Response to Referee # 2:

Anonymous Referee #2

Received and published: 27 February 2013.

The authors appreciate the referee # 2 for giving us the constructive suggestions to improve the quality of the paper. In the revised version, we have modified the details according to the referee's comments. Please refer to our responses for the details given below.

The following is a point-to-point response to the comments.

General comments:

This paper presents a hydrological modeling application. The emphasis is mainly on results rather than describing the modelling approach of wetlands and although there seems to be a fair amount of calibration parameters they are unfortunately not adequately discussed. Moreover, the paper does not provide enough information on the calibration procedure. Although it is a relevant paper, it would greatly benefit of an upgrade based on the following comments.

[Response: Thanks for the positive comments. We are very sorry for the unclear specific expressions. The referee's opinions have inspired us, and we supplement the discussion of the modeling approach, calibration parameters and calibration procedure]

Specific comments:

(1)The introduction is clear, but I am not sure the authors can say that hydrological modelling is the only way to understand wetlands (line 20 p.14037), they should never forget that field data is always welcome to corroborate the concepts supporting the modeling exercise (line 15 p.14038)…

[Response: Thanks. We agree with this comment. The hydrological modeling is not the only way to understand wetlands and the field data are important for the modeling system. The meaning of the sentence (line20 p14037) is the hydrological modeling is one way to understand wetlands, not the only way. Considering the confusing expression, the word "alternative" is deleted.]

(2)Is the word «rolling »(line 4 p. 14039) appropriate? Please substantiate the following statement with numbers: «Annual streamflow of the study area decreased since 19

70s, affected by the climate change and the human activities ».

[Response: Thanks. According to the referee's opinion, we reconsider the word "rolling", and ascertain the appropriateness of the word. In previous papers, the word "rolling" had been used in the description of the topography (see http://www.upwcwatershed.org/PDFs/Topography.pdf). The detailed presentation with number which substantiated the statement is added in the last of section 2.1.]

(3)(Line3p. 14041): Can a 30m resolution DEM be qualified as a «High resolution Digital Elevation Model »? I do not think so.

[Response: Thanks. A 30m resolution DEM can't be a high resolution DEM, but in Zhalong Wetland the 30m spatial resolution DEM which was created by using 3229 elevation points and contours extracted from 1:10000 topographic maps in this paper can satisfies the resolution needed in the plain area and is relatively high resolution DEM in the data which are available for the study area.]

(4)(Line 15 p.14042): Is the modelling work inspired by other studies? As we know SWAT provides a modeling framework for wetlands.

[Response: Thanks. SWAT indeed provides a module for wetlands, but SWAT treats wetlands as water bodies within subbasins and allows only one wetland to be modeled for each subbasin, which does not consider the unique hydrological characteristic of wetlands and flow exchanges between wetlands and river channels. Considering the above reasons and complexity of Zhalong Wetland, the modeling system is founded inspired by the "Hydrologic Equivalent Wetland (HEW)" concept in the study of Wang et al. (2008). This paper is cited and presented in manuscript.]

(5)There is not any reference citations in this section, this is strange, Do the authors use the wetland equivalent concept to conduct their modeling exercise? I would assume they do, but unfortunately there are silent about it.

[Response: Thanks. We are very sorry for the fault. We surely used the wetland equivalent concept to conduct our modeling system, and added the reference.]

(6)How do you estimate the depth of a wetland (line 15 p. 14043) (« Individual wetland water area, water depth and storage were determined by the DEM and ArcGIS analysis »). This is too vague; please further detail your modelling approach and parameterization framework. .

[Response: Thanks. The detailed descriptions of the modeling approach and parameterization framework are replenished. The water depths of the wetlands within the same HRU were identical, which is acquired by statistical analysis of DEM. The water area and water volume were estimate by the ArcGIS 3D analyst module (Surface Analysis-Area and Volume tool).]

(7)(Line 21 p. 14043) «A parameter was used to determine the proportion of the open wetland and closed wetland in the HRU wetland », How did you determine this parameter?

[Response: Thanks. The initial value of the proportion of the open wetland and closed wetland in the HRU is specified as 0.5. The proportions are adjusted in the model calibration process.]

(8)(Line 22p.14043) "The open wetland was defined as having an outlet and would spill when the storage of the open wetland exceeded a spillage threshold that was equal to a fraction of total storage without an outlet". How did you estiamte this fraction?

[Response: Thanks. We are very sorry for the improper expression. The sentence is revised as "The open wetland was defined as having an outlet and would spill when the storage of the open wetland exceeded a spillage threshold. The spillage thresholds were estimated by the ArcGIS 3D analyst module (Surface Analysis-Area and Volume tool) using the threshold of the water level in each HRU wetland.]

(9)(Line 12 p.14044) «Water flows were routed into wetlands through drainage channels, using a user defined fraction of inflows ». How did you estimate this fraction?

[Response: Thanks. The fractions of inflows were estimated according to the length of drainage channels and monitoring data from Qiqihar Hydrology Bureau. The fraction of inflows is inversely proportional to the length of drainage channel in corresponding HRU.]

(10) (Line 5 p.14045) How did you calculate the «outflow coefficient »?

[Response: Thanks. The outflow coefficients were defined artificially on the basis of the melting condition of snow and ice. According the different temperature of each month, the different outflow coefficients were defined. In our study, the outflow coefficients during December to March next year were defined as 0, because of the total freezing. The outflow coefficients during June to September were 1.0, and the outflow coefficients

of other months were between 0.3-0.5.]

(11)(Line 15 p.14045) What do you mean by: «and the confirmations of wetland-related parameters »?

[Response: Thanks. The meaning of confirmations of wetland-related parameters are that the assignment of wetland parameters which are listed in the last part of the paragraph. The wetland-related parameters include the fraction of wetlands on each HRU, fraction of closed wetland an open wetland, surface area of wetlands at maximum water levels, storage of wetlands, seepage coefficient and so on.]

(12)(Line19 p14045) «confirmed by ARCGIS spatial analysis of high resolution DEM». How did you do that?

[Response: Thanks. The water area and water volume at maximum water level were estimate by the ArcGIS 3D analyst module (Surface Analysis-Area and Volume tool).]

(13)(Line 10 p.14047) «Overall, the model better simulated the streamflow in the Zhalong Wetland, and would be a useful tool for the hydrological study in data limited wetlands». Better than what?

[Response: Thanks. The evaluation indices of the model mainly include PV, E_{ns}, and R^2 in our paper. According to Wang and Melesse (2005), the simulation has a "good" performance when PV is greater than 0.80. Meanwhile, we analyzed the cause of relatively poor performance during the validation period, comparing with the calibration period. Then we concluded that the model had a good performance in simulating the streamflow in the Zhalong Wetland. The meaning of word "better" is relatively well or properly.]

(14)(P.14047 dernier paragraph) The authors refer to one or other applications. This is not clear, please provide further explanations and/or details…

[Response: Thanks. The further explanations are added.]

(15)There is not any figure supporting the validation exercise, this is a weakness of the paper.

[Response: Thanks. The suggestion is implemented. The figure supporting the validation exercise is added.]

(16)(Line 1p.14048) «Comparing the simulated water area with the results of image interpreta tion (Zhao et al., 2009; Gong et al., 2010; Tong et al., 2008), there were less differences in the

water area ». This is not clear, please provide more information. Is there a satellite image bac king up this statement, please provide further details.

[Response: Thanks. In our paper, we compared the simulated water area with the results of satellite image interpretation (Zhao et al., 2009; Gong et al., 2010; Tong et al., 2008). The satellite images are the Landsat TM images of 8 periods during the period of 1986-2002. The further details are replenished.]

(17)Figure 7, I think there is a need to comment the variaitons between subwatersheds. Why are not the results of SUB8 as good as the others?

[Response: Thanks. We agree with this comment. The reason that the results of sub8 are not as good as the others is added in the second paragraph in section 5.4.]

(18)(Line 14 p.14050) «In this study, a wetland module was developed and incorporated with the SWAT model». Please provide a figure illustrating the flowchart of the wetland module. This description falls short and leaves the readers with too many unfulfilled descriptions that strongly weaken the paper.

[Response: Thanks. The flow chart of the wetland module is provided in section 3.2.3.]

(19)(Line 20 p.14050) «The simulation results show that model with the modified module has a good performance in simulating wetland hydrological processes ». The authors should also specify that the model did not perform well for the validation exercise.

[Response: Thanks. The model also has a good performance during the validation period, according to the research of Wang and Melesse (2005) that the simulation has a "good" performance when PV is greater than 0.80. Meanwhile, we analyzed the cause of relatively poor performance during the validation period, comparing with the calibration period in section 5.1.]

Finally, once again we appreciate you for your good and comprehensive comments. The revisions according to your comments really make this manuscript improve a lot. Thank you!