The manuscript “Hydro-Climatic Modelling of an Ungauged Basin in Kumasi, Ghana” reports on the application of the SWAT model to the Owabi catchment, located about 10 km to the North-West of Kumasi City Centre, Ghana. The Owabi reservoir is part of the study catchment and provides about 1/6 (Erni 2007) to 1/5 (manuscript) of the drinking water demand of the Kumasi metropolis. The authors state that the aim of the study is to simulate the streamflow and water balance of the watershed and to predict its future state. Historical meteorological data is available from 1980 to 2015 for calibration and validation of SWAT. RCP8.5 climate projection data of a single RCM is used to drive the model in the period 2020 to 2050.

Although the manuscript is mostly well structured, I have serious doubts, if it can be published. My general concerns include:

(1) The authors state that the Owabi watershed has an area of 13 km². This number also corresponds to the map shown in Figure 2, when taking the scale bar into consideration (Side note: Legend and scale bar in Figure 1 are too small and not readable). However, Akoto and Abankwa (2014) and Ghana Hydro-Database (2017a) give an area of 60 and 69 km² for the Owabi reservoir catchment, which is about 5 times larger than the value used in the manuscript.

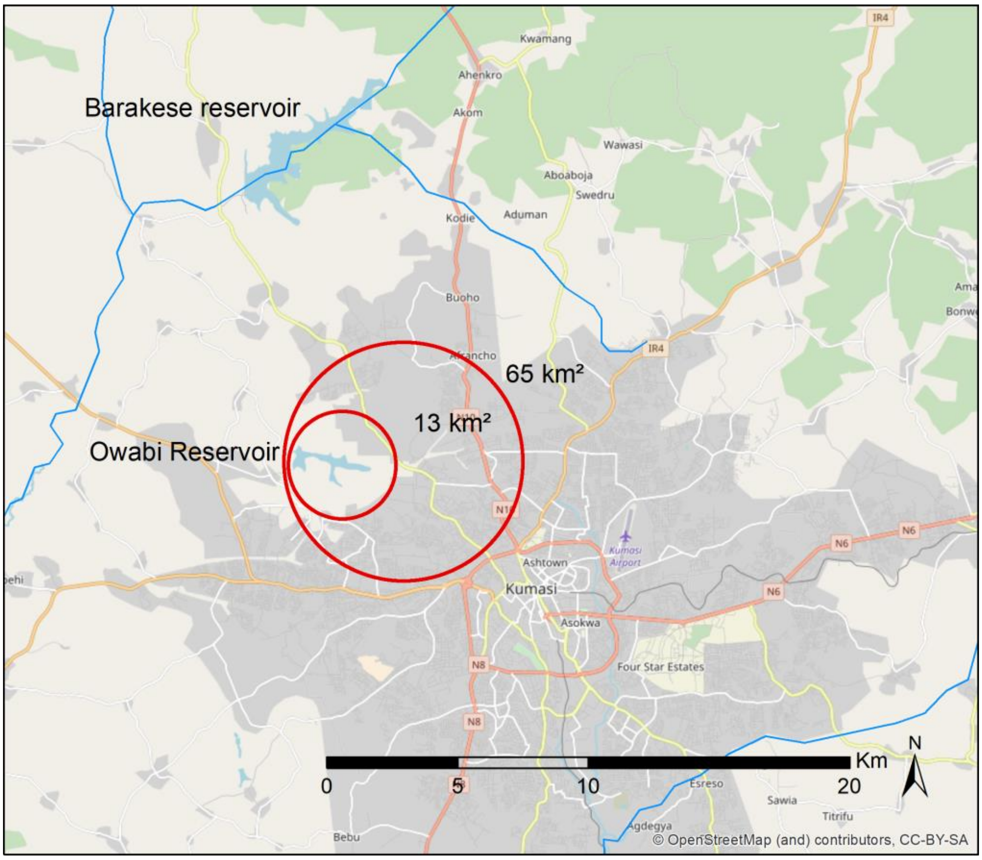

Figure 1: Owabi reservoir, located about 10 km NW of Kumasi City Centre, including circles with areas of 13 and 65 km²

Figure 1 shows the Owabi and Barakese reservoirs around Kumasi. The river network is provided by Ghana Hydro-Database (2017b). Unfortunately, catchment polygons are not available and a catchment delineation was not done for this review. As a size comparison the map includes two circles of 13 km² and 65 km². These circles do unfortunately not really shed light on the real catchment area, and from the map it remains unclear if the catchment area used in the manuscript is correct.

There are however indications that the catchment area of 13 km² is not correct, at least if the aim is the modelling of the reservoir catchment: A long-term mean annual streamflow value of 0.073 m³/s is given by the authors (P14L15). This corresponds to a daily water yield of 6 300 m³. This number seems unrealistically too low for two reasons: (i) According to Ghana Hydro-Database (2017a) the reservoir has a storage volume of 2 600 000 m³. With the streamflow given by the authors, it would take over 400 days to fill the reservoir. A reservoir is normally not designed and dimensioned in this way. (ii) According to Erni (2007) the Owabi reservoir provides about 13 500 m³/d for drinking water. This number is over two times larger, compared to the water yield given by the authors. The streamflow in the manuscript would therefore not cover the water demand currently used for the water supply. These considerations ignore issues of residual or environmental flow, which would enhance the quantity of water needed to fill the reservoir or provide water for the water supply.

In summary, a wrong catchment area implies that the results are to be reviewed in a critical way and are likely not showing what they should – the hydrological conditions of the Owabi catchment.

(2) It is clear that data availability is a challenging aspect when modelling areas not only, but also in SSA. In the manuscript, missing discharge data is substituted by, very crudely, multiplying the daily rainfall data with a factor of 0.15, assuming a time constant runoff ratio of 15 %. (Eq. (2) should be something like $Q_{e,t} = P_t * c * w$, with $Q_{e,t}$ [m³/s] - estimated discharge of day t, P_t [mm/d] - rainfall of day t, c - runoff coefficient (0.15) and w - a factor to convert mm/d to m³/s, including catchment area).

The estimated discharge is then used to tune or calibrate the model parameters. This procedure is not legit for several reasons. (i) It completely ignores that runoff ratios change with time (e.g at the beginning of the rainy season, depending on antecedent soil moisture conditions, rainfall intensities or vegetation cover etc., different runoff ratios will be found compared to the end of the rainy season; etc. - reasons why runoff ratios change with time are numerous). (ii) Discharge time series normally show recession curves or falling limbs after peaks that frequently have the form of an exponential function. They are also continuous in time. Rainfall time series are in contrast discrete. Simply multiplying the rainfall data with a constant factor, especially with daily data, is not an appropriate method to generate an "estimated discharge", since the time series characteristics will be completely different. (iii) The estimated discharge (which is based on the rainfall) is used as comparison to tune model parameters of a model driven by the same input on which the “observed” discharge is based on. This is something like a circular reference and is problematic, to put it kindly. The authors do not, in any way, critically reflect their procedure.

(3) In total, 36 years of historical meteorological data is available, of which 31 years are used for calibration and validation of the simulations (5 years are used as spin-up time). However, the data used is not consistent. About 1/3 of the time series of temperature and rainfall is based on reanalysis data. Judging from Figure 9, the “estimated discharge” seems to be systematically lower in the periods, in which reanalysis data is used (1985-1997/98) compared to periods in which station data is available. This can be a coincidence, but lastly cannot be verified, since the “observed” discharge data is intrinsically based on the (biased?) rainfall.

Additional meteorological parameters (e.g. solar radiation or humidity) are taken completely from reanalysis data. The authors do also not critically discuss this. The additional meteorological data is probably used for estimating potential evapotranspiration (ETp). Why did the authors not use the simpler Hargreaves method also available in SWAT, in which "only" minimum and maximum daily temperature is needed, especially when having the climate projection simulations in mind?

(4) Uncertainties in the simulations are significant. Not necessarily evident in the objective criteria (e.g. Table 6, numbers in Fig. 6) but based on the fact that the discharge estimates used for calibration are not legit (see (2)). The trustworthiness of the model is low. With this model, the future runoff conditions are simulated based on a single climate model projection. Uncertainties in climate projections are, especially concerning precipitation, extremely large. Therefore more than one climate projection should be used as input, simply to get an idea about uncertainties concerning future changes. I also missed a critical discussion by the authors on this topic.

(5) In this context, Table 7 shows the differences between historic and future simulations. Although there is some change in seasonality in rainfall, the annual sums do not differ significantly (1266 mm/a vs. 1234 mm/a). However, actual evapotranspiration (ETa) is reduced by over 62 %, from 671 mm/a to 366 mm/a! This seems unrealistic and the change is

theoretically not reproducible. Since temperatures are expected to increase (e.g. Issahaku et al. 2016), it is likely that the potential ET will be of the same magnitude or, more probable, higher compared to current levels. So the energy available for evapotranspiration will likely increase. It could be that, compared to the past, more months show lower precipitation input, which could lead to lower ETa, since the system becomes water limited. However, this does not seem to be the case, since all months systematically show lower ETa values, independent of the precipitation sums (Table 7). The reason for the lower ETa is insufficiently analysed. The authors state that Penman - Monteith (check spelling in manuscript) was used to estimate ETp. This method is very data intensive and it is unclear, what data (e.g solar radiation, wind speed or humidity) was used for the future simulations.

(6) The Owabi catchment is located near the strongly growing Kumasi metropolis and is therefore exposed to significant human pressures. Changes in the land use and land cover in the catchment is an issue, as stated by the authors but also by Ameyaw and Dapaah (2017) or Forkuo and Frimpong (2012). The latter for example show for the Owabi catchment that the class "Built-up" increased by 26 % and 11 % in the periods 1986-2002 and 2002-2007. At the same time, the class "High Density Forest" was reduced by -23 % and -12 %. These changes took place in the period, for which the simulations were performed. These changes in LULC should be considered, not only for the past, but also for the future projections. (Side note: Why is there no land-use class "water" in Figure 2?)

I will stop my review here, without going into more specific comments.

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