

Interactive comment on “Trends and abrupt changes in 104-years of ice cover and water temperature in a dimictic lake in response to air temperature, wind speed, and water clarity drivers” by M. R. Magee et al.

Anonymous Referee #3

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This manuscript presents a study to demonstrate a long-term change in ice cover and thermal structure of Lake Mendota using a 1-D hydrodynamic-ice model. I have enjoyed reviewing this manuscript and I do believe that it is suitable for publication in a special issue of Hydrological Processes, in terms of its overall content. In general, the authors have made sound intellectual arguments and use an appropriate methodological approach, based on knowledge obtained from previous research studies. In addition, they provide a reasonable interpretation of the results obtained from this study.

General comments:

C1

The author used daily meteorological data to run the DYRESM-WQ-I model, however is mentioned that the model has 1-hr time step at page 6 line 5!

The author used the rain fall and snow fall observations from weather station. Snow accumulation regimes differ significantly not only between but also within the various locations over a lake. Snow depth can be very thin and dense to non-existent on some lakes or lake sections due to the wind. This difficulty in accurately measuring snowfall have to be considered specially when running 1-D models. This can be done by looking at any available in-situ snow observations over lake and calculating the percentage of snow in comparison with the station data. And also it is not clear how the snow density is defined. Is there any in-situ observations available for snow density?

Some specific questions/comments I have about this manuscript are as follows:

Page 2/lines 24-25: “Air temperature, wind speed, and water clarity are important factors driving these lake ecosystem properties”, reference is missing.

Page 2/lines 27-29: “The long-term response of lake ice and water temperature to changing air temperature and wind speed is integral to assessment of the potential impacts of climate change on water quality and ecology of lakes.” It is not clear if the author is talking about the role of lake ice on climate or the response of the lakes on climate. Please be more specific.

Page 8, 3.2 meteorological variables: the location where the meteorological data are collected is not clear and how far it is in comparison with the simulation points.

Page 12/lines 22-26: “Other models including LIMNOS (Vavrus et al. 1996) on Lake Mendota, Wisconsin; MLI (Rogers et al. 1995) on Harmon Lake, British Columbia; and CLIMo (Duguay et al. 2003) on lakes in Barrow, Alaska; Poker Flat, Alaska; and Churchill, Manitoba produced similar errors to Lake Mendota between modeled and observed ice thickness and snow cover”. This comparison should be more specific and the author have to give a range of error.

C2

Please also note the supplement to this comment:
<http://www.hydrol-earth-syst-sci-discuss.net/hess-2015-488/hess-2015-488-RC3-supplement.pdf>

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2015-488, 2016.