

Comments on “Hydro-Climatic Modelling of an Ungauged Basin in Kumasi, Ghana”

Overview:

This manuscript presents on an important topic of water balance processes and their changes over time according to climate change in an ungauged basin. This article focused on the Owabi catchment located in the Ghana and which provides about 20% of drinking water demand of the Kumasi metropolis. The aims of this study are: 1) To simulate stream-flow and establish the water balance for the catchment thanks to the SWAT model; for this purpose, a sensitivity, calibration and validation analyzes were performed using SWAT-CUP. 2) To forecast the streamflow for the catchment under three different climatic scenarios and two land-use changes.

General comments:

I am glad to see the many improvements on the paper since the last submission. I think this new work has a good publication potential, however, more work needs to be done to improve the process and the conclusions. Based on the comments below, I think this paper needs a major revision before a re-evaluation for publication.

1) The purpose of your manuscript indicates that you will establish the water balance of the watershed. However, only Figure 5 shows a water balance, not complete elsewhere, which is only a monthly average. It would have been interesting to make an assessment, even annual, on the different years of simulation (calibration + validation) to get an idea of the different terms and their evolution over time. In addition, a complete analysis would make it possible to check that the water balance is closed. It would also be interesting to add in the total water balance, the surface, lateral and groundwater contribution part instead of the water yield. The definition of this last term must be modified on page 6 line 14: $WYLD = SURQ + LATQ + GWQ - TLOSS$ - pond abstractions. Using only discharge data to explain the different contribution of precipitation and evapotranspiration on total runoff is not enough.

2) Many details are missing in the methodology section and in particular explanations about the choices that the authors have done. Some examples: Why this partial evolution of vegetation cover? How precisely climate biases have been corrected? How are the comparisons made on the different scenarios? Which criterion is used in this case? Where are located the meteorological stations? (Closest is not sufficient, gives values and indicates on figure), Why did you use the Hargreaves method for evapotranspiration? (just temperature data are available?) This information should also appear in the methodology section and not only in the result section. Check all this part.

3) The observed discharge from the neighboring station, Offin river are used for this study. The regionalization method to determine runoff is a strong assumption in an article on calibration and validation of a model from these data. It seems important to me that the authors develop this part and explain in detail the different steps, datasets used etc. According to Hrachowitz et al. (2013), to regionalize, it is necessary to

admit a homogeneity in terms of land use, topography and land cover between watersheds, is that true here?
Expend this part.

4) The authors list the different uncertainties associated with the observation data but do not show their impact on the results. It would be interesting to add an "uncertainty" part to the input data regardless of the 99PPU SWAT-CUP analysis.

5) A first calibration step is performed on various sensitive parameters of the model (9): CN2, SURLAG, ESCO, SOL_BD, SOL_AWC, CH_N2, ALPHA_BF, RCHRG_DP, and GW_REVAP. The calibrated model is then used as to generate runoff with the different landscape scenarios. However, calibration of parameters such as CN2 or SOL_AWC is not possible if thereafter, the surface condition changes. The authors must think carefully about the parameters that can be used in the calibration without biasing the scenario part. The authors should be careful with the calibration of some parameters taking into account the possible bias on the scenarios results.

6) Some parts of the article should be changed or even deleted to focus on a more innovative and interesting part to clearly see the originality of the paper (I suggest you read Srinivasan et al., 2010 or Sisay et al., 2017 for example).

Technical and specific comments:

I listed few important technical comments here but I have not developed this part at this stage.

Figure 1: Keep the same term: "Catchment" or "Watershed"

Figure 2: Add the hydro-Meteorological stations on this figure

Figure 3: Add "(LU1)" in the legend as in the Figure 4

Figure 9 and 10: Not readable, zoom over hydrological year

Table 1: Add "Temporal resolution" or "Acquisition dates" for all data (DEM etc.)

Page 2, Line 6: Management

Page 3, Line 54: Keep the same precision of the surface area (69.72 here and 69 in the abstract)

References:

Sisay, E., Halefom, A., Khare, D., Singh, L. and Worku, T.: Hydrological modelling of ungauged urban watershed using SWAT model, *Model. Earth Syst. Environ.*, 3(2), 693, doi:10.1007/s40808-017-0328-6, 2017.

Srinivasan, R., Zhang, X. and Arnold, J.: SWAT ungauged: Hydrological budget and crop yield predictions in the upper mississippi river basin, *Am. Soc. Agric. Biol. Eng.*, 53(5), 1533–1546, 2010.