Anonymous Referee #1

General comments:

1.The authors used the glacier boundaries and region divisions from RGI dataset 5.0. We know that both have been updated to the 6th version in 2017. Despite the small differences between the two versions in glacier divisions, the authors should carefully examine the differences in glacier boundaries between the two versions and use the latest version as a basis because it is important for an up-to-date glacial lake inventory. Also, the authors merged some subregions in this study, which is different with the original region divisions in RGI dataset 5.0. I suggest the authors use the region divisions provided by RGI dataset 6.0 directly, if not, the authors should give the reasons for such mergers.

Based on your suggestion, the RGI dataset 6.0 has been used to recalculate the buffer zone of 10 km from modern glacier terminals in the revised version. We have carefully reexamined and updated the glacial lake inventory of HMA based on the buffer zone of 10 km from modern glacier terminals of RGI dataset 6.0. All the descriptions and results based on RGI 5.0 in the previous version have been updated simultaneously. In all, the total area of buffer zone increased from 1.19×10^6 km^2 to 1.25×10^6 km^2, and new Landsat images have been collected to fill the gaps between the two buffer zones calculated by RGI dataset 5.0 and 6.0 respectively. 1117 and 1169 glacier lakes with a total area of 113.77 km^2 and of 124.22 km^2 in 1990 and 2018 have been newly recorded in a 10 km buffer area of glacier terminals of RGI 6.0 respectively compared with in a 10 km buffer area of glacier terminals of RGI 5.0. The updated data is shared at http://www.crensed.ac.cn/portal/metadata/706ce17f-1684-4e8d-bf5e-7d517e03693c.

There are 16 subregions in HMA region according to RGI dataset 6.0. However, relatively fewer glacier lakes in 2018 survived in some subregions such as 235 and 572 glacial lakes with an area of 13.94 and of 24.91 km^2 in Qilian Shan and E Kun Lun, 264 and 706 lakes with an area of 44.97 and of 47.29 km^2 in W Kun Lun Shan and Karakoram, 200 and 1624 lakes with an area of 11.01 and of 89.99 km^2 in Hissar Alay and W Tien Shan. Characteristics presented by too small sample lakes in these subregions appeared incongruous. Thus, E Kun Lun and Qilian Shan, Hissar Alay and W Tien Shan, Karakoram and W Kun Lun were merged respectively according to geomorphology and their climatic background characteristics. The rest of 10 subregions are the same as RGI dataset 6.0. Finally, we get 13 subregions in this study.

2.The authors got the total uncertainty of the lake area for the entire study region or subregions only by adding the uncertainty of each lake area. It would be wrong because the accumulation of errors should be based on error propagation theory rather than simple addition. I suggest the authors to download the document from the link:http://ipl.physics.harvard.edu/wpuploads/2013/03/PS3_Error_Propagation_sp13.pdf, which include the detailed introductions on how errors are propagated.

Yes, error propagation wasn't considered in the previous version. A single lake area uncertainty may be either overestimated or underestimated by the formula (2) of the manuscript. Thus, it was wrong to calculate the total uncertainty only by adding the uncertainty of each lake area. We have recalculated uncertainty of the lake area for the entire study region or subregions by the following formula according to the suggested document (link:http://ipl.physics.harvard.edu/wpuploads/2013/03/PS3_Error_Propagation_sp13.pdf):

$$E_T = \sqrt{\sum_{i=1}^{n} {a_i}^2}$$

where "E_T" is the area error of the entire study region or subregions, "i" is number of the lake in the entire study region or subregions, and "a" is the error area of a single lake. We have updated the uncertainty contexts in line of P15 L1–5 in the revised manuscript.

3. For the High Mountain Asia, there are a lot of regional or river basin-based studies have been made on dynamics and evolutions of glacial lakes, and their potential hazard and risk assessments also primarily based on satellite images and GIS technology. Based on this, many glacial lake datasets have been produced, hence I suggest the authors add a sub-section at the end to collect and compare these regional or basin-based datasets with the dataset produced by the authors. It is important for data paper and will improve this manuscript.

This is a very precious suggestion. We have accordingly collected the available documents or datasets investigating the glacial lake in HMA and have excerpted a Supplementary Table S1. The description about dataset comparisons has been added in a sub-section of "**comparison and limitation**"(P19 L11-P20 L21).

There are at least 34 published reports or datasets on the regional extent of glacial lakes in the HMA area, which are based on various lake boundary extraction methods and different data sources (see Supplementary Table S1). The previous research work examined glacial lakes from as early as 1962 up until 2017. However, it is difficult to evaluate any discrepancy comprehensively because glacial lake distribution was examined in different extents and thresholds of minimum lake area were used inconsistently. Therefore, glacial lake inventory data of the Third Pole region in 1990 (Zhang et al., 2015) and of the HMA (Chen et al., 2020) in 2017 have been used for comparison because both recorded glacial lakes in the same buffer zone (i.e., within 10 km of the modern glacier extent) and over similar periods. For the comparison, same thresholds and regions have been adopted for the inventory data. Marked discrepancies have been found to exist between the different datasets in terms of both the number and the area of the glacial lakes. In 1990, only 4601 glacial lakes ($\geqslant$0.0054km^2) with a total area of 554.33km^2 were recorded by Zhang et al. (2015), whereas 20,410 glacial lakes with a total area of 1376.23 km^2 have been catalogued in the Third Pole region in this study. In 2017, 14,477 glacial lakes with a total area of 1635.94 km^2 were recorded by Chen et al. (2020), whereas, we have recorded 22,727 glacial lakes ($\geqslant$0.0081 km^2) with a total area of 1726.41 km^2 in 2018 in HMA (excluding Altai and Sayan). We consider the discrepancies attributable to three primary factors. (1) The buffer zone within 10 km of the modern glacier extent is inconsistent between the data sets because different glacier inventories have been used. (2) Different operatives have catalogued the glacial lakes using different remote sensing data covering different periods. (3) Many glacial lakes were possibly missed because of comparatively less manual vectorization effort involved in the work of Zhang et al. (2015) and Chen et al. (2020). Overall, our glacial lake inventory has catalogued glacial lakes throughout the entire HMA more comprehensively and with more careful error assessment compared with available glacial lake data sets from regional or river-basin-based studies.

Table 1. The comparison of glacial lake amount from the documents of Zhang et al. (2015) and Chen et al. (2020) with that from this manuscript

Region	Year	Numbers	Area (km^2)	Minimum Area (km^2)	Reference
The Third Pole region	1990	4601	554.33	0.0054	Zhang et al., 2015
	1990	20410	1376.23		Wang et al., 2020
HMA (Altai mountains excluded)	2017	14477	1635.94	0.0081	Chen et al., 2020
	2018	22727	1726.41		Wang et al., 2020

4.The language of this paper still needs further polishing due to some inappropriate sentence's constructions. I had trouble in understanding and following some sentences, and suggest seeking a professional editor before publication.

The language of the revised manuscript has been polished by a professional language retouching company.

Specific comments:

P1 L1: Please rephrase the title so that it can contain a more explicit time information because the present title seems to be a long time series dataset, but the authors only provided two periods of dataset.

The title of manuscript has been changed into "Glacial lake inventory of High Mountain Asia in 1990 and 2018 derived from Landsat images"

P3 L28: : : : are shown in Figure 1.

It has been revised.

P3 L29: It would be better to include the specific latitude and longitude ranges.

It has been revised as "This region (26°–54°N, 67°–104°E)"

P4 L7: Add the reference(s) for the annual average glacier meltwater.

We are sorry to say that we cannot find the source of "an average meltwater volume of 110–150 km^3 a^{-1}". For this reason, we have used a new data of glacier negative mass balance of -150±110 kg m^{-2} a^{-1} in HAM to replace it. This information is sourced from "Hock, R., Rasul G., Adler C., Cáceres B., Gruber S., Hirabayashi Y., Jackson M., Kääb A., Kang S., Kutuzov S., Milner A., Molau U., Morin S., Orlove B., and Steltzer H. 2019. High Mountain Areas. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [Pörtner H.-O., Roberts D.C., Masson-Delmotte V., Zhai P., Tignor M., Poloczanska E., Mintenbeck K., Alegría A., Nicolai M., Okem A., Petzold J., Rama B., Weyer N.M. (eds.)]".

P6 L15: 4.2

It has been revised.

P7 L5: Landsat TM/ETM+.

It has been revised.

P7 L11-13: Provide more information about this step, i.e., how to determine the thresholds for different regions?

In the present study, we have determined the optimal thresholds in each region or image. By considering the edge effects according to the mixed pixels, this study firstly selects a lower optimal threshold (approx. −0.1) for specific images to obtain the maximum water body. Then, higher thresholds are tested for visual water extraction before a suitable threshold (varied in the range of −0.10 to 0.20) is selected. It has been explained in line P7 L12–19.

P7 L14: For the High Mountain Asia, a lot of regional or basin-based studies on glacial lakes have been made during the past decades. Hence, it is a better choice that the authors can collect these published glacial lake data to help identify and locate the glacial lakes except for the method the authors used because we know the water bodies automatically extracted contains many errors because of mountain shadows and snow cover.

This is a valuable suggestion. We have accordingly collected and used the available glacial lake data in HMA (see Supplementary Table S1) to identify and locate the glacial lakes when the glacial lake inventory of HMA was reexamined and updated.

P9 L3: Please check this reference format: Weicai et al., 2014

It has been revised as "Wang et al., 2014".

P10 L25-27: Please provide more details on how to use these ancillary data to distinguish the glacial lake types because it is important as a guide for similar studies in the future and in fact, we know that the subsurface channels are ubiquitous. Have the authors considered this problem and how to solve it?

We have distinguished the glacial lake types of glacier-fed from the non-glacier-fed by whether or not a glacial lake can possibly receive surface meltwater from the modern glacier (Fig. 1). We have recorded a glacier-fed lake based on the following facts: (1) a lake has a lower elevation than modern glacier (mother glacier); (2) the mother glacier(s) melting water can visually flow into lake through surface flow route assisted by 3D digital terrain imagery from Google Earth; (3) all the glacial lakes were visually examined one by one.

Theoretically, the boundary of glacial lake basin and melting water surface flow route can be calculated based on DEM data which undoubtedly would contribute to distinguishing the glacier-fed lake from the non-glacier-fed lake. Practically, we tried but failed to do this at the present stage for no appropriate DEM data with satisfactory resolution was obtained since so many small glacial lakes survived in HMA. Nevertheless, we will further focus on this in the future work.

The glacial lake fed by melting water through subsurface channels is a common phenomenon and little field-surveyed work about this has been reported. We choose to ignore this issue as it is difficult to survey the subsurface channels of glacial lakes from remote sensing data. In addition, lake type is distinguished from topographic features of the lake basin and modern glaciers. In most cases, the lake can be possibly fed by melting water both from subsurface channels and surface route.

We have added the explanation in line P11 L1–9.

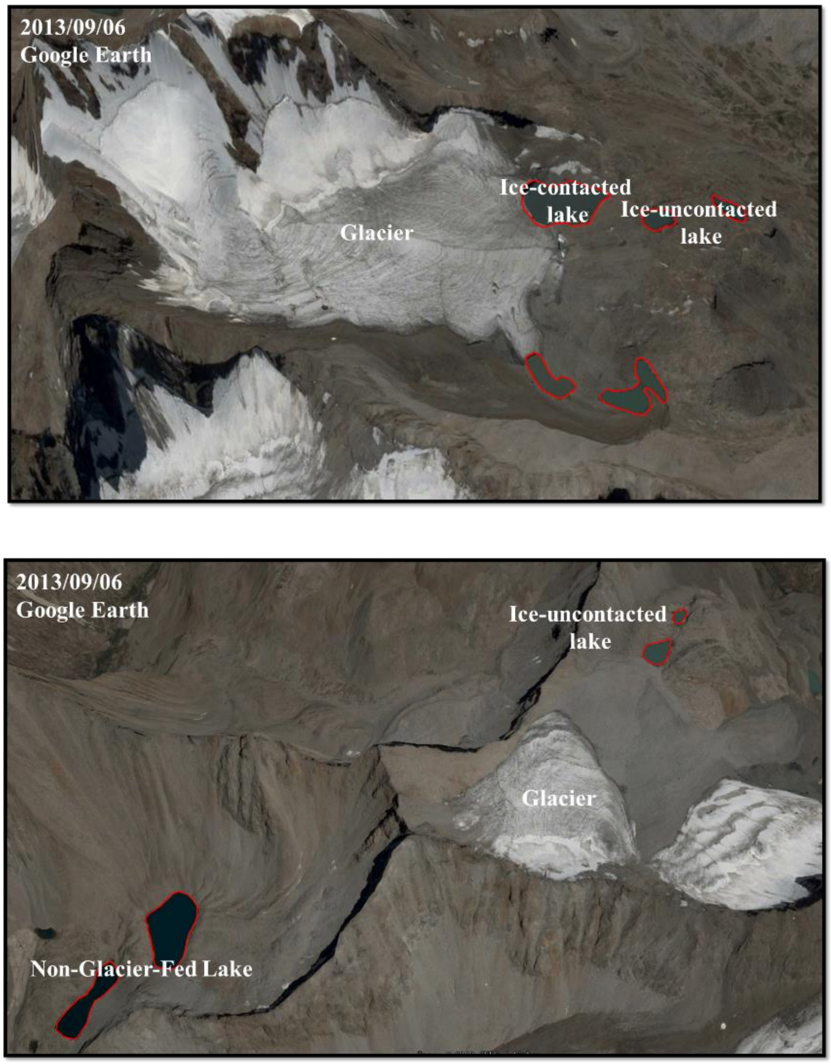

Fig. 1 Different types of glacial lakes distinguished from 3D digital terrain imagery from Google Earth

P16 L3-4: This description is the opposite of that in the legend in Figure 6. In fact, it can be removed because it is already clear in the legend.

It has been deleted.