The authors would like to thank our anonymous reviewer for his critical evaluation of the manuscript and comments. They have been very insightful.

General Overview

1. Measured streamflow data were not available. The authors used a very questionable method to derive streamflow. As a result, there is a very high uncertainty in streamflow data that were used for calibration. In general, the methodological approach is often unclear to me. There are many open questions. I will come back to that later in the specific comments. In general, the results are based on many vague and questionable assumptions.

Response: The observed streamflow generation method has been removed, as measured streamflow data from a the nearest gauge station (River Offin) is being used. This so as we employ the spatial proximity setting approach aimed at obtaining a more realistic streamflow data for our analysis.

2. The authors used only one climate change scenario, RCP8.5. This scenario is the worst case scenario and I wonder why other more moderate scenarios (RCP6.0, RCP4.5) were not taken into account.

Response: The high pace of urbanisation and deforestation at the catchment led to the choice of the RCP8.5 as the projection scenario. Notwithstanding, we are also including trends in RCPs 2.6 and 4.5 in the revised manuscript. Previously, the landuse input map was used for the projection of future hydro-climatic trends. However, different landuse scenarios are being considered in hand with the different RCPs to give consolidated conclusions to this study.

Specific comments:

P1, Line 6: I believe, SUFI-2 was only used only for calibration and not for validation as well.

Response: SUFI-2 was used for both calibration and validation as stated in the text, "The SUFI-2 algorithm was used for calibration and validation on both daily and monthly temporal resolutions."

P2, Lines 34-35. This sentence can be deleted

Response: We believe the statement in lines 34-35 are significant, since most manuscripts outline the structure of their study.

P3, Figure 1: The resolution is too coarse to get all information of the figure. Catchment boundaries would be fine.

Response: Figure 1 will be modified and the resolution also improved.

P4, line 17: Please, provide the SWAT version number.

Response: SWAT version 2012 (SWAT2012). This is updated in the revised manuscript.

P4, line 19-20: what is the grid cell resolution of the land use map?

Response: The grid cell resolution for land use map was 500 m x 500 m. However, in the current update of the model, we are using ESA annual 1992-2015 landuse map at a resolution of 300 m x 300 m. This is to account for land use changes occurring within the time period of the study, as well as incorporate the water body (WATR) land use category which was previously not captured by the SWAT model.

P4, line 28: what is the grid cell resolution of the DEM?

Response: DEM resolution is 30 m x 30 m. This is updated in the revised manuscript.

P4, line 30: This is a small catchment for a SWAT analysis. Soil map has a coarse resolution, land use and DEM I do not know. However, I cannot understand why the authors set thresholds. They lose even more information. They ignore 20% of land use, for example. Please, explain.

Response: The study focussed solely on modelling the forested part of the Owabi catchment. Landuse within the forest remains fairly uniform with no changes within the 13 km^2 forest cover. However in the updated manuscript, we have taken into consideration the entire catchment area of about 69 km^2. Therefore to include all land uses, the threshold has been set at a value of 1 %.

P5, Fig 2: This map is unclear too me. There is a green dot representing the dam. The catchment outlet is downstream. That means discharge is completely controlled by dam regulations. The dam itself is approx. 2km from east to west. Am I right that large parts of the delineated catchment is actually open water from the reservoir? So, to avoid confusion and for clarification I suggest to provide different maps. 1. DEM with catchment boundaries, 2. Areal photo or topographic map with REAL river network and delineated catchment boundaries, 3. Land use across the catchment. The legend in the presented map shows DEM and land use but there is NO in formation in the map.

Response: Although the outlet is downstream, the dam has a free overflow spillage system. Dam information has been updated in the model run. The paper focussed on the forest hydrology of the catchment, but update is being made to expand the area to cover the actual 69 km^2 of the catchment. The individual input maps for delineation of watershed, soil, vegetation and HRU maps will be added in the revised manuscript.

P5: Are meteorological data from the point in fig 1?

Response: Daily rainfall and temperature records are point data from the study area in Fig 1

P6, l1: Are these data available in daily resolution? Are the local data consistent with the ARC2 data? A figure would be fine, showing prec coming from local and ARC2 data

Response: All data were in daily resolution. Both station rainfall data and ARC2 rainfall datasets on the other hand, have been compared for the periods of 2000 – 2004 and there existed quite good agreement (R=0.4). However, observed gridded rainfall data from the station as seen in Aryee et al., 2017 is being used for the model. A figure would be provided when necessary in the revised manuscript.

P6, l3: Are these data available in daily resolution? Are the local data consistent with the ECMWF data? A figure would be fine, showing temp coming from local and ECMWF data

Response: All data were in daily resolution. Although comparison of daily minimum and maximum temperatures (2000 – 2004) from the Owabi station and ECMWF data showed a consistent agreement (R = 0.6), currently, we have used the nearest weather station data from Kumasi Airport to fill in the missing temperature gaps.

P6, l6: Which statistical data do the authors mean?

Response: These are the daily data needed for generating the weather generator file (an input for the SWAT model) for the study area. The data include; rainfall, maximum and minimum temperatures, solar radiation, dewpoint temperature and wind speed. Statistics such as monthly averages, standard deviations, skew coefficient, among others were calculated from the listed datasets as described in the SWAT2012 input/output documentation manual (Arnold et al., 2012).

P6, l7: What is the dewpoint temperature for? What about relative humidity?

Response: Dewpoint temperature was used for the calculations in the weather generator file (WGN). The statistics within the WGN file was then used for simulation of relative humidity for the catchment.

P7, l1-l14: This is one of the most critical points in this paper. The authors calculated monthly climatic water balance (cwb) from precipitation and potential evapotranspiration. Next, they defined that 15% of monthly cwb is surface runoff. This is weird and calls for explanation! (Also, according to fig6 there is always flow. According to Fig 4, the annual cwb is negative (PET=1459, PREC=1266). That means that there are months with 0mm surface runoff and eventually 0mm total discharge, please explain.). To obtain streamflow, the authors multiply surface runoff with catchment area. Is this an accepted method? Are there references? Please, explain. In addition, the unit surface runoff in eq2 is mm/d. But it is unclear, monthly surface runoff data were converted into daily values. Also, what is the unit of A (basin area)?

Response: The observed streamflow generation method has been removed, as measured streamflow data from a the nearest gauge station (River Offin) is being used. This so as we employ the spatial proximity setting approach aimed at obtaining a more realistic streamflow data for our analysis. The basin area (A) had the units of m^2. It should be noted that, the chances of rains are low during the dry season (November to February) in the Kumasi metropolis since the entire area country (Ghana) is dominated by a high pressure system and the North Easterly trade winds. Therefore, surface runoff is also likely to be low and discharge will reduce to a minimum.

P7,l18: There must be two model sets, for daily and for monthly calibration, right? But later on, I see only one parameter set.

Response: The results for calibration and validation for both model sets are shown in pages 10-11.

P10Table4,5: Are these tables really necessary?

Response: Absolutely, since they clearly show the ranking of the sensitive parameters.

P11, l3: It is unclear to me, why the authors calibrated against daily and monthly streamflow data, and only monthly results are presented. Due to the uncertainty of "measured" streamflow, I would only calibrate at a monthly scale and delete all passages related to daily calibration.

Response: The new model run which is still underway would focus only on the monthly simulations of streamflow since observed streamflow data from the River Offin gauging station is available in mean monthly resolution.

P11, l13: 10 and 12 mm maximum rainfall per month? This is certainly much too low!!!

Response: The values are mean monthly, which was unfortunately not stated in the text. This has been modified in the revised manuscript.

P12, fig7: maximum monthly rainfall approx. 18 mm? This is certainly much too low!!!

Response: It is the maximum <u>mean</u> monthly rainfall value.

P11,l20-21: I do not understand, why fitted parameters were inserted into a default model? "This was to ensure that the new fitted ranges boosted the model performance for climate and stream-flow prediction." I cannot follow, why model performance for climate? Please, explain!

Response: The aim was to observe the trends in the water balance parameters as well as streamflow after model calibration. Climate prediction has been removed.

P12,l1: I am confused: There is Fig6 with optimized streamflow and there is fig9 with optimized streamflow data. Predicted streamflow in Fig9 is much higher. Why showing uncalibrated data…

Response: The model is currently being re-run, and this section would be modified.

P13,l5: Why did the authors only used RCP8.5 and not others?

Response: The high pace of urbanisation and deforestation at the catchment led to the choice of the RCP8.5 as the projection scenario. Notwithstanding, we are also including trends in RCPs 2.6 and 4.5 in the revised manuscript. Previously, the landuse input map was used for the projection of future hydro-climatic trends. However, different landuse scenarios are being developed in hand with the different RCPs to give consolidated conclusions to this study.

Table7: The table captions are not explained. Is it important to show lateral flow? Groundwater flow is not show. Is the high percentage of surface runoff realistic? WYLD in future projection is more then three times larger. Is this realistic? The same for surface runoff….

Response: Table captions would be explained. Meanwhile, the model is currently being re-run, the results will be modified to reflect the future hydrology of the catchment.

Figure 10: I believe it is not a good idea to show future projections year by year. Nobody knows, how the weather will be in 2040. But there are scenarios, how the climate will develop. Therefore, I suggest to compare a 30-years reference period (average) with the future projection (also 30 years, 2021-2050)

Response: This would be done.

REFERENCES

Arnold, J., Kiniry, J., Srinivasan, R., Williams, J., Haney, E., and Neitsch, S.: Soil and Water Assessment Tool: Input/Output Documentation version 2012, Texas Water Resources Institute, 2012.

Aryee, J.N.A., Amekudzi, L.K., Quansah, E., Klutse, N.A.B., Atiah, W.A. and Yorke, C., 2017. Development of high spatial resolution rainfall data for Ghana. *International Journal of Climatology*.