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Discussions

Interactive comment on "Modeling glacier melt and runoff in a high-altitude headwater catchment in the Cordillera Real, Andes" *by* T. Kinouchi et al.

Anonymous Referee #1

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General comments: The paper in principle addresses an important overall topic. Glacier retreat, particularly in distinct wet-dry climates as in the tropical and outer tropical Andes, is a serious concern for the local population. The specific objective and research questions of the study are however not clear. In principle, the authors apply a semi-distributed model to simulate runoff from a partly glaciated catchment. The model approach has been used in many other studies before (as stated by the authors), and it remains unclear, if the authors have further developed or adjusted the model for this study and the specific conditions of the case study region and thus provide an added value that is of interest for the scientific community. Since the objective of the article seems more to aim for climate change impact information in the study regions, rather than to provide technical or methodological improvements, my biggest and most seri-

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ous concerns are related to the available observational data and the scenarios use in this study. In my view, both are far from allowing any scientifically sound conclusion! A 2-yr- observational record and a scenario based on the 2-yr-record and one single GCM scenario can for many reasons in no way be the basis of a scientifically sound climate change study (see also specific comments below).

The organization of the article is unfortunately not supportive for an improvement of the understanding and clarity of the study. Data description, methods, discussion etc. are all mixed up in several chapters, and thus a comprehensive description of data and methods, results, discussion is missing. Most of the time the description etc remains very much cursorily, often physically not sound and without the needed context.

The figures are in principle nicely produced, however, they could also be much more supportive and corresponding with the text.

My final conclusion/recommendation is that the idea of this article should be postponed till several years of good data is available, or the focus of the paper needs to be completely changed. In the later case, I would recommend to undertake a comprehensive study of current observed climate and glacier conditions of the target catchment only, maybe including a broad sensitivity study to better understand the ongoing processes in the region. A second study could focus on scenarios, but much more work is needed for a scientifically sound analysis of climate scenarios of the target region.

Specific comments

1 Introduction: The first part of the introduction is mentioning some references from past glacier studies in the area of the tropical Andes in a very general sense and often somewhat imprecise. Also, the focus region of the article (Cordillera Real) is not put into a (climatologically, glaciological, etc.) context compared to other regions of the Andes (or the world). In a second part the authors start to focus on glaciated and non-glaciated catchments with example from different mountain regions on earth. The passage from tropical glaciers to partially glaciated catchments is not very sound, and

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in principle not coherent with the title of the article.

p.13095; l7: 99% in numbers, area, volume? p.13095; l18: As it is written here, one could assume that the message is that in particular tropical glaciers (also compared to non-tropical glaciers) are an important indicator for climate change. p.13095; l24: Please express yourself more clearly and sound (in general); here for example: decrease in meltwater because of area and volume loss, or enhanced variability -> why? p.13096, paragraph.1: provide a figure illustrating the situation in the C. Real (enhance Fig. 1 and refer to it already here) p.13096; l17: Strange sentence, and 'vulnerable' is certainly not a correct word here

2 Study area: A figure showing the location of Huayana West headwater catchment would help to locate and understand the situation better (see also comment above – Fig. needs to be improved)

3 Characteristics of. . .: Fig.1 and 2, and the corresponding text should be improved for easier reading and understanding.

The section is a very general description of the measured data in the catchment. There is no information about data quality, no reference to the general climatological situation in the region, in particular, how the two years of measurements fit to longterm observations of the area. There is also no focus on relevant analyses needed for the objective of the study.

4 Glacier melt and runoff modelling This section describes detailed (incl. many equations) the approach used in this study, an approach that has been used in many other studies in the past, as stated in the text. That is, it is not clear if there is something newly developed etc for this study. Information about input and output data, specific parametrisations and experiences from using this model in tropical mountain areas is not provided. For the reader a lot of important information is thus hidden and does not allow a sound understanding of the overall approach.

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5 Input data and parameter setting Paragraph 1: the information (data and method) provided about the delineation of the glacier catchments is very sparse. The rest of the section is basically a description of the model tuning, however, scientific argumentation or consideration of local conditions of the study sites are not provided.

6 Simulation conditions for future prediction Most of this section is a quick review of other studies, unfortunately without a critical analysis for the study region of this article. The finally used approach is not sound. As written on p13112, the first case bases on "current observed conditions. . .." This is highly problematic with a 2-year observation record only! And for case (2) it is simply not sound as well to only use output from one GCM, without any evaluation. On page 13113 (final paragraph and Table 3) the authors write about a bias correction for solar radiation and wind velocity and it is absolutely not clear what here has been done, however, it is very clear that this is by no mean anyhow sound, above all because of the 2-year observations only.

7 Model application First paragraph: The authors write that Figure 6 shows that the model reproduces well the observations and they also explicitly mention the good simulation of the peaks. This is however too be expected, because in section 5 it is explained that the model is tuned to meet the peaks! The following discussion of deviation where it is argued with spatial snowfall differences, wind, albedo, etc is in my view an over-interpretation because the model and observations available (at least according to the information provided in the article) is not able to go into such detailed process analyses. An example of a sentence that is showing the general cursoriness of the article is for example on page 13115m line 8-11. What is for example meant by 'high' temperature?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 13093, 2013.