

Manuscript: Rationalizing the Decline in Lake Michigan-Huron Water Levels Using the Coordinated Great Lakes Routing Model

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Name of Reviewer: **Brian Barkdoll**

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| 1. Are the objectives of the work clearly stated? | 1 |
| 2. Are the methods employed valid, appropriate and sufficient to address the questions, hypotheses or the problem? | 1 |
| 3. Are the observations, conclusions and recommendations supported by the material presented in the manuscript (e.g., data, model and analyses)? | 1 |
| 4. Are the assumptions used valid and are the mathematics presented correct? | ?? |
| 5. Is the manuscript well organized, material precise and to the point, and clearly written using correct grammar and syntax? | 2 |
| 6. Are all of the figures and tables useful, clear, and necessary? | 1 |
| 7. What is the quality of the overall work? | 2 |

Recommendation (please circle your response) **B**

A - acceptable

B - acceptable with suggestions for revision

C - acceptable if adequately revised

D - unacceptable

If you have selected **C**, do you wish to receive the revised manuscript for further review?

yes no

Rating (Circle the rating you would like to give this manuscript. Unacceptable work should be given a score of 40 or less.)

100 90 80 70 60 50 40 30 20 10 0

Comments (limit responses to one paragraph for each question; reference pages, charts, and data. Please distinguish if responses are of major or minor concerns.)

A. What is the best/most unique part of the analysis?

Use of Bootstrap Method

B. What is the most critical aspect of the study/analysis? Why?

Net Basin Supply determination.

C. Which aspect of the analysis/modeling is weakest? Why? How can it be improved?

Conveyance determination, but difficult to improve with existing data.

D. Are there any other suggestions that are related to how this analysis may be used more effectively or the results explicated in a more understandable manner?

No suggestions. It is difficult to determine past events with incomplete past data.

Please indicate any confidential comments to the Co-Chair(s) of the Independent Peer Review Group in the space below. Comments for transmission to the author(s) should be on a separate sheet attached.

Signature: Brian Barkdoll Date: June 6, 2009

Comments for Transmission to Authors

It would be useful to have both general comments and specific comments for major and minor revision. Please use additional sheets should they be required.

1. Please provide a table of contents.
2. Please include an executive summary.
3. Please provide a list of assumption of CGLRRM and their applicability to the current modeling effort.
4. In lines 57-58 it is stated that “The Chicago diversion was taken to be a constant 91 m³/s over the simulation period.” Justify this.
5. In lines 82-84 it is stated that “Component NBS is net inflow to a lake and is calculated as NBS = over-lake precipitation + runoff into the lake – over-lake evaporation.” Also in lines 90-91 it is stated that “Therefore, this report focuses as much as possible on using component rather than residual NBS values for driving the model.” Since the analyses will depend on over-lake precipitation, runoff into the lake, and over-lake evaporation, explain where you get these data and how accurate they are. They seem

difficult to quantify, especially over large lakes such as are being studied here. Discuss the possible effects on the accuracy of the modeling effort.

6. Justify the coefficient 1600 in Eq (3) in line 212.
7. Justify using 10% overestimation of NBS in line 221.
8. In Section 2.5.2, Scenario Analysis of Steady-State Lake Levels, please explain the rationale for this analysis. It seems arbitrary and not realistic.
9. In Table 5 explain how the column labeled “Fall Difference” is calculated and what significance it has.
10. In lines 586-591, “Metric M_4 is defined as the number of years when the average annual MH-Erie lake fall difference is less than or equal to the historically low value of 2.051 m for the measured data in 1990 (see Figure 10). Metric M_5 is defined as the number of years when the 3-yr moving average of the MH-Erie lake fall differences is less than or equal to the historically low value of 2.101 m for the measured data in 1991”, how can anything be lower than its historically low value. Perhaps it would help to explain if M_4 and M_5 are alternate realizations, how they were calculated, etc.
11. Summarize why the bootstrap method is preferred over Monte Carlo analysis.
12. In addition to the Bootstrap Method, a sensitivity analysis should be performed to evaluate uncertainty.
13. In lines 668-69, justify the use of 1000 input time series. How did you know it was enough?

Grammar Corrections

1. In Lines 13-15, the sentence “This report is designed to help shed some light on the relative contribution of changes to lake Net Basin Supplies (NBSs) and St. Clair River conveyance change in the to this decline in head difference.” seems to have a word missing.
2. In Lines 151-153, it is stated that “These 8 stage-fall-discharge equations were then used to produce a set the monthly mean flows for the St. Clair River using monthly mean stages from 1962 to 2007 for the ice free period (May – November).” Produce a set of what?
3. Lines 522-523, should read “The analyses conducted in Section 3 are designed to assess the distribution of MH-Erie lake fall metrics that would be observed under randomly sampled alternative time series of NBS inputs.”
4. In Lines 528-529, the statement “Instead, the analyses here are designed to evaluate the distribution MH-Erie lake fall metrics that result from the observed variability in NBS over time.” seems unclear. Do you mean the distribution of the MH-Erie lake fall metrics?
5. Lines 621-623, should read “Vogel and Shallcross (1996) note that in this application of the bootstrap, the entire set of NBS time series (Lakes Superior, MH, St. Clair and Erie) and ice and weed factor retardation factor time series (for the St. Clair, Detroit and Niagara Rivers) are bootstrapped together.”
6. Lines 635-636, should read “Since this study is focused on a multivariate data set, the block length determination involved considers the cross correlations in addition to the autocorrelations.”
7. Lines 651-652 should read “The next analysis was to determine the appropriate block lengths based on an autocorrelation and then cross correlation analysis to assess the annually averaged (Apr-Mar) time series” No apostrophe at the end.

8. In Lines 656-658 “Block lengths more than four years were considered too long given that the length of the time series to constructed by the moving blocks bootstrap was 10 years in length.” it seem like there is a word missing.
9. In lines 681-683 the statement “Note that CGLRRM inputs are as described in Section 3.1 and Eq. (2), describing the current St. Clair River conveyance regime of the, is the equation for simulating St. Clair River flows.” is unclear.
10. Lines 817-819 should read “Comparing these percentages to the impacts of conveyance change (experiment 2c) where simulating under the old conveyance regime only reduces the M_{1s} and M_{3s} drop metrics by 9% and 18%, respectively.”
11. Lines 869-871 should read “The ice and weed retardation factors used currently should eventually be updated as they have been derived on the basis of Eq. (1) rather than the conveyance equation that better represents the current conveyance regime (Eq. 2).” Make sure equation references have a parenthesis around the page number throughout the report.
12. In Lines 872-874 the statement “Another issue is that the calculation of the ice and weed factors requires the measured connecting flows such that a one type of system behaviour must observed in order to quantify other types of system behaviour (lake levels).” is unclear. What is meant by a “one type of system” and “must observed”?
13. In Lines 891-893 the statement “In addition, it seems likely that the largest prediction CGLRRM prediction errors for the 2001-2005 will be reduced with this new NBS data. “ has the word prediction twice.