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Hydrology and Earth System Sciences Discussions

Interactive comment on "Assessment of impacts of climate change on water resources – a case study of the Great Lakes of North America" *by* E. McBean and H. Motiee

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The authors are very grateful for the attentive reading of the paper by the referees and for their comments that raises the quality of the research. In response to the comments by the second referee, descriptions are provided as follows:

- Page 3184 (lines 20-23) ĚĚĚĚ.. : Answer : yes, it's the average depth. This will be mentioned in the revised version of the paper.

- Page 3185, lines 1 through 5 Ě.. :

Answer : The merit of application to the Great Lakes system for the types of analy-

ses presented herein, is that the catchbasin of the Great Lakes is only twice the size of the Lakes. There are no major storage reservoirs impounding water beyond the Lakes themselves and the detention times of the lakes(as per Table 1 are enormous) . Hence, changes in consumptive uses have some influence on the water budget, but the changes in annual flows over the period 1930-1990 are not influenced (to a significant degree) by the land use changes.

- Page 3186, “Global climate change and climate change models”ĚĚ.: . Answer: The authors disagree with the reviewer’s comments in that this paper is not on GCM modeling but instead focuses on measurements and indications of trends over time.

- Page 3187, lines 7 to 10 - are there any more recent references available?.....: Answer :IPCC continues to produce additional documents and the “ paper trail” is a continuation of these findings.

- Page 3187, “3.1 Historical data assembles”ĚĚ:

Answer: The projection of trend was on the basis of historical data for precipitation, temperatures and flows, not on a single dimension. The data were provided over a six decade period, by (NOAA,2004, http://www.glerl.noaa.gov/data/pgs/hydrology.html), The sheer magnitudes of the Great Lakes system is such that seasonality as opposed to annual data is not relevant to the apparent long term trends. Further, if the trends for hydrologic and temperature parameters were different, from one locale to another, then questions of how many gauges were employed would be relevant, however, as apparent from the reported findings, there is substantial uniformity throughout the Basin. The reviewer comments that linear regression was used as a projection method; this method was intended only as “if this condition continues as measured” as a means of comparing with the predictions from the GCMs. There is of course, uncertainty whether the trends apparent over the sixty year history of record used in the assessments relied upon in this paper will continue. The comparison/lack thereof in the scatter from different GCMs (as portrayed in Figures 5(a) and 5(b)) were interesting and informative

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regarding uncertainties in the GCMs projections and that was the primary intent of the depiction. The values listed in Table 8 will only occur in the event of a continuation of the trend over the period 1930-1990, and this may or may not happen. The records gathered for precipitation and temperatures were until 2000, but flow records were over to 1990. To allow comparison over similar timeframes, the records for three parameters were chosen till 1990.

- Pages 3188 to 3193 ĚĚĚĚ.:

Answer : The Mann-Kendall statistics as summarized in Tables 2 through 4 demonstrate the situation of statistical significance of the rates of change (significant for four out of five precipitation records, and three out of four flow records). The R-squared value to which the referee refers, represents variability of the individual data points, not the statistical significance of the trend line. The statistical significance trend lines (F) were calculated for all trends and are in Tables 2 through 4.

- Page 3192 and Figures 5a and 5b. Could the GCM results be updated?.....

Answer: As Mortsch et al. (2005) indicate: there is no comprehensive “best” model for prediction future climate change, or worst scenario or the average. The values employed in Figure 5 were published in Lofgren et al. (2002). The authors have used the recent results of GCMs by Lofgren(2002), and in his scenarios published at that time, the results of HadCm3 were not used. It would be most interesting to determine how updated results from the GCMs will end up plotting in a revised version of Figure 5(a) and 5(b) if the information could be made available.

- Page 3194, lines 10 to 13 : Answer: As indicated above, of interest is the statistical significance of the trend line, and hence use of the Mann-Kendall statistic. The variability of the individual points is relevant to the magnitudes that the precipitation/ temperature/flows demonstrate from year to year, but confidence limits on the individual values would not represent the uncertainty in the trend line. As apparent in Tables 2 through 4, the slopes of the trend line uniformity are highly significant.

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