International Upper Great Lakes Study – Sub-Product Reviews, Synthesis Product Reviews, and Draft Final Study Report Reviews Template

Peer Review of Manuscripts

Manuscript: Statistical and Spatial Analysis of Bathymetric Data for the St. Clair River, 1971-2007

Author(s): David Bennion

Name of Reviewer: Richard Vogel

1. Are the objectives of the work clearly stated? 4

2. Are the methods employed valid, appropriate and sufficient to address the questions, hypotheses or the problem? 4

3. Are the observations, conclusions and recommendations supported by the material presented in the manuscript (e.g., data, model and analyses)? 4

4. Are the assumptions used valid and are the mathematics presented correct? 4

5. Is the manuscript well organized, material precise and to the point, and clearly written using correct grammar and syntax? 3

6. Are all of the figures and tables useful, clear, and necessary? 4

7. What is the quality of the overall work? 4

Recommendation (please circle your response)

B - acceptable with suggestions for revision

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

80

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?

The best aspect of the work is that it addresses one of the primary goals by clearly demonstrating in Figure 5 the areas of geomorphic change in the upper St. Clair River where change was consistently indicated in their analysis. This is important, because the author shows over and over, various inconsistencies associated with the conclusions drawn from various statistical analyses, leading him to conclude, for example, that "no clear pattern emerges from the data" regarding changes in channel bed volumes. However, Bennion was able to discern some patterns in elevation changes as shown in Figure 5 as well as to show movement of bottom materials. Importantly, Bennion also documents clearly that if one wishes to determine whether or not significant changes in bed volumes occur, then higher resolution datasets will be required, similar to the 2007 dataset. The lower resolution datasets associated with previous measurement campaigns, prior to 2007, were simply not adequate to provide the type of definitive conclusions regarding channel bed volumetric changes sought in this study. This is an important and useful finding to help target future resources.

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

Since the purpose of this study is to determine whether the morphology of the St. Clair River has changed and whether or not zones of active erosion and deposition can be identified, the study hinges upon its findings that: (1) no clear patterns emerged from the analysis of volumetric changes and (2) Figure 5 highlights the areas of consistent changes in channel elevations. Thus the most critical aspects of the work involves the error analyses, comparisons and interpolations performed on the DEM grids. This analysis appeared quite reasonable and generally supports the findings. However, as described below, there are numerous ways in which the author could be more clear in his explanations of the various changes he has observed using summary statistics.

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

Throughout the report, the author uses statistical terms like root mean square error, standard deviation, mean, etc. However, he often uses them too loosely, without defining them clearly. For example, all of these (mean, standard deviation, root mean square error) are statistics of a random variable, yet he often does not state clearly which random variable he is referring to. An example of this is in paragraph 1 on page 6 where Bennion states that 'the root-mean-square error was examined' and then again he states that 'a close relation of the mean standard error value to the root-mean-square error value indicates …'. What I would ask him to clarify is what exactly he is referring to. That is, 'root-mean-square error' of what? Similarly 'mean standard error' of what? I believe here he is referring to the root mean square error associated with the elevation errors and the mean standard error associated with the elevation errors. Note that mean square error of a variable is equal to the square of its standard

error plus the square of its bias. Thus saying that the mean standard error (of the elevation errors) is related to the root mean square error (of the elevation errors) simply implies that the bias is low. Why not just examine bias and say that bias is low. A reading of the report indicates that the author doesn't seem to understand the meaning of these basic statistics, yet he reports them over and over again.

Another example of lack of statistical clarity: page 4, column 1, paragraph 2, "Vertical uncertainty associated with… is assumed to be 0.3 m. " What is this uncertainty relating to? Are you quoting a standard deviation? Here and elsewhere you need to be more clear about what you mean by uncertainty.

All random variables can have a mean, a standard deviation (sometime called standard error), a mean square error, and a root mean square error. So one must always follow those terms by the variable of interest. For example, in Table 5 he reports the mean absolute error and the standard deviation of the errors for the 1-meter DEM's.

Another concern I will raise which is minor here, but I raise it in the hopes that you will do better in the future. This concerns your tests of normality in column 2 on page 5. There you quote several previous studies who have suggested how to test whether a sample is normally distributed. Neither of the methods used are efficient or entirely reliable methods because they do not account for differences in sample size which impact the fit of a normal distribution to data. Instead, a preferred approach is to construct a normal probability plot and to evaluate the linearity of the plot using the probability plot correlation coefficient hypothesis test. This method is outlined in Chapter 18 of the *Handbook of Hydrology*, McGraw Hill, 1993.

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?

Abstract – Bennion says: "and interpolation processes limit the statistically certain results". I suggest he say "and interpolation processes limit the statistical certainty of the results".

Abstract – Bennion says: "within the range of uncertainty associated with the datasets". I suggest he say "within the range of measurement and interpolation uncertainty associated with those methods".

Page 4 – column 1 – paragraph 5 – 'data are predisposed to certain results from comparison". This is very misleading and confusing. Please rewrite.

Page 5 – column 1 – paragraph 1 – please write out the equation for DEMcell size, because your use of square root * (area / # of points) is not at all clear. The * symbol is usually a multiplication symbol, but I don't think you intend that here. Please use a standard equation.

Page 5 – column 1, second to last line, ’10 percent of the original dataset that were withheld’. Please clarify how they were withheld.

Page 5 – column 2, line 6, “allowing the best 95-percent points’. Please clarify what you mean here. What is a ‘best 95-percent point’? This is very nonstandard language. How can one quantile be better than another?

Page 6 – column 1 – paragraph 2, ‘maps of prediction errors’ please clarify. Prediction errors of what?

Page 6 – column 2 – formula for ‘total potential cut/fill error is missing a right hand parenthesis.

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: _____ Date: _____

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.