This manuscript develops a novel method of creating seamless snow cover extent (SCE) data for China. The novelty of this study is significant in that there is currently no other dataset of SCE with such a long time series and quality (e.g., a full spatiotemporal continuity at 500m and daily resolutions, sufficient evaluations, and accuracy) that can be comparable with here developed. The improvement of performance in forested areas is also impressive. I have some minor concerns as follows.

Response：Many thanks for your positive comments. We have revised the manuscript following your suggestions or comments listed below.

- Landsat-8 OLI data are used as training data in this study, however, how were they processed as reference SCE data? By manually vectorizing or also using an NDSI-like method? This process of course has uncertainties that should be mentioned.

Response：Thanks for your constructive suggestion. In our study, Landsat-8 OLI snow products are derived using the improved "SNOMAP" algorithm developed by Chen et al. (2020). We have added this information in the new manuscript in section 2.2. It is an NDSI-like method. To ensure these products' accuracy, we also check them again by our visual interpretation. On average, their over accuracies are larger than 99% comparing to the results of our visual interpretation. On the spatial scale of 30-m, most pixels are pure snow or snow-free, and mixed pixels are infrequent. Therefore, a simple NDSI-like method can give a very high accuracy. Following your suggestions and those of referee # 1, we rewritten this section. Please see the newest section 2.2.

To refine the decision rules (will be elaborated in section 3), we must obtain the quality MOD09GA and MYD09GA training samples in advance. Toward this, two groups of Landsat-8 Operational Land Imager (OLI) snow maps across China during the 2013 – 2018 snow seasons (beginning on Nov. 1st through Mar. 31st of the next year) are produced here. The first group is derived from 1509 scenes of OLI images, which will be regarded as "true" values to acquire the Terra-MODIS training samples; and the second group comes from 1648 scenes of OLI images, which will be used to acquire the Aqua-MODIS training samples. These snow maps are generated by the improved "SNOMAP" algorithm developed by Chen et al. (2020), and have a spatial resolution of 30-m. In every OLI snow map, there are only three classes — snow, snow-free, and cloud.

Then 30-m snow maps will be aggregated within the 500-m spatial window to indicate whether the corresponding MOD09GA and MYD09GA pixel is covered by snow or not. Within a spatially and temporally (in the same day) collocated MOD09GA/MYD09GA pixel, if no less than 50% of OLI pixels are snow-covered, then it is a snow sample. If over 50% of OLI pixels are snow-free, it is a snow-free sample. If the most of the OLI pixels are the class of cloud, it will be deemed as an invalid sample and is subsequently discarded. Of course, all of these must be done under the condition that the collocated the MOD09GA/MYD09GA pixel is a clear pixel.

Finally, for the MOD09GA, totally 21.20 million snow samples and 17.66 million snow-free samples are obtained; for the MYD09GA, 12.05 million snow samples and 12.65 million snow-free samples are obtained in total. Note that it is necessary to obtain

the Terra-MODIS and Aqua-MODIS training samples separately, as MYD09GA band 6 is not the directly observing data (many sensor's detectors of this band have broken since the Aqua launch), but the restored data using the algorithm of Wang et al. (2006).

Chen, S., Wang, X., Guo, H., Xie, P., Wang, J., and Hao, X.: A Conditional Probability Interpolation Method Based on a Space-Time Cube for MODIS Snow Cover Products Gap Filling, Remote Sens., 12, 3577, doi: 10.3390/rs12213577, 2020.

- Why were two groups of Landsat-8 snow maps used for training Terra and Aqua separately? I do not think the overpass time is a good reason for explaining this because most Landsat-8 data are in the morning which is closer to Terra. This could also be an uncertainty for training Aqua data.

Response：In fact, many Landsat-8 snow maps are same in the two groups. Of course, some are inconsistent because there may be a very different weather condition for Terra and Aqua overpasses. As you have noticed, Landsat-8 overpass time is closer to that of Terra. Therefore, they more likely have the consistent weather condition. If we use the same one group of Landsat-8 snow maps, the sample number of Aqua will much less than that of Terra. To ensure the sample number even, we have to import more Landsat-8 snow maps for Aqua. This will result in two groups of Landsat-8 snow maps are needed. Because Landsat-8 overpass time is closer to Terra's, Terra's training samples should be more accurate. Thanks.

- I am a bit confused by Table 2 because there are several duplicate land cover types in the first column and some types with multiple rows. It can be improved to be clearer.

Response：Thanks for your comment. We have split this table into two in the new manuscript. One is for Terra-MODIS, the other is for Aqua-MODIS. Indeed, the previous presentation is misleading. Please see the new manuscript.

- In section 2.4, I recommend adding more explanations for the use of station observations. I can understand that the station data were used as they were totally free of the effects of cloud blockage. However, for some readers, this could be confusing when Landsat8 snow maps were already used as reference.

Response：Done. Thanks for your suggestion. Please see the below description in the new section 2.4.

Daily ground snow-depth observations up to 362 stations from the China Meteorological Administration (CMA) since 2000 will be used to validate or assess all associated MODIS SCE products in the study. To ensure the qualities of the measurements, most CMA stations obey the following observing specifications: 1) snow-depth is measured manually in an open spot near the station using a professional ruler; 2) the measurements were conducted only when the fractional snow cover in the field of view is larger than 50%; 3) all observations were done at 8:00 Beijing time every morning.

At each station, the surface true condition, snow-cover or snow-free, is determined by the criterion proposed by Klein and Barnett (2003). That is, if measured snow-depth is ≥ 1-cm, it is covered by snow; else it will be snow-free. Because ground measurements are not

limited by weather conditions, they are a better choice to independently validate all satellite-based SCE products.

- For section 3.1.4, the use of ERA5 LST could be a (possibly not big) problem or not optimal. The MODIS standard product uses MODIS LST with a high resolution of 1km in the aid for temperature screening, however, ERA5 only has a coarse resolution of 0.25° which is much larger than the pixel size of MODIS SCE data.

Response：Yes, maybe MODIS 31 brightness temperature is a better choice, as done by MODIS standard snow products. But unfortunately neither MOD09GA/MYD09GA nor GEE provide this data. As you may notice, it is a very huge workload to download and process the MODIS 1B products for that data. Here the quality of LST may be not that important because the temperature screening is only for deleting a few obviously false snow pixels. Thanks.

- In Figure 7, the microwave-based snow depth data are suggested to be additionally plotted against other data. It can be seen in Figure 7 that there are large data gaps in both Terra and Aqua snow map on that day and the microwave-based snow depth data could provide valuable reference data of snow in those areas.

Response：Thanks for your suggestion. The purpose of Figure 7 is to present an example of our product, and demonstrate what new SCE datasets look like. The microwave-based snow depth data is not our product. It is really weird to put them together because it is irrelevant to our product. Besides, the spatial resolution of microwave-based snow depth

data is so coarse that the figure may look very ugly due to many rectangular spots. From the figure, one can intuitively see after our gap-filling there is no gap existing in the new CGF SCE dataset, but clear-sky SCE datasets are affected by clouds severely. This is the reason why we give Figure 7. Here we do not want to demonstrate the microwave-based snow depth data is promising because it is not affected by clouds.

- The English writing has a large potential to be improved.

Response：Thanks for your comment. We know as a non-native speaker there must be language problems throughout the manuscript, more or less. Therefore, before the submission to HESS it in fact had been edited by a professional company, EDITSPRINGS. Please see the below certificate (at that time, our manuscript title is "The NIEER MODIS snow extent product over China"). After this revision, we asked them to polish the English again, and then check our English carefully again. I hope the new manuscript is much better than the previos.

EDITSPRINGS

EDITORIAL CERTIFICATE

This document certifies that the manuscript listed below was edited for proper English language, grammar, punctuation, spelling, and overall style by one or more of the highly qualified native English speaking editors at EditSprings.

Manuscript title:
The NIEER MODIS snow cover extent product over China

Authors:
Hao Xiaohua, Huang Guanghui, Zheng Zhaojun, Sun Xingliang, Ji Wenzheng,
Zhao Hongyu, Wang Jian, Li Hongyi, Wang Xiaoyan

Date Issued:
Aug 27 2021

Certificate Number:
ES-202106241645578090

This certificate can be verified on www.editsprings.com/query.asp. This document certifies that the manuscript listed above was edited for proper English language, grammar, punctuation, spelling, and overall style by one or more of the highly qualified native English speaking editors at EditSprings. Neither the research content nor the authors' intentions were altered in any way during the editing process. Documents receiving this certification should be English-ready for publication; however, the author has the ability to accept or reject our suggestions and changes.

Typo errors:

Lines 65-66: please add a reference

Response：Done. Thanks.

Zhang, H. B., Zhang, F., Zhang, G. Q., Che, T., Yan, W., Ye, M., and Ma, N.: Ground-based evaluation of MODIS snow cover product V6 across China: Implications for the selection of NDSI threshold, Sci. Total Environ., 651, 2712-2726, doi:10.1016/j.scitotenv.2018.10.128, 2019.

Lines 133-138: the two paragraphs could be combined to reduce duplications

Response：Done. Thanks. Please the new manuscript.

For that purpose, we investigate all available snow samples, and find for Terra-MODIS more than 99% of the snow samples are constrained in the condition of band $2 \geq 0.15$, band $4 \geq 0.05$, and band $6 \leq 0.45$. Therefore, the preliminarily screening rule of the Terra-MODIS is adjusted into: all possible snow pixels must meet the condition of band 2 ≥ 0.15, band $4 \geq 0.05$, and band $6 \leq 0.45$, and pixels that do not meet will be identified as snow-free immediately. Similarly, for Aqua-MODIS 99% of the snow samples are constrained in the condition of band $2 \geq 0.12$, band $4 \geq 0.07$, and band $6 \leq 0.40$. The preliminarily screening rule of the Aqua-MODIS is set into: all possible snow pixels should meet this condition, and pixels that do not meet will be deemed as snow-free immediately.

Line 154: NDIS should be NDSI

Response：Very good suggestion! Thanks.

Line 213: gas should be gap?

Response：Very good suggestion! Thanks.

Line 300. Terra? I guess you'd like to say Aqua?

Response：Very good suggestion! Thanks.