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Interactive comment on “Glacier changes from 1966–2009 in the Gongga Mountains, on the south-eastern margin of the Qinghai-Tibetan Plateau and their climatic forcing” by B. Pan et al.

Anonymous Referee #1

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The manuscript “Glacier changes from 1966-2009 in the Gongga Mountains, on the south-eastern margin of the Qinghai-Tibetan Plateau and their climatic forcings” by Pan et al. contains useful and interesting measurements and observations of glacier retreat in this region covering a forty-year period. However, in its current form it is not acceptable for publication in The Cryosphere and would recommend reconsideration after major revisions. Considerable work needs to be done on improving the presentation of the glacier retreat record – which is an important contribution and relevant to the journal’s scope. In addition, more analysis of the meteorological records and areal changes within the region is required to provide more robust interpretation of the measured retreat, its climatic significance and how it relates to glaciers in a larger

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regional context. Overall I would rate the scientific significance good, the scientific and presentation quality fair. One of my major concerns with the manuscript in its current form is that considerable rewriting is necessary to improve its readability and make it easier for the audience to understand what is presented. The figures and graphs as presented are small and difficult to interpret as well. Improving the figures will also make the results easier to understand and interpret. I have made a number of corrections/suggestions on the manuscript itself that may help improve readability. The methods need to be better presented. While the authors apply methods that are in common use in the field, their study site is impacted by debris cover which adds additional uncertainty in their computed glacier areas. The authors also note that at least in one case, perennial snow fields may be impacting their results. They also mention that manual editing of glacier extents was done in some cases. Because of these factors I would strongly encourage the authors to provide some evidence as to the accuracy of their estimated glacier areas which would help in the interpretation of the glacier retreat rates. The author's present air temperature and precipitation observations from nearby stations to demonstrate that air temperature increases, and not precipitation decreases are the cause of the observed glacier retreat. While I do not doubt the validity of their conclusions, I do have some concerns with the author's assessment of differences in temporal trends between stations. For example on page 9 lines 286-303 a number of statements are made about the strength (e.g. the mean annual precipitation to not exhibit a significant incremental trend) as well as magnitudes of changes (e.g. at the HLG station the air temperature warmed at 0.21 °C per decade. However, no information is provided how the temporal trends were calculated or how the statistical significance of the trend determined. Also as can be seen in Figure 7, the length and operational period of the three weather stations differed significantly, therefore I would hesitate at drawing any conclusions about similarity or dissimilarity of climate trends between these stations and hence between the east and west slopes of the Gongga. Also on line 300 the statement is made that mean annual precipitation increased by 1% even though it was stated earlier in

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the paragraph that no trend was present, so 1% is not significantly different than no increase. Care needs to be taken about consistency in presenting the results. It is also doubtful to me whether the errors associated with determining glacier area as discussed above support some of the claims made regarding area loss presented. For example on lines 306 it is stated that the rate of area loss on the western slopes 5.89% is greater than on the eastern slopes 5.48%. The manuscript then goes on to explain the cause of this difference. However, I think the authors would be hard pressed to show these retreat rates are actually statistically different. The manuscript also presents the retreat data in the form of Tables (Table 5 and 6). While this is useful basic information it would be advantageous to present the area loss in graphical form to make it easy for the readers to understand the changes in the four glaciers studied. It would also make interpretation of the text easier to follow for example it would be quite clear how the rate of glacier loss varied by period. I think the authors should carefully reevaluate some of the statements made about differences between eastern and western slopes and retreat for example in light of what the potential mapping errors may introduce in terms of uncertainty. Some additional text and graphics on the relationship between glacier area loss and size/topography would also strengthen the author's arguments in the discussion on these topics. Specific comments Page 5 line 126 – What is meant by the sentence “. . .aerial photographs taken at a scale of 1:60,000 taken during 1966, and corrected by aerial photographs. . .” It is not clear how one set of aerial photographs can be corrected by another. Page 5 line 158 and 164. What are the wavelengths of the selected bands? Page 3 line 170 – What is meant by “great” percentage of area loss? A more quantified assessment should be provided? Page 6 line 172 – Some indication of how water bodies can be confused with glaciers in satellite images should be provided as this is not obvious. Page 6 lines 193 and 195. How was the “climatic” snowline determined? Some description of the technique should be provided. Page 7 line 203. The last portion of the sentence is a bit unclear. Do you mean to say the areas of most glaciers have slopes ranging between 25 and 40°? Page 10 lines 335-336. The authors state that monsoonal nature of the Gogga

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glaciers may make the time lag between mass balance changes and terminus fluctuations shorter than for other glaciers because of their characteristics. Could the reverse also be true? Some supporting information for this claim should be provided. Tables Table 1. What does the Quality number indicate? Is it from the USGS assessment of quality or is it your own. If so, some explanation is required or the column should be dropped. Figures Figure 1. Figure 1 needs some improvement. For example, three meteorological stations are mentioned in the text. However, I could only located 1 on the map. I do not see any GPS survey data on the main map only the inset map (c), but the legend seems to indicate the points should be in the main map. It might be useful to show enlargements of all the 6 studied glaciers in some figure as the glacier outlines are quite small as presented. It is stated on line 218 that Figure 2 illustrates a trend of decreasing glaciers size in the Gongga Mountains, however Figure 2 only illustrates the size & number/area relationships of glaciers and does not illustrate temporal trends. Figure 3 is confusing. It is unclear to me how the aeral percentages in figure 3b sum to 100%. Figure 4. The figure is so small it is difficult to see what is going on in terms of terminus changes. The lines in the subset images presumably represent the mapped terminus at different times. However, it is what times the outlines correspond to. These should be labeled. Figures 5 & 6. It is difficult to figure out the intent of these figures. For example in Figure 5 it is difficult to see the relationship between b and c and the image in a concerning the separation of the glacier. In Figure 6 it appears the glaciers are still connected in the images but not in the satellite images? Is this the case? The size of the images makes it difficult to ascertain.

Please also note the supplement to this comment:

<http://www.the-cryosphere-discuss.net/5/C1874/2012/tcd-5-C1874-2012-supplement.pdf>

Interactive comment on The Cryosphere Discuss., 5, 3479, 2011.

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