

Earth Syst. Sci. Data Discuss., referee comment RC2
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Comment on **essd-2020-360**

Anonymous Referee #2

Referee comment on "Glacier changes in the Chhombu Chhu Watershed of the Tista basin between 1975 and 2018, the Sikkim Himalaya, India" by Arindam Chowdhury et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2020-360-RC2>, 2021

Review on the manuscript entitle "Glacier Changes in the Chhombu Chhu Watershed of Tista basin between 1975 and 2018, Sikkim Himalaya, India".

Comments to the authors

After several read, I find this work very informative, especially the illustration (figures) and data analysed are impressive. This shows the degree of data processing and visibility. One way it may attracts many readers to follow, on the other hand the study has focused only a small catchment containing only 74 glaciers (2018). Considering, the V order basin of the Himalaya, there are >100 of V order basin and 10 times of that the glacierized catchment. Since, remote sensing techniques are well known for its spatial coverage. I would supposed to have this study at least to a basin level with the same efforts.

General comments

Authors could be clearer about what readers can learn from the data about the temporal changes in the length of the glaciers. The following are comments elaborate on this point.

Basically this work has focused on the inventory of the glaciers in the Chhombu Chhu Watershed and tried to explain the enhanced retreat rate during recent with metrological data. Climate variability and its impact on glacier changes show no convincing agreement in terms of temporal variations. This must be worth discussing. Similarly: In the last sentence of the abstract you state that this inventory will provide valuable information for planning the water resources in the Sikkim state of Eastern Himalaya. But such information of temporal changes, planning and execution is not discussed in the text.

Another thing that was lacking in the manuscript is proper terminology and the literature review. For instance, (PDC) (MDC), mountain (SB) valley (CB) use of such abbreviation is hard to follow as it is newly added and several times used in the manuscript. Use, debris-covered, fully debris-covered, partially debris-covered, mountain glacier, valley glaciers or else. Length change, retreat rate, recessional rate, glacier area loss or glacierized area loss. Fix these words and follow consistently throughout the manuscript.

Detailed comments

Abstract: Debris free: use clean ice or clean glacier instead debris free. In fact it should be mentioned in the method that how you categorized the Clean 'C' type and debris-covered 'D' type glaciers. Partially debris-covered: being quantitative mentioned the % for partial and maximum debris-cover.

L18-22: Use quantitative results in the abstract, rather to provide general statement.

L29: This sentence is not understandable, or required proper validation such as referencing.

L30: How and what is the response indicators, is it response time of the glacier? If so then try to explain response indication glaciers in prior sentence.

L31: Such comparison in the sentence actually raising curiosity in readers that how large is the difference, is it two fold or comparably similar specific loss.

L33-34: referencing is more than what was mentioned in the text.

L42: Delete 'However'.

L44: This sentence should come first.

L45: Any of the bigger statement need proper citation.

L46: sediment related concern needs proper background, why this brings in context to the

present study.

L52-53: It does not make any sense, even cited article not intended to say this statement.

L54-56: If this is the case for present study, then all basins are somehow related to the same problems. Here need to state the fundamental of present study by answering how and why.

L58: Delete the whole line. Avoid to use local-level, try to use small scale, regional level, basin level, catchment level etc.

L73: Delete, on glaciers since historical past.

L86-88: Here describe about the climate of the area, not that ISM plays role in glacier fluctuation. Such data article actually needs a greater details of climate of the study area.

Suggestion on referencing : the two article Debnath, 2018 and 2019, which were cited 18 times in the manuscript, brings special attention to read both of them, while there were different objectives described, here it was cited for different context. Authors, need to be careful with statements and article citation.

L170: please acknowledge the university or institute having ArcGIS 10.2.2 license.

Section 3.6. L201: Provide the aspects of extensive field measurements, means the instrument used or it is visual interpretation and shown with figure 3.

L206: delete 'dangerous'

L208: If it is benchmark glacial lakes, there must be name of it.

L212: For minimum size threshold, as per RGI they consider 0.01 km² the minimum size, but recent inventories has consider 0.02 km² (Frey et al., 2012; Chand and Sharma, 2015). This information should come in method section with reference.

L220-225: This will be better while comparing with other studies in discussion section, so shift it.

L286-289: This can be shift to discussion section. And delete Fig. 10c showing the retreat map of the study area (1975–2018).

L290: Describe the results and then followed by the referred figure.

General: L300: Better term is clean glacier or 'C' type, not debris free DF, and please used full word for terminology having definitions. It is interesting that having enhanced retreat rate of the glaciers in this catchment, still have higher number of clean glaciers. Ok what is the criteria set for clean glaciers in this study?. PDC: same here, how much debris cover (in % either for the total glacier area or for total ablation area) was categorized for partial debris-covered glaciers.

L305: "mainly due to lower terminus elevation" This is not the reason for recession, it is a mechanism that glaciers having longer length and lower terminus position has receded at higher rate due to higher negative mass balance at the lower elevation.

L313-314: This is the process observed but the deferential processes is something else, which I described in the above comment. So rather, you may show the observation instead the reasons.

5.1 CCW: Chhombu Chhu Watershed

335-345: For this comparison between inventories of glaciers, providing detail only in Table will not justify. For valid comparison and stating the discrepancies of other inventory you might have to provide a figure with glacier outline. I think it is available for all datasets.

348-353: First, Authors have selected wrong dataset for GSI inventory, so check with Sangewar and Shukla, 2009. Second, that was the era, when Geological Survey of India has make larger efforts to provide a detail study of Indian Himalayan glaciers. So, I suggest to follow their glaciological terminology and the best out of the old literature. Avoid to say misinterpretation, rather you can provide uncertainties.

384: December: provide years and number of days with time of measurement. The surface temperature has diurnal variability. So comparing morning and evening may lead

to misinterpretation.

L394-397: Though, the difference is very much close, still authors needs to discuss the reason in here, rather to provide results.

397_399: " These glacial fluctuations are controlled by the variations of ISM in summer while the midlatitude westerlies dominates in winters, resulting in a clear seasonality of precipitation which enhanced the glacier melting on the north face of Kanchengyao–Pauhunri massif over the past 43 years (Ali et al., 2018; Benn and Owen, 1998)" . This is really not connected to the previous sentences, and even cannot be end like this. Frankly, I could not see any topographic control on glacier changes, see north facing and south facing have almost similar rate. And then how temperature of rock, water and grass comes under topographic influences. This sections needs proper discussion on the observations.

L339: refer Bhambri et al., 2017, there the total number of glaciers are 206 with surge behaviour.

L451-454: "The rising temperature contributes to glacier shrinkage over the entire Tibetan Plateau (Fujita and Ageta, 2000; Yao et al., 2012) as well as in the different Himalayan regions (Ageta and Higuchi, 1984; Das and Sharma, 2018; Debnath et al., 2019)" . For Himalayan glaciers regional level ice mass change and perturbation in climate read these articles Bhutiyani et al., 2012; Pratap et al., 2016.

L455: "Moreover, the response of entire Himalayan glaciers are quite sensitive to precipitation, directly or indirectly through the albedo feedback mechanism on the short-wave radiation balance (Azam et al., 2018)". conect this sentance with previous sentance.

L457: Why it is ironically?, I saw this word several times.

Table 2: Use Glacierized instead glaciated. by definition

Glaciated; Covered by glacier ice in the past, but not at present (read Cogley et al., 2011).

Glacierized; 'Of a region or terrain, containing glaciers or covered by glacier ice today.

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