The authors would like to thank our anonymous reviewer for his immense review and criticisms. We here provide responses to his comments. Responses are written in **bold italics** and comments in plain text**.**

1. The originality of the work is low. In my opinion, this manuscript presents the application of a well known model to a new catchment. As such, there is nothing new with that. Commonly available data with very little pre-processing, as well as a standard calibration process were used. Readily available weather data for climate change scenarios were used, again with no pre-processing. There are already several papers in the literature focused on using hydrological models with climate scenarios to project future water availability. I encourage the authors to follow the scientific method: what do you want to verify? State your hypothesis! What/where is your contribution? I advise mentioning explicitly in the introduction what your contribution to the advancement of science is.

The objective of the paper would be made explicitly clearer in the introduction of the updated manuscript. A major component which was not adequately highlighted was the fact that the Owabi catchment is ungauged and how the chosen regionalization method for the transfer of stream-flow data from the Offin basin to the Owabi catchment impacts the calibration results. The spatial proximity method which was chosen as the data transfer scheme relies on a dense gauge network in the vicinity of the proposed catchment. Most studies have also applied this scheme for transferring data onto larger catchment area. It was therefore hypothesized how the spatial proximity scheme can be used on a smaller catchment using only one proxy station (Offin basin) as donor. These information would be updated accordingly.

2. The Owabi basin is ungauged. To me, this is a central issue for this work, but only very little information is provided in the manuscript about that. For one thing, although it is mentioned that the nearest gauging station is located 11 km away from the Owabi basin, on another basin called Offin. a map showing its location is not provided. Such a map would be very useful. In addition, information about the similarities and differences between those two basins (area, slopes, vegetation, soil, etc) should be provided. Finally, although you are using an existing method for transferring streamflow from Offin to Owabi, I believe you should nonetheless describe the method succinctly. Much more emphasis should be given throughout the manuscript to the fact that the basin is ungauged and that the calibration of SWAT was thus performed using streamflow (and corresponding meteorological observations, I would assume) from another basin.

The gauging station at Offin is located 11 km from the Barekese dam. This dam is also found 19 km away from the Owabi catchment. This makes a total distance of about 30 km between the Owabi catchment and the Offin basin gauging station. This has been updated in the manuscript. For clarity of the map and owing to the distance apart, only the Owabi catchment alongside its neighbouring towns can be projected on the study map. Mean elevation at Offin is about 277m as opposed to 265 m at the Owabi catchment. They both have the same soils (orthic acrisols), semi-decidous forest types, rapid urbanisation within the last decade as well as influenced by bi-modal rainfall regimes. Geologically, the Owabi catchment falls within the Birimian meta-sediment of the Kumasi Basin which consists of phyllites, granodiorites, schists, greywackes, tuffs with its associated granitoid, whiles the Offin Basin is underlain by the Voltain, Birimian and Granite rock types. Although the hydrometeorological stations cannot be available on the map, their geographical coordinates have been stated in the 'hydrometeorological data' section.

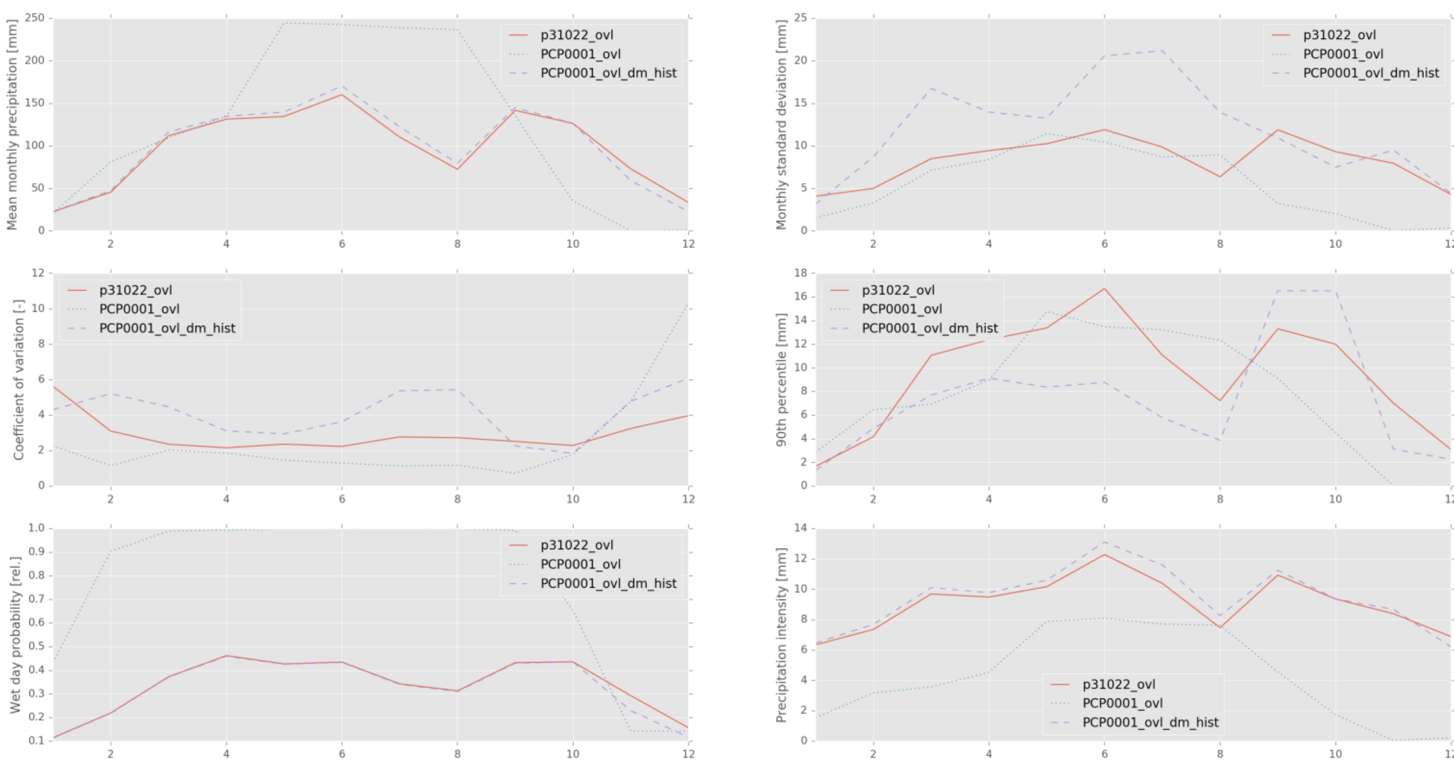
We applied the spatial proximity global arithmetic mean method (page 6 line 8-9) as used in Oudin et al. (2008), which relies mainly on a dense gauge network. However, the results obtained with only

one hydrological station data yielded acceptable results during calibration for the Owabi catchment. The Owabi catchment has a meteorological station situated on its premises, the other meteorological station data used were only to fill in gaps which existed in some years in the Owabi data. We believe that emphasis was placed on the use of the Offin data as the source of stream-flow data for the Owabi catchment in table 1. However, this has been emphasized in appropriate areas of the text.

To me, although you mention bias correction for the climatic projections on page 7 line 10, it is not clear how the quality of those simulations was assessed. I would have liked to see much more details regarding those biases (with graphs and numbers) and also more details about the efficiency of the bias removal process. In addition, although you mention on page 7 that « These were projected under three Representative Concentration Pathways (...) » you do not provide any detail about what those projected scenarios represent (for instance, which one is worst than the other in terms of greenhouse gaz emissions). I would have appreciated more details.

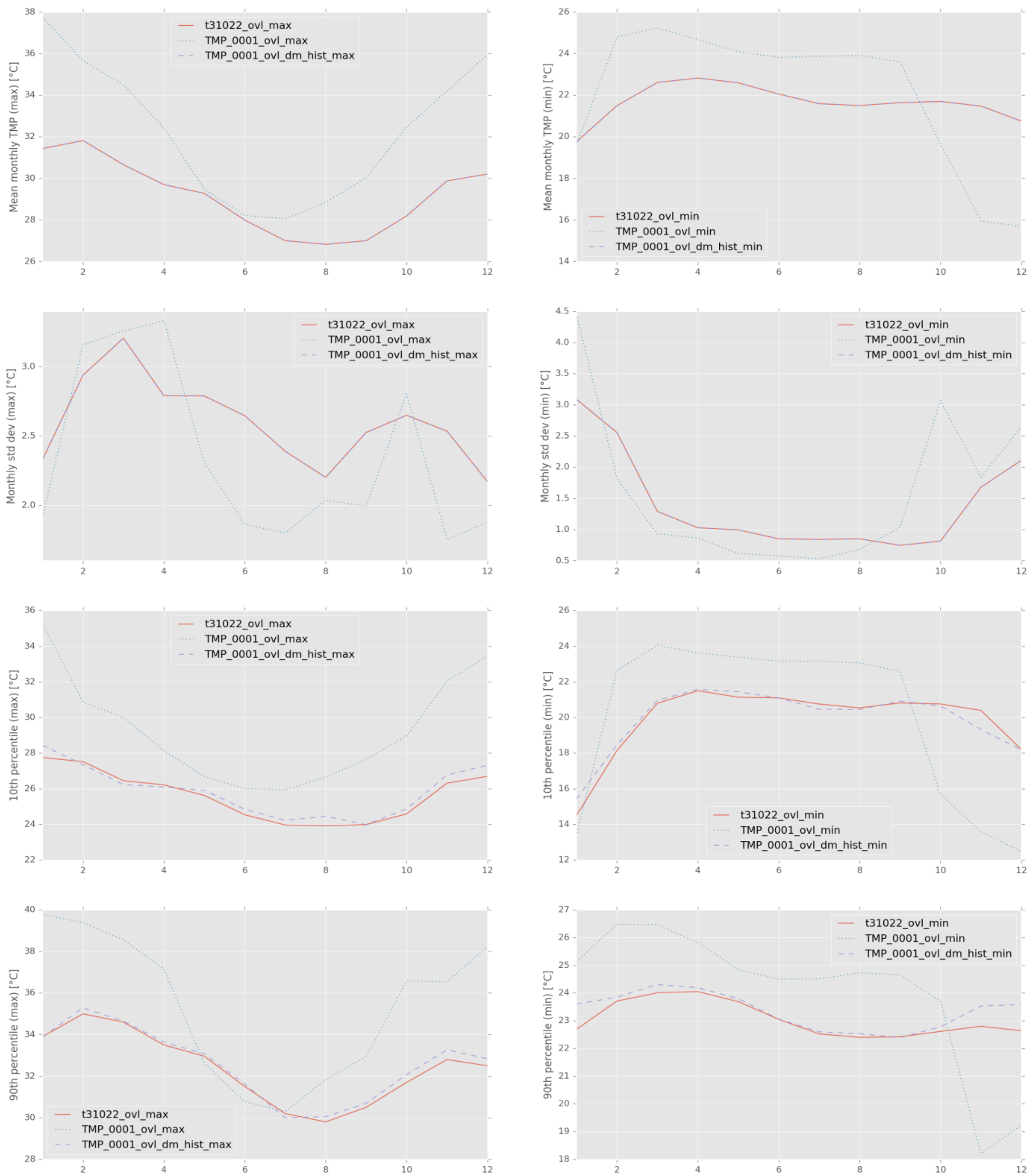
The CmHyd software has about seven bias correction options available for precipitation and temperature. This included; distribution mapping of precipitation and temperature, linear scaling, delta-change correction, precipitation local intensity scaling, power transformation of precipitation. All these options were used to correct for biases in the historic rainfall and temperature datasets which included the observed data and that of the RCM for different RCP scenarios. After correction, the best bias correction option was the distribution mapping which simulated historic rainfall and temperature patterns as close as possible to the observed historic trends. This option was therefore chosen for the climate change analysis. Figures such as that found below, showing trends in the mean monthly rainfall/temperature as well as the performance of the method would be included in the revised manuscript. To assess the quality of simulations, the figures showing the coefficient of variation and standard deviations would be provided. Further details would also be given on the Representative Concentration Pathways in the manuscript.

Figure A



Distribution mapping correction method of rainfall (RCP2.6): Comparison of observed (p31022_ovl) model historic without correction (PCP0001_ovl), and model historic corrected (PCP0001_ovl_dm_hist).

Figure B



Distribution mapping correction method of temperature [Tmax and Tmin] (RCP2.6): Comparison of observed (t31022_ovl_max/min) model historic without correction (TMP_0001_ovl_max/min), and model historic corrected (TMP_0001_ovl_dm_hist_max/min).

You also mention on line 12, page 7, that distribution mapping assumes a gaussian distribution of the dataset. Have you verified that the datasets indeed follow gaussian distributions? Again, more details regarding that, alone with test results, should be provided. Why using two bias correction methods instead of one? Can you provide comparative graphs of the outcomes of those methods? How do they compare?

The datasets were not verified to follow the gaussian distribution, but contrary to temperature, the high variability of tropical rainfall does not follow the gaussian distribution. Therefore, within the CmHyd software, the gaussian and gamma distributions embedded in the distribution mapping of precipitation and temperature modules are used to correct the temperature and rainfall datasets respectively. The module creates a transfer function which corrects the distribution of historical rainfall and temperature to the observed measurements. The working principle of the module is such that, with rainfall, a gamma distribution is assumed with a shape parameter (α) and a scale parameter (β). Alpha controls the distribution profile, such that, when $\alpha < 1$, the Gamma distribution is exponentially shaped, $\alpha = 1$ is a special case and characterizes an exponential distribution whiles $\alpha > 1$ shapes a skewed uni-modal distribution curve. The scale parameter β on the other hand, determines the dispersion of the Gamma distribution with a smaller β leading to a more compressed distribution and a lower probability of extreme events and a larger β, causing a stretched distribution, with higher probabilities of extreme events.

For temperature time series, the Gaussian distribution with location parameter (μ) and scale parameter σ is assumed to give the best fit. The scale parameter σ determines the standard deviation of the Gaussian distribution and smaller values imply a more compressed distribution with lower probabilities of extreme values. Contrary, a larger value for σ indicates a stretched shape with higher probabilities of extreme values. The location parameter μ directly controls the mean and therefore, the location of the distribution. Further details can be found in the Teutschbein and Seibert (2012). These details has been be added to the manuscript along with figures and numbers (where necessary) to show the performance of the bias correcting method.

I do not find Appendix A to be useful, as it contains basic equations that are very well-known in hydrology. I would advise removing it.

These equations are indeed well-known but nonetheless very important in stating them for clarity and for useful resource. For this reason, they were not put in the main text but the appendix. The authors therefore think it should be retained.

The SWAT model operates on a daily time scale but you analyse data at a monthly time scale. I also understand that you might have access only to monthly streamflow observations for the Offin basin. I would have appreciated much more detail about the choice of the monthly timescale and how it impacts model calibration and data preparation, as well as post-processing of the outputs (simulated stream-flows).

The SWAT model operating on a daily timescale implies that the climatic input variables (rainfall and temperature) are formatted into daily or sub-daily values before being used as input for the model. The model can therefore run on the daily climate variables and give output simulations in either daily totals, monthly or annual means as preferred by the modeller. Due to the availability of monthly observed stream-flow, the monthly simulated streamflow was the best choice. Again, after calibration, the SWAT is known to perform better in simulating monthly than daily stream-flows (Uzeika, 2011), since most daily errors are compensated for on the monthly timescale.

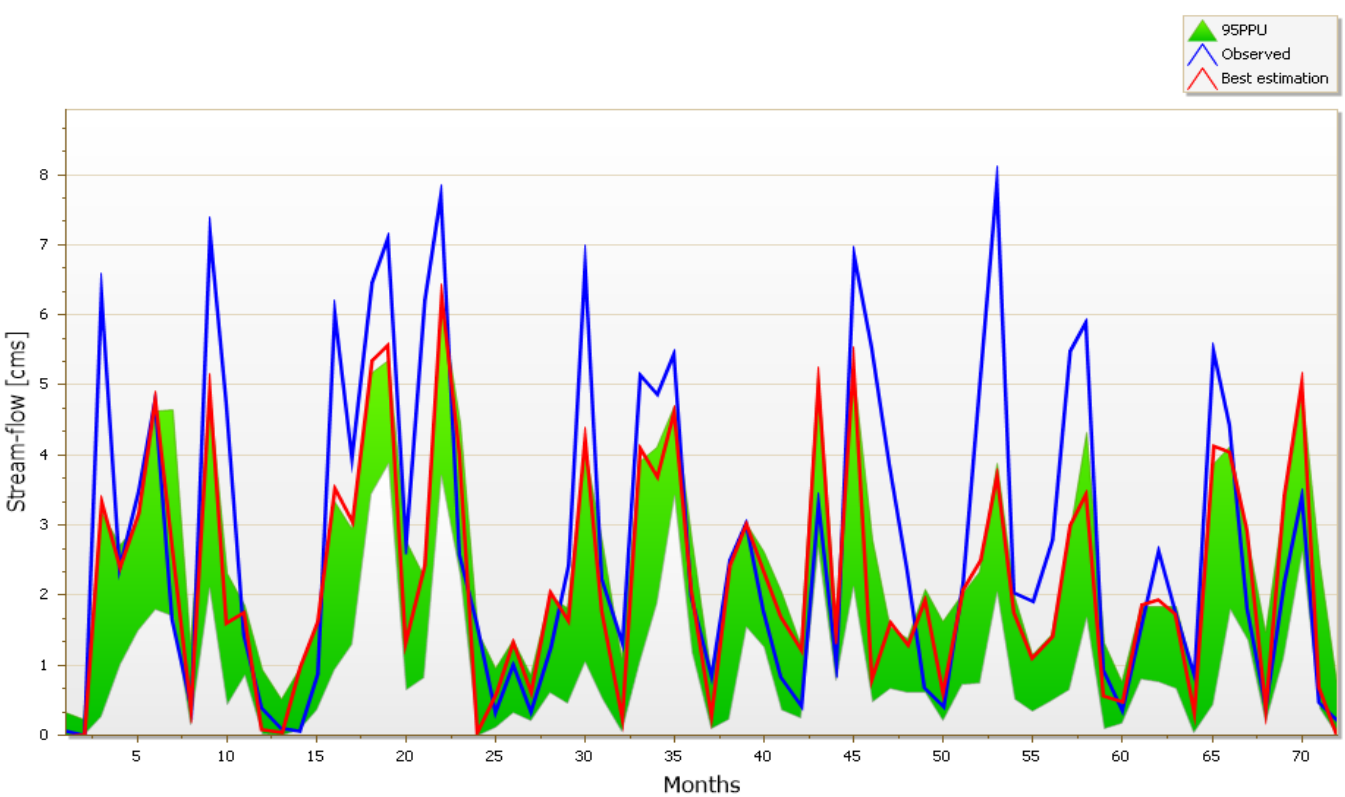
The authors mention an uncertainty enveloppe on simulated streamflow. This envelope is not displayed on figures, and the methodology to compute it is also not explained. Again, more explanations are needed. The reader can only guess that it was obtained through the use of SWAT-CUP (page 8).

The following has been updated in the manuscript: The p and r-factors at a 95% prediction uncertainty determine the degree of uncertainty associated with the model. A p-factor of 1 and an r-factor which 0 is usually considered as a perfect model fit with observed with no uncertainty. However, for streamflow, a p-factor >=0.70 is the better choice of model fit, although it is also acceptable for the model to cover more than half of the observed data. These factors are calculated during model calibration and validation within the SWAT-CUP tool.

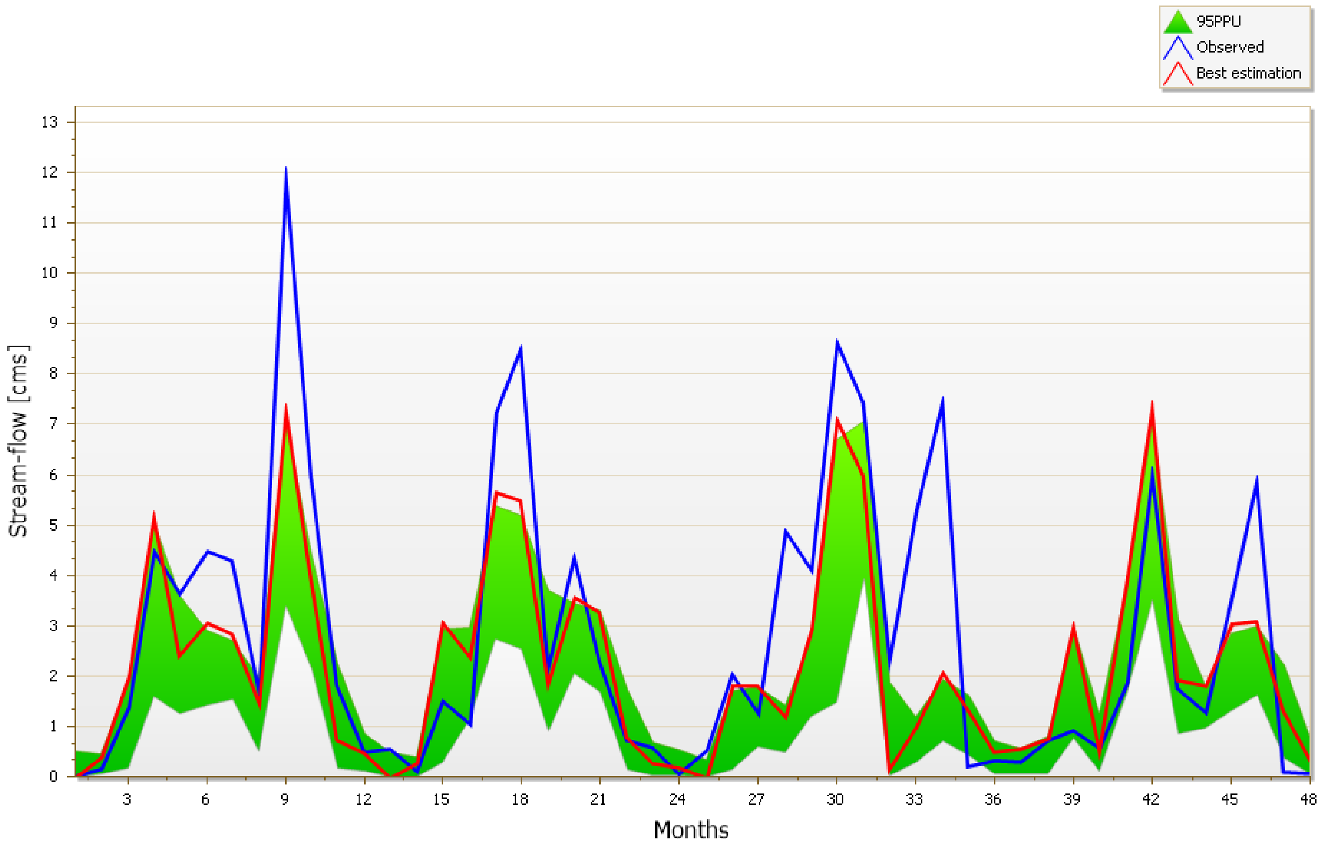
The envelope is not displayed on figures, but the values corresponding to the p and r factors have been shown in Table 4. The gnuplot software was used which is unable to capture the uncertainty envelope, unlike the default MS-Excel-like plot tool which is embedded in SWAT-CUP, however this is being considered in the revised version to capture the envelope. The uncertainty values are also shown in Table 4 to give a fair idea.

For your perusal, we have inserted the default plots from SWAT-CUP to show the envelope (in green color) below.

(a) Calibration plot



(b) Validation plot



Specific comments

1. Typos/spelling mistakes: I would advise a very thorough linguistic revision. These are only a few examples:

• The word « streamflow » is sometimes spelled « stream-flow ». Please check the entire manuscript and ensure consistency.

For consistency, all spellings within the manuscript has been changed to stream-flow.

• Page 1, line 15, page 8 line 15, page 10 line 3 and several other instances: please replace « at the catchment » by « at the catchment scale » or « on the catchment », depending on what you mean.

Page 1, line 15: Catchment replaced with 'at the catchment scale'.
Page 8 line 15 and page10 line 3: At the catchment replaced with 'on the catchment'.

• Page 2 line 28: on the Bani... (not at)

Word replaced with 'at the Bani'.

• Page 2 line 30: « but sometimes highly overestimated... »

Statement modified to, ' but sometimes overestimated ...'

• Page 3 line 2: « conclusion IS given in section 4. »

The word 'is' has been inserted.

• Page 3 line 5: Correct « ... in Ghana. redIt comprises of the forest »

The word 'redIt' has been modified to 'it'.

• Page 8 line 15: remove comma after « that »

The comma has been removed.

• Page 8 line 16: correct « ... soil group of type D... »

The statement has been modified.

• Page 9 line 15: correct « ...the root nature of the forested trees ...». Perhaps by « the forested area » or « trees in the forest ».

Statement replaced with, 'the forested trees'.

• Page 10 line 21: « The catchment topography ranged from ... » should be corrected to « The catchment topography ranges from ... »

The statement has been modified to 'ranges from'.

• Page 14 line 3: Replace « welcoming » by « welcome »

'Welcoming' has been replaced by 'welcome'.

• Page 15 line 13: Replace « projection » by « projected »

Projection has been replaced by 'projected'

• Page 16 line 2-3: The sentence « Specifically... for the catchment » is confusing and needs rephrasing. As written now, I understand that the model can « simulate its own calibration ».

The statement has been rephrased as follows, 'Specifically, the model simulated both historic and projected stream-flow as well as water balance whiles the SUFI-2 algorithm embedded in the SWAT-CUP software was used for model calibration and validation for the catchment.'

2. Page 1 line 2: « Major stakeholders... » please add a reference.

Appropriate references have been added.

3. Page 3 line 8: There is a problem with one reference « Commission » is not a valid author name.

The citation has been updated to 'Forestry Commission of Ghana'.

4. Page 4 after equation (1): « t » should be in italics. Also, there is a sequence in which you name 5 symbols but only mention 4 definitions (« Rday, Qsurf... »)

The 't' has been italized and the definition of w_seep has been updated in the text as the amount of water entering the vadose zone from the soil profile.

5. Page 6 line 6: « ... it has been revealed that regionalization and other genetic networks... » I don't understand what you mean by genetic network. Please clarify.

'Genetic network', is analogous to 'artificial neural networks'. This has been updated in the text.

6. Page 8 line 1: A reference is needed for the SUFI-2 algorithm.

A reference has been given as Abbaspour (2015).

7. Page 8 line 12: I suggest nuancing the sentence « Unlike rainfall that is easily measurable... ». There are lots of issues regarding accurate rainfall measurement (for instance under-captation and lack of spatial coverage of ground stations).

There are undeniable issues regarding the accuracy of rainfall, but the statement used in the text was to imply that, rainfall is the most measurable quantity of the water balance globally and hence can easily to be used as input in hydrological models to simulate the other components of the water balance.

8. Page 10 line 15: You say that 14 parameters have been selected from literature. First, you need to cite some supporting references. In addition, again, this is much too vague. Why are those parameters so important compared to others?

A citation has been added, Arnold (2012), which highlights the rate for which these parameters have been used for calibration. The criteria for selection was to ensure that all hydrological processes occurring within the Owabi catchment would be incorporated as much as possible to give the best calibrated result.

9. Page 10 line 21: Given its importance, the long name of parameter CN2 should be mentioned (even if it is in the Appendix). In fact, this table should be in the text and not in an appendix. Incidentally the number of the Appendix as referred to in the text is not good (it is table 5, not Appendix 5).

The abbreviation has been written in full on page 10 line 21. The table has also been been inserted in the text and properly referenced.

REFERENCES

Abbaspour, K.: SWAT-CUP, eawag, 2015.

Arnold, J., Moriasi, D., Gassman, P., Abbaspour, K., White, M., Srinivasan, R., Santhi, C., Harmel, R., van Griensven, A., van Liew, M., Kannan, N., and Jha, M.: SWAT:Model use, calibration and validation, Transactions of ASABE, 55, 1491–1508, 2012.

Teutschbein, C. and Seibert, J.: Bias correction of regional climate model simulations for hydrological climate-change impact studies: Review and evaluation of different methods, Journal of Hydrology, 456, 12–29, 2012.

Uzeika, T., Merten, G., Minella, J., and Moro, M.: Use of the SWAT model for hydro-sedimentologic simulation in a small rural watershed, Revista Brasileira de Ciência do Solo, 36, 557–565, 2011.