Interactive comment on "An improved Terra–Aqua MODIS daily cloud-free snow and Randolph Glacier Inventory 6.0 combined product (M*D10A1GL06) for high-mountain Asia between 2002 and 2019" by Sher Muhammad and Amrit Thapa

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Anonymous Referee #2 This paper represents an update of the previously published (and reviewed by myself) 8-day SCA dataset to daily SCA. The current method uses the 8-day product as a training dataset which additionally reduces overestimation in the daily data due to large SZA. The dataset generated is distinct and a useful contribution to the community and therefore I feel deserves publication in a data journal

C1

such as ESSD, subject to the following comments. Response: We are thankful to the reviewer for the constructive review and comments to improve the readability of the manuscript. We carefully consider all the comments raised by the reviewer and revise the manuscript accordingly. Following are the comments from the reviewer with response to each comments. Page and line numbers are given when appropriate eg. p3 l21 (page 3 line 21). MAIN COMMENTS 1. The fractional snow cover daily product is very useful for data assimilation and other modelling applications. Can the authors explain why they chose to degrade this to a binary product? Response: The original snow data values are NDSI which requires to be converted to snow and no snow for assessment of snow cover changes, using it as an input to glacio/hydrological model, and other water related studies. Although, in some cases, fractional snow is important, but for most of the applications, the data need to be used as snow or no snow. Also, our 8-day snow is binary data which makes it comparable. Therefore, we converted it to binary. 2. In general the paper reads well but there are grammatical and style mistakes throughout the paper and would benefit from a careful proofread. Some examples in MINOR COMMENTS below. Response: We carefully revised the manuscript to remove grammatical and style mistakes. We do hope the revision will be satisfactory for the reviewer and the editor. 3. I think the dataset on Pangea requires a readme. The manuscript is of course an important reference for the dataset but the dataset published on the repo must include this "use metadata", that is required in order to use the data (basically pixel codes). Response: We agree with the reviewer, a dataset readme file is now attached to the PANGAEA dataset. The DATASET readme is attached to the PANGAEA dataset as "Further details: README - Description of M*D10A1GL06 data product". 4. I would like to be further convinced that you don't just end up with something that looks like the 8-day product with this gap-filling strategy - i.e. is information added? Perhaps you could include a plot of a one month "gappy" interval where you compare the 8-day and gap filled daily so it can be seen how that looks. This is not discernible when the entire timeseries is plotted. Response: Thanks to the reviewer for asking to add further information about the difference in daily and 8-day compos-

C2

ite improved data. We have now added a figure to show the difference on a monthly interval as suggested (Figure 5). The results show that the 8-day composite data overestimates snow by ∼32% on average during the study period which is quite significant. We also have added some details to the manuscript on the basis of the difference in daily and 8-day snow as "It is important to mention that the 8-day composite show an overestimation of 32% on average when compared with the improved daily snow data as shown in Figure 5. These results are quite critical for studies related to snow onset and melt timing and related hydrological simulations. The daily or 8-day snow products should be carefully selected depending on the nature of the application to avoid biases and uncertainty."

5. p3 l21 How is it possible to have daily extents greater than the 8-day product as the 8-day max is defined by the max snow cover extent in any given daily extent? Response: Our 8-day composite is improved product in which we have reduced overestimation by discarding mismatching snow in Terra and Aqua products (if snow is only in one of the Terra or Aqua product, then it is discarded, the pixels with snow in both Terra and Aqua is the final snow). It is possible that the daily product contains snow beyond the 8-day maximum (improved) product. 6. p5 l14 "and overestimation caused by large sensor zenith angle (SZA) were reduced in this paper" - as this is quite a central contribution of the dataset I would like to see evidence supporting this statement. Response: we have added some explanation to the effect of SZA and reduction of overestimation in the results as "The effect of SZA was reduced by merging of daily Terra and Aqua products with snow if the pixel is snow in both the products while giving 0.5 weight if the pixel is snow in one of the Terra or Aqua. This criterion reduces 6.2% of the overestimation in the daily composite snow product." We also explained the effect of SZA in P8, L8-14 as "To assess the variability of snow overestimation mainly due to SZA differences, we compared the minimum (snow overlapped by Terra and Aqua), maximum (snow in either Terra or Aqua), and mean snow (1 weight to minimum snow and 0.5 to maximum snow). The maximum and minimum snow cover area showed a difference of 12.4% on average for the whole study area, whereas the mean snow differs by 6.2% on average

C3

in comparison to the minimum and maximum snow. Therefore, we suggest using the mean snow for snow cover analysis using this product. Also, both the minimum and maximum snow may be analyzed for estimating a range of snow cover area." MINOR COMMENTS 1. Abstract l.10 poor grammar of the sentence. Response: the sentence is revised and corrected as "The uncertainties in passive optical remote sensing snow products mainly underestimation caused by cloud-cover and overestimation associated with sensorsËĹ limitations hamper to understand snow dynamics." 2. p1, l28 remove "The" (unnecessary article, a common mistake throughout). Response: "The" removed, manuscript checked throughout and corrected for such mistakes. 2. p2, l13 "was somehow reduced" - poor language style. Response: The sentence revised as "The cloud contamination in the original eight-day composite MODIS snow cover products is comparatively less than the daily products (Hall et al., 2002), but remains significantly, e.g., In the Karakoram 9% and 15% of the Terra and Aqua 8-day images are cloud-covered (Thapa and Muhammad, 2020)." 4. p3, l26 "reduce overestimation due to large SZA" - state this explicitly it is a key contribution! Response: another sentence is added to the introduction section to explain the overestimation reduction due to SZA. "Larger SZA mainly causes an overestimation which was further reduced in the daily product by combining Terra and Aqua following the MOYDGL06* product methodology with a slightly different approach." 5. p5, l8 I don't think it was "improved" but "extended" to 2019? Response: In above statement we talk about daily snow products improved in this study. This product is not only extended but improved also (by removing cloud cover and reducing overestimation). 6. p9, l1 why the data link here? You have it in the data availability section. Response: We agree and removed the data link from P9, L1. We thank the reviewer for the constructive comments to help us improve the readability of the manuscript.

C4