Revised manuscript review: The Cryosphere

Title: Spatio-temporal Patterns of High Mountain Asia's Snowmelt Season Identified with an Automated Snowmelt Detection Algorithm, 1987-2016

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Comments:

In the revised paper, the authors included some comparisons between their results and other datasets (MODIS fractional snow cover and HAR surface temperature), which is helpful. However, it appears that the derived snowmelt onset dates in the paper are not associated with actual snow melting, instead as stated in the response: "Figure 4 below shows a direct comparison between our melt onset dates and the MODIS and HAR datasets. As can be seen in the middle panel, the onset of melt correlates with the peak of MODIS fractional snow cover, and with the yearly minimum temperature from HAR (this has been added to the Supplement asFigure S2). This implies that our melt algorithm is capturing the turning point where snow ceases to increase and starts melting out. These figures have been added to the Supplement."

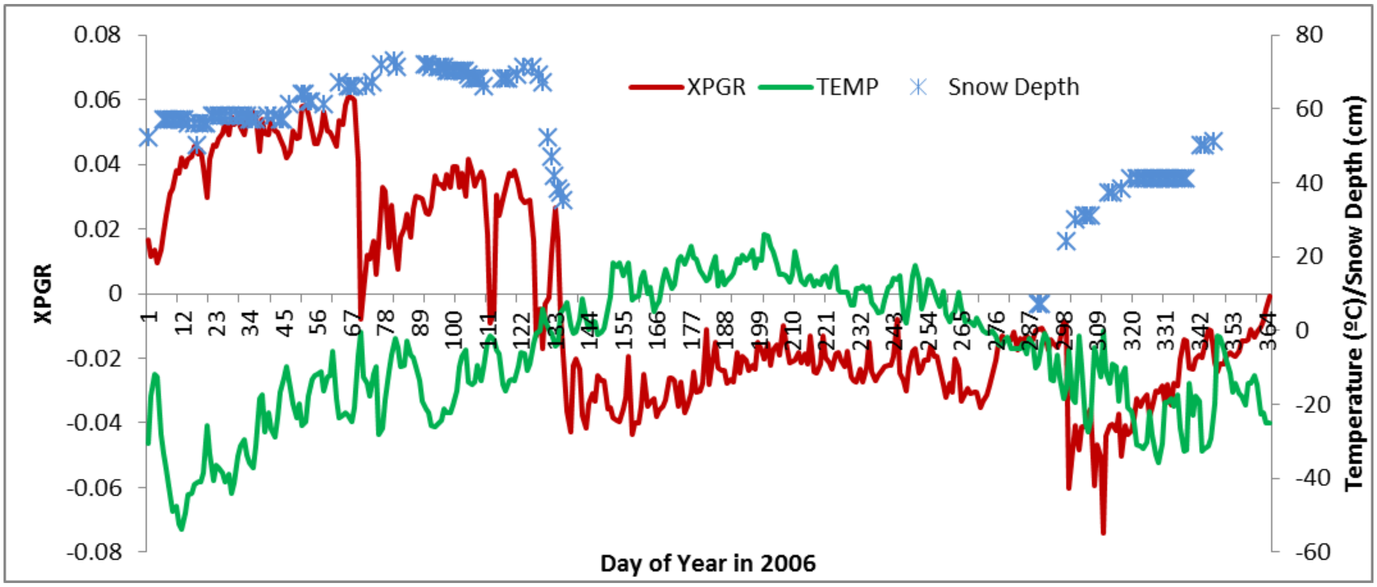
Figure 5 also shows that at the detected snowmelt onset dates, daytime mean temperature ranges from -30 to 30^{o}C, thus many cases with temperatures below the freezing point.

Thus snowmelt onset date from this study is not the same as in previous studies, which is usually the date associated with the appearance of liquid water in snow and near freezing point surface temperatures.

In addition, I found the temporal variations of XPGR in Fig.3 of this paper over seasonal snow cover are different from those for permanent snow on Greenland in previous studies. For example, in Fig.2 of Abdalati and Steffen (1995), large XPGR values are concentrated during the summer melt period, with much lower values during the frozen period. In Fig.3 of this paper, XPGR increases gradually from the beginning of the year until reaching its annual peak around the date of maximum SWE, then decreases to the annual minimum in the summer, with secondary peaks of ups and downs in between. This warranties careful calibration/validation of using the XPGR method in HMA region.

For curiosity and to fulfill my responsibility as a reviewer, I plotted (shown below) the daily XPGR (red, from SSM/I EASE-grid 25km data), daily mean surface air temperature (green), and daily snow depth (blue) at Tarko-Sale weather station (64.917^{o}N, 77.817^{o}E), unfortunately not in HMA. The time series of XPGR in my plot exhibits similar temporal variations as shown in Fig.3 of the current paper, which is likely the case for season snow cover. The maximum XPGR (~0.06) occurred on DOY66, with air T of -

22.9°C. The air T did rise to near the freezing point on DOY70 (-0.4 ºC), however, snow depth didn't show much decrease until after DOY127.



The above plot suggests that dates with maximum XPGR do not correspond to snowmelt onset, at least not the commonly defined snowmelt onset as in previous studies. To avoid misleading, I'd suggest the authors use another term such as maximum SWE instead of snowmelt onset, and also justify the applications of their results accordingly. They could also compare their results with those from a recent publication on snowmelt detection over HMA:

Chuan Xiong, Jiancheng Shi, Yurong Cui, and Bin Peng, Snowmelt Pattern Over High-Mountain Asia Detected From Active and Passive Microwave Remote Sensing. http://ieeexplore.ieee.org/document/7930395/

Xiong et al (2017) indicates that previous melt detection algorithms developed for polar regions may not work well in HMA due to its complex topography. They proposed a method using a combination of median filters and first order derivative for snowmelt detection from active and passive microwave data.