

Ann. Geophys. Discuss., author comment AC2
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Reply on RC2

Nirasindhu Desinayak et al.

Author comment on "Snow cover variability and trend over the Hindu Kush Himalayan region using MODIS and SRTM data" by Nirasindhu Desinayak et al., Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2021-29-AC2>, 2021

Authors: Authors are thankful to the reviewer for the thoughtful comments. The suggestions to include changes such as a common unit for temperature (°C) has been incorporated in the revised manuscript. The pointwise response related to plots, limitations of snow cover algorithm, and cloud cover issues, shadows are given below. We hope that the Reviewer and Editor will find the revised manuscript responsive to the reviewer's remarks and suggestions.

Status: final response (author comments only)

Snow cover variability and trend over Hindu Kush Himalayan region using MODIS and SRTM data

Nirasindhu Desinayak et al.

RC2: 'Comment on angeo-2021-29', Anonymous Referee #2, 24 Aug 2021

I agree with my colleague making a comment on 28th June 2021 that this paper require more additional work. Especially, I see a problem with having only 17 years long series that are further used for deriving trends (or even extrapolating what can happen in 7 000 years (Fig. 7 and rows 285-290)).

Response: In this study, the use of space-based Earth observation data records (17 years) can be considered as "relatively long-term" in terms of identifying major findings. We agree that 30-year or even 100-year datasets are more informative in terms of climate change, but the fact that even this decadal record shows rapid change is noteworthy and provides a case for the observations' continuity. The current work is an attempt to offer analysis across this extremely sensitive region in order to establish a case for increased attention to the influence of climate on snow cover globally. As the satellite-derived dataset expands, future studies can utilise even longer-term datasets to evaluate the validity of our findings and conclusions. We have made this point more clear in the revised paper that continued focus on observation, research and modelling analysis in this highly sensitive region of Earth is warranted.

Generally, some papers cited in the work are rather old (before 2000) - would be better to

have newer references (if possible). The same is true for description of observed trends (e.g. row 51).

Response: The cited articles cover the major findings with respect to region's snow cover and warming trend. We have attempted to further amplify this point with some recent papers in this sub-section (1.1 Regional warming and decrease in snow cover). We've added two more references (Duan and Wu 2006; You et al. 2017) that provide greater detail about the warming and cloud cover issues and their impact. The updated summary, as well as the pertinent material contained in the cited references, will provide an overview of the research conducted on the region's warming, and support the findings of this study. We hope that the summary provided in the revised manuscript together with supporting references will suffice to address the issue of warming the reviewers raised, given this manuscript's focus is on dynamics of snow cover.

''Why °K and °C are used - I think just °C would work better for the whole paper.

Regarding trends - authors use trend year, but per decade may be better (and sound more robust).

Response: The units have been changed to °C, as suggested by the Reviewer, to provide consistency in reading. In the relevant sections (introduction and results and discussion), the trend related to snow cover has been reported/cited as per year basis. The results of the study have been reported as per year basis for consistency in reading. However, based on the data used, the trend per decade can be also discerned and reported at least as a benchmark for future studies. The readers should be able to see how annual and almost two decades of changes relate in terms of magnitude and trend.

Generally, I am missing at least a small discussion about results - there is only description of the results (in parts 3 and 4), with quite complicated description in part 3, but no discussion on it. It should answer at least the question, how the length of the analyzed data can influence the results? And how did the authors handle with possible errors / problems in snow detection algorithm (deep valleys, clouds, forests ...)?

Response: For ease of reading, section 3 has been broken into sub-sections with pertinent headings. The known issues related to the MODIS snow-detection algorithms, as also mentioned by the Reviewer, has been discussed in the data and methodology section as well as results and discussion section with relevant citations.

The description of some figures is not sufficient (what are abscissae in Figs. 2c or 5a).

Response: In figure 2c, the abscissa (x-axis) is given as time in months. The ordinate and abscissa in 5a is also labelled as Northings (25°-40° N) and Eastings (65°-105° E).

If data from Jan and Feb 2016 is missed – wouldn't be better to omit it from the Fig. 3a - and how was it handled in other analyses?

Response: As mentioned by the Reviewer, the missing data is clearly shown in the figure 3a. As the data analysis spans a much longer period (17 years), the missing data of (few months in this case) is not likely to greatly influence the outcome from the analysis (spatial, altitudinal, and temporal trend analysis).

Fig. 4a – there are some suspicious values around 2700-2800 metres – where do they come from and are they correct?

Response: As the fill-values have already been removed from the dataset, the average values of mean snow cover in percentage (at 100m interval) are shown along with average values (at 1m interval) as calculated from the MODIS data. These values are correct and depict large variability in snow cover with increase in altitude. We believe this is an important aspect and finding of this study that have been made clearly now.

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Authors: Authors are thankful to the reviewer for the invaluable comments. We have revised the manuscript as per the suggestions. We are hopeful that the Reviewer and Editor would find the updated content satisfactory.