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Hydrology and Earth System Sciences Discussions

Interactive comment on "Integrated hydrological modelling of small- and medium-sized water storages with application to the upper Fengman Reservoir Basin of China" *by* C. Zhang et al.

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Comment 1: The authors have to state more clearly the differences between the original SWAT2005 model and your version and provide the intuitions for your improvement. I would like to see if your version has always a better performance than the original one. If yes, explain why. If no, identify conditions under which your version is better or provide intuition to explain why.

Response: As suggested by the reviewer, we have added more explanations below to the first paragraph of the Conclusions Section in the revised manuscript: "The dif-

ferences between the original SWAT2005 model and the improved SWAT2005 model are summarised as follows: (1) a realistic representation of the relationships between the water surface area and volume of each type of water storages, ranging from small-sized ponds for water flow regulation to large- and medium-sized reservoirs for water supply and hydropower generation, (2) water balance and transport through a network combining both sequential and parallel streams and storage links, and (3) calibrations for the physical parameters and then the human interference parameters. The improved model could have an obvious better performance than the original one in flood seasons and in the basins where water storages are the main human activities. Due to the obvious streamflow relationships among water storages in flood seasons and the neutralized influence of water storages in the basins with complicated human activities, water balance and transport through a network combining both sequential and parallel streams and storage links within the improved model would give better performance in flood seasons and in the basins where water storages are the main storages."

Comment 2: The authors use four hydrologic stations to validate the performance of the improved SWAT2005, and the results indicate that the precision of monthly streamflow simulation at the four hydrologic stations could be improved by the improved SWAT2005. However, the results only indicate that the improved SWAT2005 could perform well within the drainage of the four hydrologic stations. How can the improved model have the good performance in the sub-basin of the drainage of the four hydrologic stations?

Response: As suggested by the reviewer, we have added more explanations below to the fourth paragraph of the Conclusions Section in the revised manuscript: "The validation of the improved SWAT2005 and the calibration of its simulated streamflows are only proceeded with limited discharge gauges. The simulation results within the drainages of the limited discharge gauges could be well calibrated and validated in the whole, and it is difficult to guarantee the precision of streamflow simulation and validate the improved SWAT2005 in the sub-basins of the drainages of the limited discharge

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gauges. Specific choice for the design of the water balance and transport through a network combining both sequential and parallel streams and storage links is subject to high uncertainty, as there are few data available to validate them. The present description is of an appropriate complexity, being able to represent the basic mechanisms of hydrological processes and water management that influence the water balance, while being flexible enough to allow for inclusions of additional process knowledge or data. With the increase of available information on topography, locations and water surface area variations of reservoirs from remote sensing studies, the improved SWAT2005 and its validation approach could be refined. Additionally, a better knowledge of reservoir operation rules promises to significantly improve the model performance."

Comment 3: Page 4022, line 3 to line 9, it is useful to explain the reasons for setting three scenarios and their usages.

Response: As suggested by the reviewer, we have added more explanations below to the second paragraph of the Calibration and validation results Section in the revised manuscript: "To compare the performance between the original and improved SWAT2005 in the whole, two scenarios, S0 (considering human activities according to the original SWAT2005 with the calibrated physical parameters) and S1 (considering human activities according to the improved SWAT2005 with the calibrated physical and human interference parameters described aforementioned), are designed. To examine the performance of water balance and transport through a network combining both sequential and parallel streams and storage links in the improved SWAT2005, an additional scenarios, S2 (considering water balance and transport through a network combining both sequential and parallel streams and storage links and ignoring the human interference parameters), is designed."

Comment 4: Fig.5 and Fig.6 provide the results of monthly streamflow simulation during physical parameter calibration and human interference parameter periods. The authors should explain whether the results meet the precision requirements of basin hydrologic cycle.

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Response: As suggested by the reviewer, we have added more explanations below to the First-stage calibration results Section in the revised manuscript: “The values of R2 and NSE exceed 0.6 and 0.8 respectively, and the value of MRE does not exceed 10% in the first-stage calibration. Therefore, the first-stage calibration results meet the precision requirements of basin hydrologic cycle.” As suggested by the reviewer, we have added more explanations below to the Second-stage calibration results Section in the revised manuscript: “The values of R2 and NSE exceed 0.6 and 0.8 respectively, and the value of MRE does not exceed 10% in the second-stage calibration. Therefore, the second-stage calibration results meet the precision requirements of basin hydrologic cycle.”

Comment 5: It is not clear about the small-sized reservoirs from page 4006, line 6 to line 7. This should be defined clearly.

Response: As suggested by the reviewer, we have added more explanations below to the second paragraph of the Methodologies Section in the revised manuscript: “Large-sized reservoirs are the water storages of class 5, medium-sized reservoirs are the water storages of class 4, small-sized I reservoirs are the water storages of class 3, small-sized II reservoirs are the water storages of class 2, and ponds are the water storages of class 1.”

Comment 6: Page 4012, line 13 to line 18, the explanation of the direct inflow to water storage class r could have been clearer.

Response: As suggested by the reviewer, we have added more explanations below to the first paragraph of the Inflow Section in the revised manuscript: “The direct inflow to water storage class r is the fraction of the total sub-basin runoff Qgen and is generated in a time step as the difference between the fraction frr of the sub-basin area that drains into water storage class r and the fraction frx of the sub-basin area that drains into water storage class x<r within the drainage of water storage class r.”

Comment 7: There are several typos and grammatical errors. The authors should

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check the paper carefully before submitting it.

Response: We have corrected typos and grammatical errors in the paper.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/9/C2051/2012/hessd-9-C2051-2012-supplement.zip

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