

Ref: doi:10.5194/hessd-10-1-2013

Title: “Comprehensive evaluation of water resources security in the Yellow River basin based on a Fuzzy Multi-Attribute Decision Analysis Approach”

Authors: .K. Liu, C.H. Li, Y.P. Cai, X.H. Xia, and M. Xu.

We thank the reviewer of our above-referenced manuscript. The following letter gives our responses to the comments.

Point-by-Point Responses to the Reviewer’s Comments

The responses is based on “hess-2013-578-discussions-typeset_manuscript-version3” and revise them in the revised manuscript.

For review 1#

1. The authors gave a detailed indicator system and their corresponding explanations for water resources security evaluation as Table 1 shows. Although there are a great many indicators, more explanation on how/why to choose these indicators should be added in the text.

Response: we agree the reviewer’s suggestion and have added the explanations on how/why to choose these indicators in the revised manuscript. In fact, in Table 1, the indicators (D) have been clarified in detail. Also, indicators at level D have been used for justifying and further describing those ones in the upper level (i.e., C).

2. How to determine the standards and the weights of each indicator? Need more explanation.

Response: We much appreciate the reviewer’s comment. In Page 7, line 3-10, we have stated determination of the standards and the corresponding weights. The evaluation criteria in the Yellow River basin were set up mainly based on the corresponding national data as a benchmark. The main references for determining the criteria mainly include statistical data, relevant standards, technical reports, as well as the delivered research results. Specifically, in this paper, five interval evaluation criteria have been formulated, followed by absolute security, security, critical security, insecurity and absolute insecurity. Based on the above-mentioned evaluation criteria, the standards of the evaluation system were determined (Table 2). In terms of weight determination (Page 7, line 10-13), we adopted fuzzy analytic hierarchy process (FAHP). Also, the calculation steps were the same as the one in the evaluation process

of water resources security in the previous section. The weights of indicators were also obtained which were shown in Table 3.

3. More advantages of FMADAA should be added in the text.

Response: Since Multiple Attribute Decision Making (MADM) aims to identify the best alternative for decision-makers, it can also be used to deal with many other decision-making problems. That is to say, various alternatives can be ranked according to multiple certain criteria. In this research, Fuzzy Multi-Attribute Decision Analysis Approach (FMADAA) was developed based on the extension of the conventional MADM methods. It was effective for supporting decision-making under multiple criteria. Because ranking results of different methods are inconsistent in practical application, the results of each method were also integrated in FMADAA which enhanced rationale and applicability of the evaluation results. In addition, fuzzy information that was usually encountered in practical evaluation process has also been tackled through the adoption of FMADAA. Thus, the developed method can highly improve the previous methods in terms of applicability and uncertainty reflection.

4. The authors adopted many methods in this paper. Suggest a figure that can summary these methods and their corresponding use to make the idea of evaluation clear.

Response: Thanks for the suggestion; we give the summary of the methods in the revised manuscript in Table 9. Also, results of Copland method were presented in Fig.4.

5. Improve the overall quality of this paper. There are many long sentences that make them vague to understand.

Response: Thanks for your suggestions, we have improved the manuscript. We have made great efforts in revising the original manuscript.

For reviewer 2#

Specific comments:

1. According to the security results, it is better to give detailed countermeasures for each province, and tell basin manager to improve what indicator data.

Response: we agree the suggestion and have added the detailed countermeasures for each province according to the assessment results and their evaluation indicators. For example, water resources security evaluation condition is relatively poor in Shanxi, Inner Mongolia and Ningxia provinces. In Table 10, the indicator values of water resources stress system were smaller in the three provinces, reflecting that in the stress system, water resources stress was relatively high. Meanwhile, indicators in water resources and Water Eco-environment states of the state and socio-economic response

systems were even worse in Shanxi province. Thus, the stress indicators were reduced, and the beneficial indicators for security were improved. From page 19, line 27 to page 20, line 7, we could thus inform the manager how to improve the security indicators.

2. The manuscript uses some methods; pls tell us their advantages for the evolution.

Response: thanks, we will add the advantages of the main methods in the revised manuscript.

Technical corrections:

1. Pls think about the word use, for example, “index” , “indicator”.

Response: we will unify them in the manuscript. In page 6,line 16 and line 23, “index” is revised to “indicator”.