

## General comments

This manuscript discusses the potential and limitations of annual and seasonal geodetic mass balance estimates retrieved from Pleiades stereo images, over two regions in Muztagh Ata in eastern Pamir and Western Nyainqêntanglha. Both glacier regions are in High Mountain Asia representing different melting regimes. The topic is of high importance to further understand how the geodetic approach of measuring glacier mass balance using very high resolution optical imagery like Pleiades can be used to estimate seasonal glacier mass budgets without the need for in situ observations in a region with high elevations and difficult topography. In addition, the authors use other remote sensing data in their study. Sentinel-1 SAR and Landsat OLI was used for defining firn area and wet snow zones, both included in a Glacier Index for defining accumulation regimes. Sentinel-2 was used for retrieving glacier surfaces. In addition, the results are compared with climatic data and other geodetic mass balance estimate studies.

The manuscript is cited well and with a clear language. The datasets and method chapter is well described. The study is well compared with other studies and the authors illustrate this in tables and figures. The result chapter gives in general a good overview of the findings, and in the discussion chapter the authors compare their results with other relevant studies. This is of high importance especially for the Mustag Ata region due to the indication of a change in glacier mass balance regime to a slight mass loss.

## Spesific comments

Belart et al.,2017 states that the bulk snow density is most likely the largest contributor to uncertainty in winter geodetic mass balance. In the chapter “3.1.5 Bulk density” in the manuscript, the authors refer to other studies and assumes uncertainty values, e.g. that the density values referred to are from snow pits. It is limited data of snow density in the study regions. The authors should discuss this uncertainty more and be clearer on the consequences it might have for the results.

The use of the surface classification of snow, ice and firn from Sentinel-2 can be clarified in chapter “3.1.2 Classification of snow and ice using Sentinel-2 scenes”. The chapter gives a good description of how the analysis is done, but it can be elaborated in the start of the chapter what use these data has for the geodetic glacier mass balance and why it is important.

Some of the sentences and text includes to many parentheses with additional information or clarifications. A suggestion is to go through the whole manuscript text in general and write shorter sentences that are clearer and easier to read. Here is an example to illustrate: L: 595: “Overall, we find the glacier-wide and (for the most part) individual differences to be well within the uncertainty ranges, and attribute the differences to the overall small differences in average density (which in turn derives from the snow and ice distribution) of the September 2021 (590 kg m<sup>-3</sup>) and April 2022 Sentinel-2 (630 kg m<sup>-3</sup>) snow and ice masks.”. The parentheses are sometimes randomly placed, e.g., “(630 kg m<sup>-3</sup>)” should maybe be placed after “April 2022”?

The authors give a good overview of how they used the Glacier Index of Huang et al. (2022), to find glacier accumulation regimes. However, it is no error estimations of the retrieval of firn and wet snow areas from the remote sensing data, and this should be elaborated.

## Technical comments:

L: 91: “The major aims of this paper are therefore to investigate the potential and limitations of geodetic mass balance estimates derived from VHR Pleiades satellite data (using 5 DEMs over the 3-year period 2020-2022).” Should it be data between 2019 and 2022? (Ref. table 1).

L:425-429: “To account for different glacier areas between the study sites, we express firn and wet snow areas on each region as a fraction of the total glacier area (hereafter referred to as firn area ratio and wet snow area ratio). This ratio can vary to a great extent across different geographic regions

through time, whilst interannual variations of the firn area ratio remain relatively small.” Which ratio do the authors refer to when compared to the firn area ratio? Glacier index, I? A suggestion to rewrite sentences.

L: 440: “First, the Landsat scenes are used to recognize debris-covered and debris-free areas (ice and snow) on glaciers surface applying a threshold to the previously computed Normalized Difference Snow Index [NDSI] (Bruns et al., 2014).”. The authors describe the use of Landsat-data for glacier surface characteristics. Why was not Sentinel-2 data used for this purpose as this satellite sensor has higher spatial resolution?

L: 830: “The ever increasing and availability of very-high resolution optical satellites (with stereo capability and relatively short revisit time) will allow for increasing the number of glaciers in isolated regions that can be readily monitored.”. Can the authors clarify which satellite sensors they are referring to in the last sentence of the conclusion? It is not planned many optical missions with stereo capability in the future. Consider to be more specific and give examples of missions you refer to.

L: 1015: Wrong year in Huang et al., 2022 in reference list.

Figure 1: It is not clear to me which glaciers are “investigated glacier” in the figures. Is it all of them? Consider changing color or outline and rewrite to “investigated glaciers”.

Figure 4 and 6: Cannot really see the dh variation in the figures. A suggestion is to make the figures larger, and subsets of the individual glaciers discussed in the text can also be included.

Figure 8: Improve the representation and better the resolution of the plots.

Figure 9: It is hard to see the difference between the lines indication “this study” in the plots. Consider changing color on either “annual time step” or the individual glaciers.