We would like to thank S. Mylevaganam for his interest in this topic and for the valuable comments to improve our manuscript. Our point-by-point response to the comments is given in the following:

General comments

Comment 1

In the current version of the manuscript, the distinction between semi-distributed and fully distributed hydrological models is not apparent. What is meant by semi-distributed hydrological model? What is meant by fully distributed hydrological model? On what basis the selected model is considered as a fully distributed hydrological model (see P-4 LN-28)? Is the definition of fully distributed model meant for simulating the "necessary" hydrological element for the analysis of interest (see P-4 LN-31)? If the definition of fully distributed model is preserved only for the "necessary" elements, how would it lead to conclude that the selected model is a fully distributed hydrological model? Are there elements other than the necessary elements that are not fully described in the selected model? From the reader's point of view, having a fully distributed hydrological model is precluded with our understanding on the processes that define the hydrological system, even though many efforts have been made and are in progress to better understand the hydrological system. Moreover, from the reader's point of view, in no way, the selected model can represent a fully distributed hydrological model, considering the way the selected model has been conceptualized as described in the manuscript(see P-5 LN-1-15).

Author's response

Thank you for the comment. The semi-distributed model refers to the model which is able to simulates the spatial information, but it divides the catchment into sub-basins that in turn are divided into HRUs (hydrological response unites). Semi-distributed model lumps meteorological variables and physical parameters into sub-basins, thus, it is usually easy to setup and require shorter time relatively. The fully distributed model refers to the model that are capable of capturing the explicit spatial distribution of input variables, e.g. meteorological conditions, land use, soil characteristics and so on (Abu El-Nasr et al., 2005; Devia et al., 2015). Therefore, it can also provide explicit spatial simulations of hydrological conditions. It usually divided the catchment into regular pixels and simulate hydrological processes for each pixel and considers also the interaction between pixels. The fully distributed model is usually date intensive and needs more computation costs. The model we used in this study is a fully distributed mode that is able to reveal spatial heterogeneity in a detailed way.

Comment 2

The current version of the manuscript is based on a model that was calibrated and validated by Tian et al, 2015(https://www.sciencedirect.com/science/article/pii/S1364815214003016). Therefore, the research work that is carried out and presented in the current version of the manuscript solely depends on the calibrated and validated model. Moreover, around 82.1% of the LULC (see P-4 LN-14) of the domain of interest is desert. Therefore, it becomes paramount to evaluate the calibrated and validated model. Otherwise, the evaluation of this manuscript will be based on the assumption that the authors of that manuscript (https://www.sciencedirect.com/science/article/pii/S1364815214003016) are reliable and well-known in the field of hydrology, and/or the editorial board went through the calibrated and validated model carefully and ensured that the model is flawless. Moreover, the published manuscript (https://www.sciencedirect.com/science/article/pii/S1364815214003016)) is not feely available for a reader of an open-access journal (i.e., HESS) to evaluate this manuscript.

Author's response

Thank you for you comment. For the calibration and validation issue, we have explained in the Response to Comment 5 of Anonymous Referee # 2. For the sake of completeness, we have listed them in the following.

We refer the calibration and validation to another study for the sake of avoiding the duplicate work that require high computing cost. Indeed, the model usually has to be calibrated and validated before application. The model we used is developed and well calibrated and validated by other study but in exactly the same regions. The same model setups, configurations and parameters are taken in our study. We believe it is fair to use it for another application without further calibration and validation in the same region. There are also other studies did it in the similar way. For instance, Döll et al. (2012) used the the calibration parameter values of WaterGAP 2.1g to run the version 2.1h for another application.

We are sorry that the paper we referred is not free accessible. We have now included the critical results in the responses. We have also uploaded this paper and you can download it via the following link https://1drv.ms/f/s!AglvjnHO73u2geN-Cff-ikYApDVeZA

Comment 3

As per the "new" framework (see P-1 LN-11) implemented by the authors, the green and blue water resources are calculated for each pixel and then summed up (see P-6 LN-11). What is meant by this framework (fully distributed? new framework?)? How did the authors implement the streamflow routing? How did the authors account the pixels that represent the stream network? How did the authors calculate the surface runoff/excess rainfall at the uppermost point of a reach, which got routed along the reach? Moreover, what is the meaning of green water in the deserts (i.e., 82.1% of LULC)? Are these green water available in the root system for the plants in the deserts? If this is the case, the classification of LULC is misleading? Why are those areas considered as deserts?

Author's response

Thank you for the comment. The framework here means the proposed one for green and blue water assessment. It is not directly related to fully distributed issue. The main features of this proposed new framework consists of the following. (1) We investigated the blue and green water from both water supply and water consumption perspectives, while conventional studies focus only on one of them. (2) We considered the interaction between green and blue water in a detailed way, while conventional studies usually ignored the interactions.

Response to the questions "How did the authors implement the streamflow routing? How did the authors account the pixels that represent the stream network? How did the authors calculate the surface runoff/excess rainfall at the uppermost point of a reach, which got routed along the reach?". For streamflow routing, we used the original routing module named "Cascading-Flow Procedure" in GSFLOW model. The stream network is derived in the model based on the DEM and flow accumulation. Surface runoff and interflow are added to stream reaches by connecting HRUs to stream segments. The volume of runoff and interflow are distributed to each stream reach in a segment on the basis of the fraction of HRU associated with a stream reach. For more details about such technique issues, we would like to refer to the manual of GSFLOW (Markstrom et. al., 2008).

Response to the green water in desert issue. The water evaporated in desert is also accounted as green water, even there is no plant there. This part of water is also known as the non-productive green water, while the water is used for transpiration refers to the productive green water (Rockström and Falkenmark, 2000). Sorry that we did not explain it clearly in the manuscript. We have now added the following explanation in the manuscript Page 2, Line 7 "The green water also consists of two components: The productive green water, i.e. the transpiration involved in biomass production in terrestrial ecosystems, and the non-productive green water, i.e. interception and soil evaporation (Rockström and Falkenmark, 2000)."

Author's changes in manuscript

Page 2, Line 7.

After "... aquifers and dams that can be extracted for human use (Falkenmark and Rockström, 2006)." the following sentence is inserted "The green water also consists of two components: The productive green water, i.e. the transpiration involved in biomass production in terrestrial ecosystems, and the non-productive green water, i.e. interception and soil evaporation (Rockström and Falkenmark, 2000)."

Comment 4

As per the authors, the study area (i.e., HRB) is impacted by "heavy human activities" and the hydrological cycle is "dramatically" altered. Moreover, the study area has "strong" GW and SW exchanges (see P-4 LN-5). Do these statements need supportive texts/references?

Author's response

Thank you for the comment. We have now included the supportive citation.

Author's changes in manuscript

Page 4, Line 5

Citation is added. "... HRB are impacted by heavy human activities and the hydrological cycling is dramatically altered (Zhou et al., 2014)"

Page 4, Line 6

Citation is added. "... HRB has strong groundwater and surface water exchanges which influences the interactions between green water and blue water (Zhu et al., 2008)"

References

Abu El-Nasr, A., Arnold, J. G., Feyen, J. and Berlamont, J.: Modelling the hydrology of a catchment using a distributed and a semi-distributed model, Hydrol. Process., 19(3), 573–587, doi:10.1002/hyp.5610, 2005.

Devia, G. K., Ganasri, B. P. and Dwarakish, G. S.: A Review on Hydrological Models, Aquat. Procedia, 4(Icwrcoe), 1001–1007, doi:10.1016/j.aqpro.2015.02.126, 2015.

Markstrom, S. L., Niswonger, R. G., Regan, R. S., Prudic, D. E. and Barlow, P. M.: GS-FLOW—Coupled Ground-Water and Surface-Water Flow Model Based on the Integration of the Precipitation-Runoff Modeling System (PRMS) and the Modular Ground-Water Flow Model (MODFLOW-2005), U.S. Geol. Surv., (Techniques and Methods 6-D1), 240, doi:10.13140/2.1.2741.9202, 2008.

Rockström, J. and Falkenmark, M.: Semiarid Crop Production from a Hydrolog- ical Perspective: Gap between Potential and Actual Yields, Critical Reviews in Plant Sciences, 19(4), 319-346, 2000.

Zhou, S., Huang, Y., Yu, B. and Wang, G.: Effects of human activities on the eco-environment in the middle Heihe River Basin based on an extended environmental Kuznets curve model, Ecol. Eng., 76, 14–26, doi:10.1016/j.ecoleng.2014.04.020, 2015.

Zhu, G. F., Su, Y. H. and Feng, Q.: The hydrochemical characteristics and evolution of groundwater and surface water in the Heihe River Basin, northwest China, Hydrogeol. J., 16(1), 167–182, doi:10.1007/s10040-007-0216-7, 2008.