

Interactive comment on “Glacier terminus retreat, mass budget, and surface velocity measurements for the Jankar Chhu Watershed, Lahaul Himalaya, India” by Suresh Das and Milap Chand Sharma

Anonymous Referee #1

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The authors describe the combination and production of several remote sensing datasets, together with some fieldwork observations from a valley in the Himalaya. Apart from some minor technical implementations, this work seems like common practice. At first hand this sounds like a positive point, but it can also be seen as a weakness. It raises the point what exactly the authors want to convey with this dataset. Their study starts with a review on literature on glacier change in the Himalaya, with a big table in the supplement. There is a section with some temperature measurements and debris cover thickness. And their work as presented in 2019 about glacier outlines is explained again in this work.

C1

In my opinion, the new contribution introduced in this study comes from the remote sensing datasets. The used datasets are generally available, such as SRTM and TanDEM-X, and these have been used for the whole mountain range of the HKH. Similarly, datasets of velocity are available in (annual) mosaic form (such as ITSLIVE) or individual pairs (like GOLIVE). These are similar datasets, but rely on multi-temporal velocity estimates (in the case of ITSLIVE), while the authors rely on single data pairs. Consequently, the velocity results do not seem to be physically reasonable (as large blobs of velocity exist in all shown time periods). The estimated precision might be in line with the real uncertainty, but already by eye gross errors are present, so there is an issue with reliability. I can not see why such a dataset would be of interest. Furthermore, the authors produce a mean velocity over a glacier, while it has gaps (thus a changing sampling set) and velocity is highly dependent on slope.

Concerning the elevation changes, the results presented in Figure 8, seem to have an aspect dependency. Many north facing slopes have a positive elevation change, this might be a real signal, but for example glacier G18 experiences area loss, while a general elevation gain is measured. This contradicts each other, especially in the lower snout. Such errors will be part of the noise for regional estimates, but the authors use it here on an individual glacier basis. Again, if sufficient temporal data is present, these errors might diminish, but this is not the case here. Then data from HMA from WorldView is such a dataset and very helpful (<https://nsidc.org/data/highmountainasia>). Given in light of these available and open datasets it is very difficult to distill what the aim is of this dataset. Especially, because validation data is not present, which is difficult for remote sensing of high mountain glaciers. But, given the detail the authors aim for here, and the envisioned audience, this is a strong shortcoming.

The main points of this study are given in the conclusion, being - area change, which was highlighted by the authors in already another paper - elevation change, which was done on a large scale by others as well - velocity change, which was also already done. Furthermore, there are large sections about SRTM C and X band penetrations, while

C2

only C-band data is used. In addition COSI-CORR is explained, but not correctly and too lengthy. The reader might also wonder why the temperature measurements are given, but not placed into context.

Given below are some minor remarks: p01.l01.: title not correct, maybe change to "Remote sensing of ...". "Mass budget" is not given change to "elevation change", "measurements"... "estimates" might be more suited.

p01.l13.: "and the limited" > "and a limited"

p01.l20.: "but the dynamic active" what is meant here?

p01.l21.: which "findings" do you mean?

p01.l29.: "enourmous" please use appropriate wording, be less subjective "large" might be sufficient

p01.l30.: "these Himalayan glacier" > "Glaciers in the HKH"

p02.l51.: "The reported glacier change" > "The reported glacier area change"

p02.l55.: "information" > "knowledge"

p02.l55.: "no study exist on the ... and ... and .. and ...". True, but individual aspects are analyzed. Please change.

p02.l59.: "during studied period" > "during the studied period"

p02.l61.: "also evaluated" ~ (meaning strange wording)

p02.l63.: "done by Das&Shrama 2019"

p02.l64.: How special are these points?

p02.l69.: "of mighty Chenab" > "of the mighty Chenab", maybe another word for mighty

p03.l75.: "highly active glaciers", what is meant here?

C3

p03.l80.: it took me a while to figure out what this figure (a) was doing here. does this really contribute here to the work? and does it give insights?

p04.: This can be shortened considerably. The data is similar to the one used in Das&Shrama'19, one line of text might suffice. You read a lot about SRTM, while a simple bias is used from the literature.

p05.l123.: "huge ice cliff", please give something in a metric unit

p05.l124.: "thick layer", what is thick and is it homogenous?

p05.l127.: "recorded", what do the authors mean "surveying/observing"?

p07.l146.: "considered as are" ~

p07.l147.: "all criterion was applied" > "were"

p07.l152.: why not use the "box"-method of (Moon & Joughin)?

p08.l173.: "penetrates more" into the snowpack

p08.p4.3.1.: reduce to one sentence

p08.p4.3.2.: can be simplified

p10.l217.: please include reference, do the authors mean the procedure of (Rolstad et al.)?

p10.l229.: Cosicorr is not normalized cross correlation

p10.l235.: it is not nadir looking, it has a swath, it is a pushbroom

p11.l242.: isn't there saturation in the green band of ETM+ 8bit data, why not use NIR, which is typically done with older data?

p11.l246.: please say why you do this

p11.l250-259.: this reads like a text from a manual, please reduce.

C4

p14.l308.: "select glaciers"

p17.l343.: "glacier in the JCW" > +s

p17.l343.: "is active"... what is meant here?

p17.l344.: "for analyzed" please change

p17.l350.: what is meant here, I don't get this out of the table. And what does this mean?

p17.l352.: "of select nine", please change

p20.l388.: "the first", GOLIVE exist for some years, see (Fahnestock et al.)

p20.l392.: "in ablation and accumulation zone" wording

p20.l392.: "that highly"

p20.l393.: "while accumulation zone"

p20.l396.: "range broadly"

p20.l403.: "with a reasonable request", what do the authors mean?

p21.l408.: "the regional climate glacier interactions", what is meant here?

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