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Interactive comment on "Satellite-Derived Light Extinction Coefficient and its Impact on Thermal Structure Simulations in a 1-D Lake Model" *by* Kiana Zolfaghari et al.

Anonymous Referee #1

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Overall review of submitted paper:

This paper is about the lake water transparency (light extinction coefficient Kd) for the freshwater Lake Erie. Satellite-based lake water transparency values were compared with in-situ Secchi disk depths (SDD). Next, the 1D Flake model was run for several water transparency values and model results were compared with lake water surface temperature (LWST) measurements. It is a clearly written paper. I therefore recommend this paper for publication after minor revision. My remarks are summarized below:

Quality of model results (1):

The model results are compared with (Martynov, 2012) in which a light extinction coef-

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ficient Kd of 0.2 m-1 was used. This corresponds to a SSD of 8.5 m (see Eq. 2), which is not a very common value for SSD. Also, the Flake model results appear to be very sensitive for Kd values less than 0.5 m-1. Potes et al. (2012) used a Kd of 1.0 m-1 for clear water. Why didn't the authors choose the more common SSD value of Potes for a comparison with their model results? This would also have been more in line with the Kd for the NDBC station with a minimum value of 0.58 m 1 and an average value is 0.9 m-1 over the period of 2003 to 2012. It is not very difficult to improve the results of (Martynov, 2012) because a rather unrealistic Kd value of 0.2 m-1 was applied in that paper. A reference value of 1.0 m-1 of Potes would probably have resulted in comparable results.

Quality of model results (2):

In this paper only a comparison with LWST is conducted. As stated on page 2, this is 'one of the key variables' for modeling thermal structures in lake-atmosphere models. Why didn't the authors compare with other key variables, such as the thermal stratification? Are CTD-measurements available at buoy stations in Lake Erie? A comparison of computed isotherms with measured isotherms (cf. Fig. 13) may significantly improve the impact of this paper.

Issues of less importance:

- (page 7) Relation between Kd and SSD; The relation in Eq. (2) is applied. However, at the end of this page is stated that the extinction coefficient can be derived from the equation Kd =1.64 * SSSˆ(-0.76), which is a different one. This is confusing. Which equation is used?

- (page 9/Fig. 9) Flake model depth; It is confusing that two model depths (12.6 and 20 m) are applied. Is a depth of 12.6 m applied in the simulations with varying Kd values applied, because this is the actual depth? I suggest to remove all results for the 20 m depth simulations, also because the results are quite similar to CRCM-12.6.

- (Figures 5 to 7) Contour interval; The interval is between 0 and 5. As a result, the interesting range of approximately 0.5 to 1.5 is not clearly visible in these figures.

- (Fig. 9) Thickness of lines; In Figure 9 for 2007 the observations are not visible for September to December 2007. This is caused by the thickness of the lines. Please use another order of the shown time series so that the measurements become visible.

- (general remark) It is beyond the scope of this paper, but why is 1D modeling applied? With the current computing power of off-the-shelf computers, 3D modeling of lakes like Lake Erie is (easily) feasible. Then, for example, horizontal circulation and the non-equidistant bed level can be taken into account.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/hess-2016-82/hess-2016-82-RC1-supplement.pdf

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