Interactive comment on "Hydrological modelling and future runoff of the Damma Glacier CZO watershed using SWAT. Validation of the model in the greater area of the Göscheneralpsee, Switzerland" *by* Maria Andrianaki et al.

Anonymous Referee #2

Received and published: 22 November 2018

The paper entitled *Hydrological modelling and future runoff of the Damma Glacier CZO watershed using SWAT. Validation of the model in the greater area of the Göscheneralpsee, Switzerland* presents a practical application of the SWAT model in an alpine catchment under actual climate conditions as well as future scenarios. Additionally, the authors present a model validation at different spatial scales. The model results are compared and briefly discussed with output from PREVAH and Alpine3D.

1 General remarks:

Even though the paper is about important issues in hydrology (model complexity, impact of climate change), the current version has several flaws.

As pointed out by Guillaume Thirel, its main goal is not clearly stated. You state that SWAT "has rarely been used for high alpine areas" and imply to study the suitability of SWAT for such environment. This is not completely true, as SWAT has been widely used in mountainous regions during the last decade (see for example Rahman et al. 2013, references within and papers citing it). The authors should carefully streamline the main goal of the paper.

A second major problem is the lack of references or justifications throughout the text. You make strong statements without justifying them or explaining why you made that choice. Here are a few examples:

- The calibration and validation periods are both very short (line 181-183). Why have you chosen such a limited period?

- You estimate the glacier retreat during the last 90 years (line 63-64) without any reference. Where does it come from?

- Climate models (line 147-151): why have you chosen these 3 models out of the 10 available in CH2011? is there any reason?

- To the best of my knowledge, the CH2011 scenarios (based on the delta change method) were not suitable for assessing changes in extreme events. Based on which element, are you stating an increase in extreme events (Line 342-343)?

You are making strong assertions based on the Nash-Sutcliffe model efficiency throughout the paper (line 197-198, 250-251, 259, 268), but be careful, because this

C2

indicator strongly depends on the hydrological regime (Schaefli and Gupta, 2007). In alpine basins where you have a strong annual cycle, a NSE coefficient of 0.49 is rather bad and not satisfactory as you state. When comparing averaged models results (Figure 6, line 284-292), based on which elements (objective/subjective) can you say that the performance of SWAT is comparable to PREVAH and Alpine3D? I personally do not agree based on the NSE coefficients you provided.

Some of the SWAT parameters seem to be scale-dependent (in time and space), which could partly explain the model performance deterioration. You should somehow discuss which parameters are the most sensitive in space (validation over the Göschneneralpsee) and in time (with regard to climate scenarios). In addition, you are using different soil and landuse maps in the Damma and Göschneneralpsee catchments (Line 114-122). For me, this choice is a bit risky as you upscale your parameters and could bring some inconsistency.

2 Minor remarks:

Some typos are visible throughout the paper, the authors should carefully proofread it. Here are some minor comments:

1. Line 44: what do you mean by "its structure is physically based"? For me, Alpine3D is a physically based model, SWAT is not. Please clarify!

2. Line 98: what do you mean exactly by this statement?

3. Line 104: "basic input" is a subjective statement.

4. Line 124: the new MeteoSwiss network is named SwissMetNet not ANETZ anymore.

5. Line 1341-134: you are right, lapse rate are critical in mountainous regions, so tell the reader which values you have used in you study!

6. In figure 1, what is the added value of the inset for the present study? There is an inconsistency in the orientation (North) between figure 1 and 2. You should just combine them into a single figure.

7. Figure 3a, is it really useful to show the uncalibrated time series?

8. We can hardly see the difference between the two curves in figure 5a. Consequently, the reader cannot really assess the quality of the model.

9. In figure 6, it is somehow hard to make the difference between the lines. Try different colors.

C4