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Interactive comment on "Mapping seasonal glacier melt across the Hindu Kush Himalaya with time series SAR" *by* Corey Scher et al.

Anonymous Referee #2

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This paper provides an application of C-Band Sentinel-1 imagery to map seasonal melting along the Hindu Kush Himalaya (HKH) for the period 2017-2019. The paper provides spatiotemporal time series of several metrics, as for example freeze onset, for the region. The authors detected horizontal (at the regional scale) and vertical differences that they assess resemble well established HKH glacio-climatic regimes while providing insights on scarcely described dynamics, such as the occurrence of melt signals at very high elevations.

My general assessment is that the paper is straight: it describes a method that naturally connects with the results. The application by itself is of great value in other regions for monitoring as well as for model validation, given the high resolution of the imagery and the mission expected length of 7 years. After reading the paper several times, however,

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I am not fully convinced the paper fits in this journal in its present form instead of a more remote sensing oriented journal. I think it lacks of a more in depth glacier-climate interpretation. Below I include some comments that argument my assessment.

General comments

(1) The paper provides a detailed description of the methods but to me the section "Results and Discussion" lacks discussion on glacier-climate regimes. The authors claim that melt dynamics coincide with different HKH glacio-climatic regimes. As far as I can tell, these regions correspond to operational inventory subdivisions (for CGI or RGI) and do not necessarily correspond to boundaries between well-defined glacier regimes. Perhaps just rearranging the narrative will clarify this, but I would suggest to expand the discussion including some reasons why these areas show these differences or whether other regional differentiation is possible.

(2) Along the same lines, I believe the paper needs to add some sort of longer climatic discussion. Currently, lines 418-419 present a reworked version of 131-132. Is it possible for the authors to include some literature or analysis on the possible weather patterns that would explain the findings for the studied period? Perhaps looking at reanalysis fields for the MO and/or FO days will allow the authors to further elaborate on the findings. In addition, this can be helpful in trying to explain the high elevation melting events.

(3) In line 374 I'm not sure if longwave energy is what drives melt at these elevations. I think that the Everest climate data is showing that the large input of shortwave energy and monsoonal activity allow for the glacier surface to reach melting temperatures despite below freezing air temperatures. Since the authors are seen this possible effect, I think there is a great opportunity to test whether some of the high-elevation melt events coincide with the conditions depicted in Matthews et al (2020), by looking at weather conditions around those dates.

(4) L184: Can you provide more details on the methods included in the computing

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infrastructure?

(5) L206: Is it possible to attempt a sensitivity analysis of the b value? Could the choice of the b value be partially contributing to uncertainty in the results?

(6) Figure 3: I think the validation data is insufficient to make general statements on the method for the whole region. I wonder if it is possible to make a comparison relative to reanalysis air temperature at equivalent geopotential levels for a larger region.

(7) Figure 5: wouldn't it be more straightforward to leave elevations in the y axis and DOY in the x axis? Also, although the spread of DOY do not seem to be statistically different there is an interesting divergence between about 5700 to 6700, where Karakoram and Western Himalaya tend to cluster differently relative to Central and Eastern Himalaya. Perhaps studying some air temperature and humidity dynamics at the corresponding geopotential levels will allow the authors to interpret that situation.

References Matthews, T., and Coauthors, Going to Extremes: Installing the World's Highest Weather Stations on Mount Everest. Bull. Amer. Meteor. Soc., doi: https://doi.org/10.1175/BAMS-D-19-0198.1.

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