surface and the atmosphere. The spatial distributions of latent and sensible heat fluxes should be evaluated in the manuscript.

R: We agree with the reviewer that the evaluation of spatial distributions of latent and sensible heat fluxes would be important. We have now included 1) spatial distributions of sensible and latent heat and 2) scatter plot of evaporative fraction (LH/(LH+SH)) to explicitly evaluate the partitioning between latent and sensible heat in the updated Fig. 10. For most grids, we found both WRF models systematically underestimate LH while overestimate SH, producing a lower evaporative fraction compared to the observational data. We have included a comprehensive discussion regarding the spatial distribution of SH and LH, and the scatter plot of the evaporative fraction in the revised manuscript (Lines 403-414).

"We evaluated the simulated LH and SH fluxes from the WRF model simulations against ERA5-Land reanalysis data. The spatial correlation coefficients (CORR) range from 0.53 to 0.58 (Fig. 10a–f). Overall, both models capture the LH gradient across the study domain, with higher LH observed in the southern region and lower LH in the northern region. Similarly, both the reanalysis data and the models show a higher SH in the northern region and lower SH in the south. A systematic underestimation of LH (ranging between 22-35 W m^{-2}) and overestimation of SH (averaging 21-31 W m^{-2}) are evident in both WRF-ELM and WRF-CTSM. The observed evaporative fraction ranges from 0.6 to 0.8 in most vegetated grids; however, the corresponding simulated evaporative fraction is approximately 0.6. This evaluation further confirms that our models tend to underestimate LH fluxes while overestimating SH fluxes. These biases may be largely attributed to the surface parameters uncertainties used in the current simulations, such as LAI or roughness length. These parameters have not been thoroughly calibrated in coupled E3SM simulations focusing on the Great Lakes region."

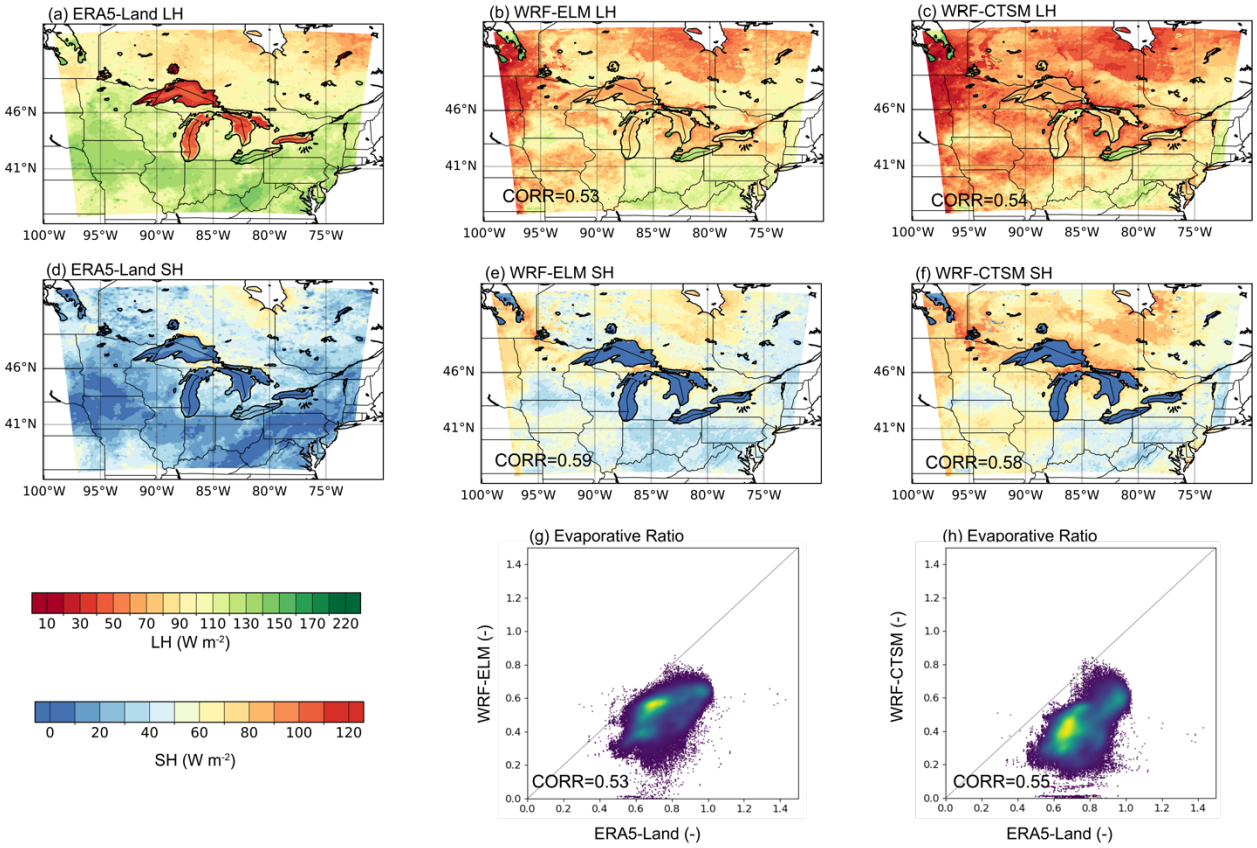

Figure 10 (a-c) Spatial distribution of latent heat in (a) ERA5-Land (b) WRF-ELM, and (c) WRF-CTSM; (d-f) Spatial distribution of sensible heat in (d) ERA5-Land (e) WRF-ELM, and (f) WRF-CTSM; (g-h) Comparison of evaporative ratio between (g) WRF-ELM and ERA5-Land and (h) WRF-CTSM and ERA5-Land over the natural vegetation grids.