

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2021-139

Anonymous Referee #1

Referee comment on "Spatiotemporal distribution of seasonal snow water equivalent in High-Mountain Asia from an 18-year Landsat-MODIS era snow reanalysis dataset" by Yufei Liu et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-139-RC1>, 2021

In this manuscript, the authors build upon previous work and develop and 18-year snow water equivalent (SWE) dataset for the High Mountain Asia (HMA) region based on remote sensing observations from both Landsat and MODIS sensors. To demonstrate the utility of the reanalysis dataset, the authors discuss spatial, temporal, and elevation variability of SWE across the region.

This dataset will be a fantastic contribution to the community, and I think this manuscript is well written. I do wish there was more analysis with the data, beyond the spatiotemporal analysis presented. As a data paper, I think this manuscript only needs minor edits for being accepted. For a research article, I would like to see additional analysis prior to being accepted. My comments are below.

- As mentioned in my summary above, I was surprised how little additional analysis there was in this manuscript beyond exploring the dataset. Especially since the algorithm development and discussion is published elsewhere, I would like to see additional analysis here. On line 249, you say "A more comprehensive analysis of HMA SWE between multiple products will be addressed in an upcoming intercomparison paper using HMASR." Can that intercomparison not be included here? This did not seem like a very long manuscript, and understanding how the HMASR dataset compared, and likely improves, upon currently available datasets would strengthen this manuscript.
- On line 62, you say that most reanalysis datasets do not assimilate snow observations, but on lines 72 and 74 you mention that JRA-55 assimilates ground snow depth and satellite snow cover and ERA5 uses in situ snow depth and satellite snow cover in the assimilation. Please rephrase the sentence on line 62 to indicate that some datasets do assimilate snow related observations.
- You only process tiles with tile-averaged elevation above 1500 m. Do you have an estimate for how much snow is "missed" with this assumption?
- Could you provide a few additional details on your setup of the SSiB3 model? How many snow layers? Could you provide a few additional details of the Liston snow depletion curve? Readers may not look back at previous publications.

- Since you use observations from Landsat 5, 7, and 8, is there any need to do any sort of correction between the three versions? Is the fSCA calculation/band math the same in each version?
- If additional analysis does make the manuscript too long, I recommend condensing the text on lines 307 to 329 since it states what is already shown in Table 1.

Minor comments

- On line 174, please write out CDF since it's the first time it appears in the manuscript
- In Figure 2, do any tiles have an 18-year average of 0? If so, could you update the colormap/figures to distinguish 0 from non-zero values?
- When describing Figure 3 in the text, could you include the percentage of the domain that is non-seasonal snow/ice?
- On Figures 3-5, consider including labels of the mountain ranges as you do in Figure 1. Probably not necessary, but I did find myself flipping back to Figure 1 to see the labels since I am not familiar with the ranges in this region.
- Please rephrase the sentence that begins on line 256 "The median date of peak...". To me, it reads awkwardly.
- In Figure 7, the time series for the Ganges-Brahmaputra does not go below $\sim 2 \text{ km}^3$. Should those areas that keep snow all year be included in the non-seasonal snow mask?