# Response to Reviewer 2

Thank you very much for your excellent comments on our manuscript. We have carefully considered the comments and have modified the manuscript accordingly. The comments and detailed responses can be summarized as follows:

1 **Comment:** A slight disappointment is to see the Montana (Tennant) method applied to a Chinese river, to set limits for certain e-flows. How do you now that Montana water level will be relevant to this Chinese river? They should be calibrated first. I suggest that the authors reconsider the justification for using the Montana method, or at least provide some evidence that the rules are relevant.

**Response:**

1) The State Environment Protection Administration of China (2006) has offered official guidelines for environmental flow assessment, called "technical guidelines for environmental impact assessment for ecological water usage, low temperature water and fish habitat facilities in the hydraulics projects (in Chinese)". In the guidelines, Montana method is recommended for the determination of seasonal environmental flows. In addition, in the Comprehensive Water Resources Planning for Hai River Basin by Hai River Water Commission, Ministry of Water Resources of China (2008), Montana method was also applied to determine the environmental flows. Our study case, the Wangkuai Reservoir, is in the Hai River Basin, and thus we also applied Montana method in this paper.

2) The main purpose of this paper is to develop a hydropower portfolio optimization method to sustain environmental flows. Checking the suitability of Montana method is not a key research point. Thus, we applied the simple and widely used Montana method for a preliminary estimation of the e-flows. If Montana method is testified not suitable for the environmental flow determination in some rivers, the researchers can replace the Montana method by other methods, and can also apply the reservoir operating rules designed in this paper to sustain the environment flows.

As suggested, to clearly explain the reasons why the Montana method is applied in this paper, we used the following sentences in the new manuscript:

*Tennant method was recommended for e-flow assessment in the "technical guidelines for environmental impact assessment for ecological water usage, low temperature water and fish habitat facilities in the hydraulics projects" by the State Environment Protection Administration of China (2006), and was applied by the Haihe Water Commission (2008) for the Hai River basin. Accordingly, the wet season e-flow was set at 30% of average daily flow (ADF), and the dry season e-flow was set at 10% ADF.*

2. **Comment:** The sentence in line 1 on page 3, "However, none of the previous research considered the need to protect riverine ecosystems", seems to be too absolute. Some existing literatures have already considered the constraints of environmental protection on hydroelectric dams from an economic perspective (See in reference: (1) Kotchen et al., 2006. Environmental constraints on hydropower: an ex post benefit-cost analysis of dam relicensing in Michigan. Land Economics, 82(3), 384-403.; (2) Castelletti et al., 2008. Water reservoir control under economic, social and environmental constraints. Automatica, 44(6), 1595-1607.) The authors may draw a similar conclusion from the perspective of the hydropower producers.

**Response:**

As suggested, the sentence has been replaced by the following one:

*However, none of the previous research on hydropower portfolio optimization considered the need to protect riverine ecosystems.*

3. **Comment:** The description of line 10-18 on page 4 is questionable. In line 12, the authors said that "Day-ahead and real-time balancing markets are also called spot markets", while in line 17 they said "The trading power volume and price will not change in a spot market". The spot market includes the real-time market. I don't think the trading power volume and price in real-time market don not change.

**Response:**

Owning to the reminder of the reviewer, we also realize the mistake. These sentences are corrected as follows:

*In a bilateral contract, the trading power volume and power price are designed by the power producers and grid companies, and will not change during the contract period.*

4. **Comment:** In section 2.2.3, the D D0 is reasonable to act as the constraint. But why is it that the designed e-flow no more than the actual reservoir water releases (Rkj EFkj) is used as the constraint?

**Response:**

It was a slip of the pen. It should be $R_{kj} \geqslant EF_{kj}$. We have corrected it accordingly.

5. **Comment:** In section 2.2.1 Range of variability approach, the variable G is the number of hydrological indicators. Is it equal to 32? Please give a clear definition.

**Response:**

Yes, G is equal to 32. We have added this information in the new manuscript.

6. **Comment:** There are some errors in detail as following: 1) On page 4, line 13, the first letter of the two words “Participants In” is capitalized at the same time. 2) On page 5, line 29, the sentence “However, the two objectives are in conflict and cannot be achieved simultaneously; a typical multi-objective problem.” is not a complete sentence.

**Response:**

The “Participants In” is correct to “Participants in”. The sentence has been has been modified as follows:

*However, the two objectives are in conflict and cannot be achieved simultaneously, which is a typical multi-objective problem.*

7. **Comment:** Variables representation is not consistent in whole manuscript. 1) On page 7, line 1, the variable of “Dm” should be written in italic type; 2) On page 7, line 2 and line 4, the letter m of “mth” should be written in italic type; 3) On page 7, line 10 and line 12-13, the letter “G” and “D” in all three places should be written in italic type 4) On page 8, line 6, the variable of “PCkj” should be written in italic type.

**Response:**

We have corrected these errors following the comment

8. **Comment:** Line 15-18 on page 15, the format of the Acknowledgement section is not alignment on both ends.

**Response:**

We have corrected these errors following the comment

9. **Comment:** The reference style is not inconsistent. 1) On page 15, line 24, the reference is not complete for lack of a full stop. 2) On page 17, line 16, the “Regulated Rivers: Reaserch & Management” should be written as “Regul. Rivers: Res. Mgmt.” for short. 3) On page 17, line 7, the reference is in wrong format and should be modified as “Eichhorn, A., Heitsch, H., and Römisch, W.: Scenario tree approximation and risk aversion strategies for stochastic optimization of electricity production and trading, in: Optimization in the Energy Industry, Springer Berlin Heidelberg, 321-346, 2009.” 4) On page 17, line 16, the reference is in wrong format and should be modified as “Fleten, S. E., Wallace, S. W., and Ziemba, W. T.: Hedging electricity portfolios via stochastic programming, in: Decision making under uncertainty, Springer Verlag, New York, 71- 93, 2002.” 5) On page 18, line 4, the magazine name should be modified as “The Electricity Journal” not “Electricity Journal”.

**Response:**

We very much appreciate the careful review and detailed check by the reviewer.

We are sure the check of the references has spent the reviewer much precious time. Thanks very much. All these detailed errors have been corrected accordingly.