

## ***Interactive comment on “Technical challenges and solutions in representing lakes when using WRF in downscaling applications” by M. S. Mallard et al.***

### **Anonymous Referee #1**

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This paper contains a good discussion of various approaches to simulating lakes within a regional climate model and the results of these approaches. It has strong value as a review paper, in addition to having a modest amount of original results. My comments are minor in nature, but I encourage the authors to heed them.

Specific comments: 1. P. 7123 uses "interpolation" on line 9, but then contradicts on line 17 by saying "no interpolation". Clarify by possibly using other terms, like "spatial analysis." 2. P. 7123, lines 9-15—This seems to be trying to compromise between accuracy and simplicity. I suggest just describing the situation that prevails in areas of interest, and the method that ends up being used there. 3. P. 7124, line 25—It seems strange to refer to a reanalysis dataset as a proxy for a GCM. It's just a dataset that can be used to drive an RCM for different purposes than would be achieved using GCM

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data. 4. This citation likely belongs in this page: Lofgren, B. M., 2004: A model for the simulation of climate and hydrology in the Great Lakes basin. *J. Geophys. Res.*, 109, doi:10.1029/2004JD004602 5. P. 7129, line 24 implies that there is a correction that was applied in version 3.5.1. What is it? 6. There are a whole lot of references to features of different versions of WRF spread across the manuscript. I suggest summarizing the relevant updates in a table. 7. P. 7131, lines 7-14 overstate the uniqueness of ice as a limiting factor in evaporation. An ice-free lake can have cool water overlaid by warm and moist air, resulting in very limited evaporation. 8. P. 7134, last paragraph discusses how well FLake performs during historical periods. Are there any thoughts on how well it might do at climate change scenarios in which lake thermal structure and stability may well change, e.g. the situation illustrated by Austin and Colman (2007)? 9. What is the horizontal structure of both FLake and CLM? Are you using a horizontal array of non-interacting 1-d columns? The caption of Fig. 4 seems to imply yes for CLM, but unless I missed it, this should be stated more explicitly. 10. P. 7135, lines 10-15—This is probably the most troubling part of this manuscript for me. The time series in Fig. 3 is showing strong evidence of numerical instability—highly unrealistic oscillation between high and low values over very short periods of time. This shouldn't happen even during a spin-up period. Without knowing the details of the code, it seems miraculous, first, that this instability continues for so long without crashing the model run, and second, that it suddenly stops and remains stable thereafter. 11. P. 7135, lines 16-17—To reiterate and clarify the comment by Anne Clites, the dataset described in Wang et al. (2012b) is not simply the NIC analysis, but is a value-added dataset, with additional quality checks and a gridded format.

Technical corrections: 1. P. 7123, line 1—insert "spatial" before "interpolation." 2. P. 7128, line 26—"result from a downscaled simulation" seems clearer than "result in..." 3. P. 7130, line 28—Especially because winter itself is a limited time period, it seems to make sense to replace "at a later time period" with simply "later." 4. P. 7131, line 1—"...open (and free of ice)" is redundant. I suggest just "free of ice." 5. Check a style guide on hyphen usage: Remove hyphens from p. 7135 line 5 "spin up", p. 7135 line

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12 "time series", and p. 7136 line 11 "spun up". Add one to p. 7136 line 3 "110-year".

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Interactive comment on Geosci. Model Dev. Discuss., 7, 7121, 2014.

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