

## ***Interactive comment on “Investigating uncertainty of climate change effect on entering runoff to Urmia Lake Iran” by P. Razmara et al.***

### **Anonymous Referee #2**

Received and published: 16 April 2013

#### General Comments

Razmara et al. have conducted an interesting modeling study to assess the potential effect of future climate change on the quantity of runoff entering Urmia Lake, Iran. The authors use 10 different AOGCM models generated under two emissions scenarios to project temperature and precipitation changes for a future period relative to a base period. They then downscale the output of these models and model the rainfall-runoff response of the Urmia Lake region under the future climatic conditions using artificial neural networks. In my opinion, the paper does address a relevant scientific question that is within the scope of HESS; however, the motivations for choosing certain methods are not entirely clear, the results are not sufficient to support a full interpretation and substantial conclusions are not reached. In addition, there are major problems with

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language that I feel detract from the overall presentation of the material. I recommend that the paper be returned for major revision before it is considered for publication in HESS. I have divided my comments below into specific comments addressing individual scientific issues and technical corrections. Since there are so many problems with language in this manuscript, I have not conducted a full technical edit and recommend that the authors illicit the help of a native-English editor to improve written fluency.

### Specific Comments

1. The title of the paper is phrased awkwardly and doesn't clearly reflect the contents of the paper. I suggest revising it accordingly.
2. The abstract would benefit from a sentence or two giving a general description of changes in the water balance of the lake that have already occurred and why. The sentences on lines 3-5 are too vague in this regard.
3. The abstract would also benefit from a final sentence or two describing the major implications of the results with respect to water resources in the region.
4. I find the first two paragraphs of the Introduction section to be focused much too broadly. I suggest focusing more on hydroclimatic trends in the Urmia Lake region and how these have affected water resources in the region. Has the water balance and hence the area of the lake been changing? If so, why? Has the causeway across the lake contributed to this? Be more specific about any anthropogenic activity in the watershed that might be contributing to the changes. The authors should also describe how changes in the water balance of Urmia Lake have, and might further, affect the local ecosystem (e.g. water chemistry and water quality, fish and wildlife habitat).
5. Much of the literature review in the Introduction section (P2183, L24 to P2186, L2 and P2186, L11 to P2186, L23) reads like an annotated bibliography. It is unclear to me how the results of these other studies build a foundation for the current study. I think that this section could be reorganized around themes that are relevant to Urmia

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Lake, for example, hydroclimatic trends and modelling efforts in other arid regions, application of future climate projections to runoff predictions, and uncertainty in the commonly used methods.

6. The authors should state in the Introduction what previous hydroclimatic related research, if any, has been conducted for this region. Is this the first study?

7. In section 2 Characteristics of the region, the authors state that the lake has a “... four hundred thousand year precedence.”? If you mean that the lake has been in its current location for that long, you will need to provide some sort of evidence and reference to other work.

8. The first two sentences of section 2 could be moved to the Introduction (see comment 4).

9. There are several problems with Figure 1. Firstly, the figure panels are too small and it is very difficult to make out the station labels and the names of adjoining countries. Secondly, the authors should mention in the caption that hydrometeorological and rain gauge stations are marked on the map. Thirdly, it may be easier for the reader to get a sense of the runoff inputs to Urmia Lake if only the major inflowing rivers were marked and not all of the lower order streams. Lastly, in the panel showing all of Iran, it is unclear what the boundaries and colors represent. I presume they are other watersheds and if so, this should be mentioned in the caption.

10. The last three paragraphs of section 2 on page 2188 seem like they should fall under the Methods section.

11. Define the base period in the caption for Table 1.

12. Most of section 3.1 seems like unnecessary information. A reader could easily look up the basics of GCMs. What I would prefer to read about in this section is why the authors chose the 10 AOGCMS used in this study.

13. In section 3.2, I would like more information on why scenarios A2 and B1 were

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chosen for this study. Are they particularly suited to the future development plans of the Urmia Lake region?

14. In section 3.3.1, explain why you use the ‘change factor downscaling’ method.

15. In section 3.3.2, it is unclear why the authors have chosen 25, 50 and 75 % risk probabilities. Is this standard practice? Does it have some relevance to decision-making?

16. In section 3.3.3, a lot of space is devoted to explaining statistical hypothesis testing (e.g. P2192, L1-9). I don’t think that this information is necessary as the reader can easily look up more information independently if required. The authors should simply state which statistical tests were conducted (including the chosen p level) and why. They should also state what software was used for the analyses.

17. I question whether or not the first two paragraphs of section 3.4 are necessary. I think the authors could revise this introduction to ANN by focusing more on why it is an appropriate method for this study.

18. Table 3 isn’t really a table (no rows and columns), just a list, and does not seem necessary. Could this information be quickly summarized in section 3.4?

19. On P2195, L4 of section 3.4, please clarify what the “(5,3,1)” represents.

20. On P2195, L6 of section 3.4, it is unclear what “Elman” means.

21. In section 4.1, the authors should state why the predetermined p-value is 1 and not 0.05, which is more often used.

22. Figures 2 and 3 are both too small and the labels are difficult to read. In both figures, the red titles should be removed and all information about the plots should be moved to the captions. Also, I suggest that the boxes for the 25, 50 and 75 % levels should be given a unique colour instead of labeling them on the cluttered x-axis. Lastly, both figures would benefit from a thin horizontal line being added at the 0 mark, so that

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the changes in temperature and precipitation can be more easily interpreted by the reader.

23. In the second paragraph of section 4.1, I find the author's description of Figures 2 and 3 confusing. In the text, they refer to the median temperature change, but the figure titles refer to the mean. I also find the phrase "mean of maximum temperature changes" confusing. I think the clarity of this whole paragraph (P2195, L19 to P2196, L6) needs improvement.

24. In section 4.1, the authors mention that the % change in precipitation was estimated for Jul-Sept (P2196, L21-25), but they do not say how. This should be mentioned here or in the methods.

25. The axis titles and labels in Figure 4 are too small. The x and y axis titles are also very vague... make them more specific. I also suggest that the two lines have different colors and be properly labeled in the legend.

26. Label the two panels in Figure 5 with an "a" and "b". Superscript the "3" in the y-axis units. Label the "future period" and "base period" data in the legend.

27. The Discussion section of the paper is very weak and needs to be entirely rewritten. Currently, the first paragraph summarizes the methods, and sections 4.3.1 to 4.3.3 summarize the results. There isn't really a discussion of the results at all. I think it would be interesting if the authors could take the modeled runoff data and use it in a future mass balance calculation to determine how the water level of the lake will be affected under the two scenarios. Then the discussion could focus more on the implications of changes in water level to the local ecosystem.

28. The discussion of uncertainty in the model output, which takes up most of the Conclusions section, should be moved to the Discussion section. The implications of the uncertainties for decision-makers should be discussed.

29. From some related reading I have done on Urmia Lake to familiarize myself with the

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region, I understand that a causeway was built across the lake, effectively separating the basin in half with minimal water flow between the halves. If this information is correct, I think that the authors should discuss how this will affect predicted changes in water level, i.e. are runoff inputs to either side of the causeway equal? If not, will both sides of the causeway respond similarly?

30. The Conclusions section should summarize the main findings and implications of the study, which it currently does not.

## Technical Corrections

P2183, L2-3: Change “... water surface...” to “... water surface area...”.

P2183, L8: Change “... while simulating for the runoff, the artificial neural network was applied” to “... and runoff simulations were conducted using artificial neural networks.”

P2185, L4-7: The sentence “Hence, contrary to the increase... decline in water level of the lake.” is too long and very awkward. It should be revised.

P2186, L4: What is meant by “... the uncertainty of the phenomena...”?

P2186, L24-29: The language in this section is very awkward and needs to be clarified. What is meant by “... one could survey more attractively the situation of Urmia Lake.”

P2187, L5-10: Sentence is too long – split it up.

P2187, L6: Change “...entering runoff to Urmia Lake in...” to “... runoff entering Urmia Lake during...”.

P2187, L11: “Having water resources in the environment...” is too vague. Please rephrase.

P2187, L18: Change “The area differs...” to “The surface area of the lake differs...”.

P2187, L18: The word “thriving” does not seem appropriate here. Perhaps just use the term “wet”.

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P2187, L20-21: Change “... a sign of...” to “... and is classified as...”.

P2188, L2: Change “... in the lake...” to “... for the lake region...”.

P2188, L2: Change “... the completed information of...” to “... data from...”. You should also specify the time interval of the data.

P2188, L5-12: This section contains major problems with language and hence is very unclear. Please revise with the help of a native-English editor.

P2189, L5: Remove “finally”.

P2189, L20: What is meant by “... with no clear-cut way of determination...”?

P2190, L7: Add a “the” to “One of \_\_\_ vital constraints...”.

P2190, L8-9: “Therefore the results should be improved as regards locality and time.” is awkwardly phrased. Please revise.

P2192, L18: Change “performed” to “applied”.

P2193, L3: Define the ANN acronym before using.

P2193, L3-4: “ANN is a strong implement...” doesn’t make sense. Please revise.

P2193, L11: Replace “... is started on.” with “... begins.”

P2193, L11-12: “In this stage, the parameter... be close to the observed flow.” is awkwardly written. Please revise.

P2193, L13: Replace “is taken” with “deemed”.

P2194, L13-15: “Of important steps... to be modeled by the networks.” is awkwardly phrased. Please revise.

P2194, L24: Replace “... constitutes of inputs such as...” to “... contains the following inputs:...”.

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P2195, L19-21: “According to the acceptable... are obtained Figs. 2 and 3.” is awkward and missing words. Please revise.

P2197, L27: Define MAE and RMSE, unless HESS guidelines state otherwise.

P2197, L2-3: “For this reason... proper function in simulation.” is awkwardly phrased. Please revise.

P2197, L6: Change “... (left and right)...” to “... (Figure 5a,b)...”. Label the panels in Figure 5 accordingly.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 2183, 2013.

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