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Interactive comment on "Improving lake mixing process simulations in the Community Land Model by using K profile parameterization" *by* Qunhui Zhang et al.

Anonymous Referee #2

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First, thank you for sharing your work. This is a very interesting study! You present a method of improving the thermal mixing of lakes in the Community Land Model (CLM). The new method introduced into CLM is K profile parameterization (CLM-KPP), a method utilized in ocean modeling. The current CLM vertical mixing scheme (CLM-ORG) assumes wind is the primary forcing in thermal mixing of lakes. KPP uses wind and surface thermal forcing to simulate lake temperatures. The model did not improve until a mixing event occurred on 16-31 August. CLM-ORG predicted a continued stratification of lake temperature from 16-31 August. CLM-KPP correctly estimated when and the magnitude at which the thermal mixing event would occur from 16-31 August. You provide a thorough analysis as to how thermal forcing within CLM-KPP was able

to correctly predict that the mixing would occur. However, I believe there a couple of points that would enhance this work.

Major Comments 1. The study seems limited using only one lake and a very narrow time frame. I would recommend the inclusion of several study locations and/or a longer period of analysis to get a better sense of the implications of using CLM-KPP over CLM-ORG. Right now the impact of the study feels limited given that only one location is examined for a two month period during the same season. 2. Related to 1, you do not provide an analysis of how the stratification beginning on 16 Aug better informs ecosystem, meteorological, or climatological analysis for the lake. A better discussion of implications of capturing this mixing, particularly if any were observed, would enhance this work. 3. Line 169-180: You discuss how RMSE and correlation (R) improved with CLM-KPP only slightly for the entire simulation period. I suggest that since you use these metrics, divide the calculation of these metrics into a before and after the mixing event occurs. This would strengthen your point. You should then note this in the abstract and conclusions to better illustrate the impact that CLM-KPP has in the simulation.

Minor Comments Line 100: Please define phi Line 161: How did you decided upon the 24 layers you specify?