Geoscientific
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Interactive comment on "A coupled two-dimensional hydrodynamic and terrestrial input model to simulate CO_2 diffusive emissions from lake systems" *by* H. Wu et al.

Anonymous Referee #2

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General comments: It is not clear why the authors call this a new model, Triplex-Aquatic (see Fig 1), since they are using CE-QUAL-W2 model but with a different CO2 gas transfer function. I am not sure this constitutes a 'new' model.

No discussion of where the meteorological data were measured. This seems critical since CO2 flux from the surface is an important function of wind speed and the temperature error statistics were unacceptably high (RMSE > 1.0oC). The choice of the wind speed function for the CO2 gas transfer is especially critical. There was no discussion as to how wind data may or may not have affected model results or choice of a wind model for surface turbulence.

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Need to justify including Appendix A in this paper since this material can just be referenced from the CE-QUAL-W2 User Manual where it is presented.

Sediment dynamics are an important contribution to inorganic C in lakes and reservoirs. There was no discussion of the role of sediment evolution of CO_2 and important sediment dynamics. The authors in Table 1 show a SOD rate of 1 g/m2/d but do not quantify its importance/sensitivity. The paper needs to see the impact of sediment CO_2 gas production relative to inflows and gas transfer.

The choice of a CO_2 gas transfer coefficient needs to be justified compared to the existing or other models of surface film transfer.

Specific comments: p. 3513 Line 26/27: Unclear sentence reword

p. 3514 Line 1: "hydrology controls…mixing processes between spatial components" – not understandable

p. 3515 Line 13/14: Using the equilibrium temperature approach is not recommended since it is an approximation to the more exact term-by-term formulation in W2. Recommend using the term-by-term formulation.

p. 3516-3517: The CO_2 gas exchange model used should have been compared to the existing CE-QUAL-W2 formulation since the version within W2 is theoretically correct. The effort though in determining CO_2 flux is understanding the turbulence in the surface layer leading to the formulation of the surface gas exchange function. For this paper or model to have any validity, the 2 different formulations should be compared. Most of the uncertainty in the end is related to wind and measuring wind speed at the lake.

p. 3520 Line 5: Any RMSE greater than 1oC shows that there is significant error and that there are probably issues with the model calibration data set. Have these been examined as to why the temperature errors are so high? Was model ice on or ice off computed with the model? This paper cannot be accepted when errors are usually

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high and there is no explanation.

p. 3520: What is the difference between model calibration and model validation? These are not as conventionally used by researchers just using an independent data set. For true validation they have to be statistically independent data sets – not just different data.

p. 3527 Line 24: How is reasonable defined?

Fig 2 needs to show a reference to CE-QUAL-W2 since these are just from that model.

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Interactive comment on Geosci. Model Dev. Discuss., 6, 3509, 2013.