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Hydrology and Earth System Sciences
Discussions

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

P. Razmara et al.

parisa.razm@gmail.com

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Dear Referee #2,

The authors wish to thank the reviewers for their accurate and constructive comments on the manuscript entitled "Investigating Uncertainty of Climate Change Effect on Entering Runoff to Urmia Lake IRAN ". Most of the revisions in the article have been performed in the following sections:

I: Abstract and Introduction sections were modified and innovations were highlighted.
II: The language of the text has been revised and many parts were rewritten.

III: The methodology of the paper was rewritten for sake of more clarity.

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IV: In the Results and Discussion section, more interpretations were added. Moreover, the results were explained with more clarity.

V: Tables and figures were upgraded according to referees' comments. VI: The response to each referees' comments were carefully prepared as attached. The revised paper is also attached for further consideration.

Response to Referee 2: All specific comments were incorporated into the revised paper.

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.

Answer: The title of paper was changed to: "Risk assessment of climate change impacts on runoff for Urmia Lake Iran"

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.

Answer: Ok, the below sentences were added. In the past 17 years, the lake's water level has decreased to 1271.06 meter, down from 1278.4 meter in 1995. The most important reasons for the loss of water level are climate change and droughts, increased area of agriculture, overuse of surface water resources, and dam construction.

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.

Answer: Ok, it was done.

4. I find the first two paragraphs of the introduction section to be focused much too broadly. I suggest focusing more on hydro climatic 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

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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).

Answer: Two paragraphs at the start of introduction were summarized. Climate change investigations are divided into three parts: (a) Definition of climate change in the past durations and their reasons. (b) Investigation on the effects of climate change and present of consistency solutions. (c) Mitigation for reduction in green house gases. Meanwhile the study of climate change definition and the reasons for runoff change in the past are important, but in the second part of this study we have paid attention to this subjects and our aim have been the study on the effect of increase in green house gases on runoff. While other factors including bridge, change use of lands and unlimited use agricultural farms affect on this subject. 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 Lake, for example, hydroclimatic trends and modeling efforts in other arid regions, application of future climate projections to runoff predictions, and uncertainty in the commonly used methods.

Answer: Our aim in this study was not presentation of a solution for Urmia Lake problem. When we have access to data of this lake in Iran, we selected it as a case study. So the whole of literature review have been discussed about the history of formation and extend (positive and negative points) of different methods and finally concluded.

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

Answer: Ok, in the introduction section was added other researcher works in Urmia Lake.

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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.

Answer: I didn't find English website about that precedence but in Persian (local) site this is written. If this information is unnecessary, I'll delete these sentences.

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

Answer: Ok, it was done.

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 hydro meteorological 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.

Answer: The figure was corrected and has been shown again. The hydro meteorological and rain gauge stations are mentioned in the caption and all of your comment was noticed.

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

Answer: Yes, it was moved.

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

Answer: It was corrected. 1961-1990

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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.

Answer: Some of non-important sentences in section 3.1 were deleted. The first reason for usage of ten AOGCM models is a need for the most number of cases to access the uncertainty and also we had access at most only to ten models among AOGCM models.

13. In section 3.2, I would like more information on why scenarios A2 and B1 were chosen for this study. Are they particularly suited to the future development plans of the Urmia Lake region?

Answer: No, these scenarios are not local, but they are global. Due to limits arising from the high cost of creating such scenarios, This study has tried to use a high emission scenario (A2) and a low emission scenario (B1) to model future temperature and rainfall in each of the ten AOGCM models.

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

Answer: Because the LARS-WG model needs to use the change factor method first and after that introduce to this model.

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?

Answer: There is not a standard level for risk. Probability levels of 25, 50 and 75% were chosen in this study because it was not possible to use continuous data as input file. Dependent to the kind of decision that decision makers want, they will state what risk levels presume for the future. The higher level of risk means the higher level of danger in future.

16. In section 3.3.3, a lot of space is devoted to explaining statistical hypothesis testing

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(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.

Answer: ok, the content of this section was summarized and "p-value" is given by LARS-WG software that we compared them.

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.

Answer: The comments of this section in manuscript were summarized. The reason of use ANN to simulate runoff is that this method is a statistical method for simulation of runoff with incomplete data and information rather than other physical models and the results of these models with high accuracy are acceptable.

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?

Answer: Table 3 was deleted. This information was added to section 3.4.

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

Answer: a neural network is characterized by its architecture, which represents the pattern of connection between nodes, the method of determining the connection weights, and the activation function (Fausett, 1994). (5,3,1) is the final network architecture of ANN model that was selected. This means that it has 5 input variables (including precipitation in present month, precipitation in last month, temperature in present month, evaporation in present month and runoff in last month), 3 hidden layers and one output parameter (Runoff for t month), By this way, we got best results. 20. On P2195, L6 of section 3.4, it is unclear what "Elman" means.

Answer: In artificial neural networks there are different ways to educate that their differ-

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ences are in neuron connectivity conditions, hidden layers, feedback kind etc. among them we can consider Elman network, etc. For instance Perceptron , feed-forward, back propagation , Elman , . . .

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.

Answer: Because p-value=0.05 is often used frequently, so we used 0.05 and all of 0.01 in this section was changed to 0.05

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

Answer: Figures 2 and 3 were drown again.

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.

Answer: Ok, it was corrected.

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.

Answer: The method of assessment for change in precipitation was similar to other months (by the following formula), but since the precipitation amount had been less in

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the July-September, the change in precipitation has been untrue very much that has been deleted in the calculation.

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.

Answer: Figure 4 was drawn again.

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.

Answer: ok. This figure was corrected as you asked.

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.

Answer: Ok. This section was revised.

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.

Answer: Ok, it was done.

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

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water level, i.e. are runoff inputs to either side of the causeway equal? If not, will both sides of the causeway respond similarly?

Answer: The topic of our paper is only investigation of climate change effect on water level of Urmia Lake and other reasons like building causeway, high demand of water, agricultural, Dams, etc have not involved in our study. . 30. The Conclusions section should summarize the main findings and implications of the study, which it currently does not.

Answer: Ok, the conclusions section was revised.

Technical Corrections

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

Answer: Ok.

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

Answer: Ok.

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.

Answer: Ok, it was corrected.

P2186, L4: What is meant by "... the uncertainty of the phenomena..."? Answer: phenomena are changed to event.

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?"

Answer: The sentence was changed to " an investigation into the future status of Urmia Lake is vital".

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

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Answer: Ok. It was done.

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

Answer: Ok.

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

Answer: Urmia lake basin has many water resources and a valuable environment, so it has been considered the worthiest aqua system around Iran's safeguarded ecosystems from 1963.

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

Answer: Ok.

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

Answer: Ok.

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

Answer: Ok.

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

Answer: Ok.

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

Answer: Ok. The time interval of the data is annual. Below sentences was added to the text. To determine average annual precipitation for the lake region, data from 15 stations was used, employing GIS software and Polygon Thiessen method in the

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period 1961-1990.

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.

Answer: Ok, it was revised.

P2189, L5: Remove “finally”.

Answer: Ok.

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

Answer: It was revised. Please see the manuscript.

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

Answer: Ok.

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

Answer: Ok. Therefore it is necessary to correct results by spatial and temporal.

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

Answer: Ok.

P2193, L3: Define the ANN acronym before using.

Answer: Ok. ANN is Artificial Neural Networks.

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

Answer: This sentence was deleted.

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

Answer: Ok.

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

Answer: In this stage, the parameter values are varied by trial and error until the simulated flow nears the observed flow.

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

Answer: Ok.

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

Answer: The selection of inputs is an important step through the designing of neural networks.

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

Answer: Ok. It was done.

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

Answer: Please see the revised paper.

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

Answer: RMSE and MAE were defined in the bellow of the Eq. 7.

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

Answer: It was corrected.

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

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Answer: Ok, the figure was corrected.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/10/C2778/2013/hessd-10-C2778-2013-supplement.pdf

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

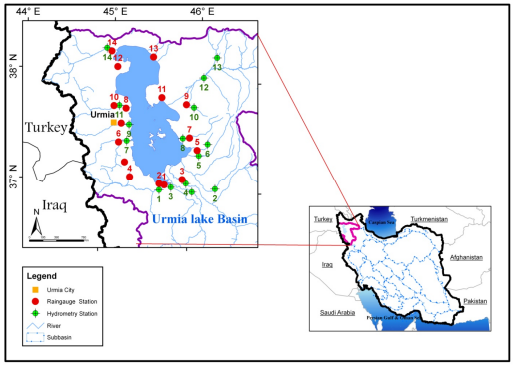

Fig. 1.

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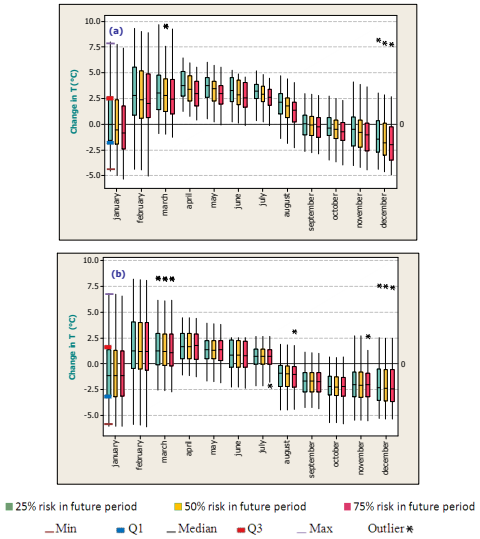

Fig. 2.

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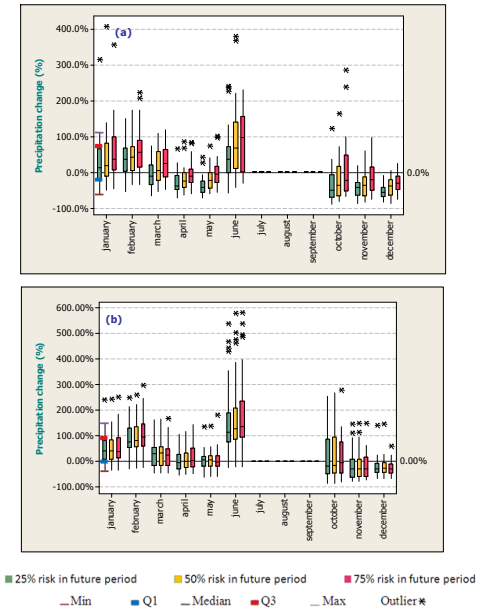

Fig. 3.

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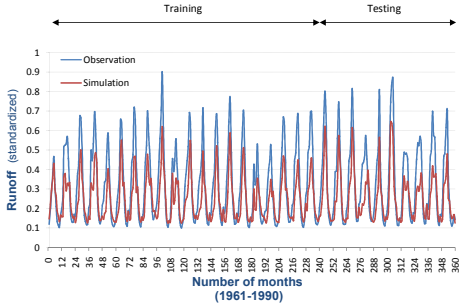

Fig. 4.

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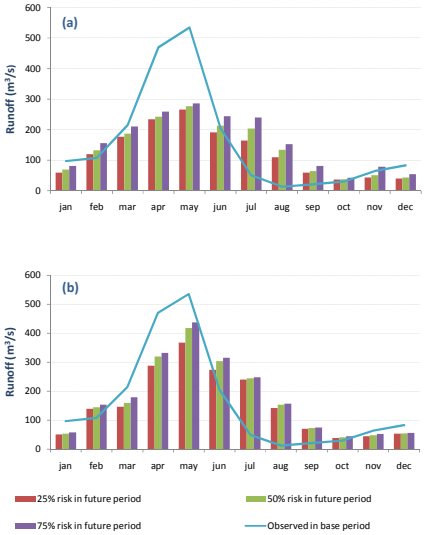

Fig. 5.

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