The Cryosphere

Open Access

Discussions

EGU

Interactive comment on "Snow cover variations across China from 1951–2018" *by* Xiaodong Huang et al.

Anonymous Referee #2

Received and published: 6 September 2020

General comments: The author gives us impressive work on snow cover variation analysis using more than 60 years meteorological station observation. Huang et al. investigated the snow cover variation characteristics with SD, SCD and snow phenology, and provide detailed spatial and temporal characteristics of snow cover in China since from 1951 to 2018. This manuscript gives a contribution to understanding the snow cover variation in China. Although M-K test which gives a break point indicating snow cover variation trends is interesting method, the authors pay little attentions to conclude and introduce this part work. This manuscript, however needs revision with regards to the organization and presentation of the results.

Major Comments 1: As described in introduction "The results indicated that from 1952 to 2010, the overall snow phenology in China reflected a delay of the snow onset date

(SOD) and an advancement of the snow end date (SED).(Ke et al., 2016)" (page 3 lines 6-7) this is similar with your finding except the dataset used in this study is longer than Ke. My first question. What's the different or new finding derived from your analysis results when using the 1951-2018 stations data?

2: M-K test results, which I think it is very good for understanding snow cover variation in China, need more efforts to enhance presentation in Abstract, Conclusion section. As suggested by Reviewer 1#, it needs to give more explanation on M-K test results.

3: Previous studies found snow cover have significant changes occurring at around 2000. And also, this study using M-K test show the break point is after 2000. You just showed this break point results and do not provide further analysis. Previous study by remote sensing snow depth data has investigated the different variation rate between before and after 2000 (Xiao et al. 2020 and other studies). Further analysis is not mandatory. This suggestion is for reference only.

4: Except that Reviewer 1# suggested potential contribution aspects (point 12), in Xiao et al. (2020) study, he found different variation trends for snow depth and snow cover days in some area of Norther Hemisphere (including China), inverse trend or same trends. One potential contribution idea is that linking the variation trends of different indexes to find different response on climate change background. Xiao et al. (2020) study may give you instruction to exhibit insight variation analysis results of snow cover indexes (SD, SCD . . .) from 1951-2018.

5. Actually, the threshold selection of snow depth has effect on SCD or SOD or SED or SDDs variation analysis (Dyer et al., 2006; Notarnicola 2020). In previous studies, many kinds of threshold have been applied to define snow-covered and snow-free, e.g., 0cm, 1 cm, 2cm, 5 cm, 10 cm. In the discussion section, this should be added in your analysis and discussion.

Specific comments: Abstract: 1)Remove "retrieved" in page 1 line 12. Snow depth is measured in each meteorological station, not be retrieved.

2)This term "snow phenology" is not familiar with most of readers. Give a short definition,

3)Change "higher than 40°N" to "northward of 40°N" in line 17

4)"This result was mainly caused by the postponement of the snow onset date and the advancement of the snow end date." Please rephrase this statement. As for the reason of the decrease of snow cover duration, it always should be related to precipitation or air temperature or atmospheric circulation, polar sea ice etc.

5)Please add the more description of M-K test results. I think this is very interesting method for snow cover variation analysis and give a novel finding that the break point of snow cover variation is after 2000.

Introduction 6)Line 28. Please add a reference for the specific number of snow cover area.

7)Line 40. Change "the dataset is" to "this dataset is"

8)What's the meaning of "the statistical significance of the linear trend is very weak"?

9)In introduction section, you give more literature review son snow cover area. But, your study does not give snow cover area variation analysis. Recommend to only give short description on this topic.

10)"Poor accuracy"? I don't think so. "short observation periods"?? According to your introduction, the NOAA snow cover extent data provide a long-term snow dataset (1967-present) "Snow Lab and the binary snow cover mask data derived from the Climate Data Record of the Northern Hemisphere Snow Cover Extent (NHSCE) can provide a long-term snow dataset (1967-present)." In page 1 line 38-39. Please rephrase this sentence.

11)In this section, you gave so many literature reviews on remote sensing snow cover monitor results, but little on stational observation results. Please reorganize this section

statement. Recommend to emphases the stational snow cover analysis results

Dataset 12)The caption of Figure 1. Please give description on the numbers in paren-
thesis

13)"Snow depth of ground observations is measured manually with a wooden ruler at 8
o'clock every day when the ground in the field of view around the meteorological station
is covered by more than half in snow." It's a valuable information for understanding snow
depth measurement at meteoritical station. Please add a reference.

14)Page 4 line 19. Remove "...from the analysis in this study."

Methodology

15) Change the title of Section 2 "dataset and methodology" to "Dataset". The section
3 title is "Methodology"

16) Page 5 line 16. "in the snow cover indices from 1952 to 2012", is it should be "1951
to 2018"?

17) Page 6 line 2. What's meaning of "UB"

18) Page 6 line 3-11. You just list a series of formulas. Actually, I don't understand
what's UB and UF stand for. Recommend to add more introduction information for Eq.
3 – Eq. 6.

19) Page 6 line 27-29. "... assume that latitude, longitude and altitude directly affect
precipitation and temperature and thus indirectly affect snow cover, while precipitation
and temperature have a direct impact on snow cover" Please give other publications to
support.

20) Which threshold was used in this study to transform snow depth to snow-covered
or snow-free?

Results

21) Page 7 line 6: "mean annual SD"? But "annual mean SD" was used in above section. Please modified.

22) The legend in Figure 3b. why did not use "< -0.1; -0.05∼-0.1; -0.05∼0; 0∼0.05; 0.05∼0.1; > 0.1"?

23) Section 4.1. page 9 lines 4-13. I think that the results of the M-K trend test (Table 3) are very valuable presentation and it give a great contribution to the snow cover variation study/research. You just offer descriptive information. I suggest that you should provide further explanations to analyze these results. What changes in climate could contribute to this break point. I am looking forward to your further analysis results in this part.

24) Similar comments to Section 4.3 (page 13 lines 5-19)

25) Section 4.3 "157th and 256th". Please give start time (1st January or 1st September) and add the specific time for these two dates, for example 7th (7th January)

26) As suggested by Reviewer 1#, the Result section could be shortened. It's helpful to put more attention on snow cover variation results analysis and the new finding interpretation. From Table 3, I find that almost all indexes (SD, SCD, SOD, SED and SDD) break point occur in the new century (after 2000s). You can give further analysis on what's the different variation rate before and after break point for these indexes.

27) Section 4.4 in line 21 page 13. change "annual precipitation" to "annual mean precipitation"

28) Page 14 lines 7-12: (Q1): why did the latitude and altitude have different effects on SD_overall and SD_max? "latitude and altitude do no impact SDoverall" but "all factors affect the spatial and temporal distribution of SDmax". (Q2): according to previous studies, latitude and altitude have a significant effect on SD. Your conclusion is "latitude and altitude do not impact SDoverall". Please give me more explanations.

29) As we all known, MODIS do not provide SD information. In page 15 line 19-21, "...

Interactive comment

Printer-friendly version

Discussion paper

whereas SD decreased in the north and northwest regions of the Tibetan Plateau from 200 to 2014 according to MODIS snow products". Please revised it. Especially, Figure 3 do not have significant change station in northwest of the Tibetan Plateau!

Reference: Xiao, X.; Zhang, T.; Zhong, X.; Li, X. Spatiotemporal Variation of Snow Depth in the Northern Hemisphere from 1992 to 2016. Remote Sens. 2020, 12, 2728.

Notarnicola C., Hotspots of snow cover changes in global mountain regions over 2000–2018. Remote sensing of Environment, 2020, 243, 111781

Dyer, J. L. and Mote, T.: Spatial variability and trends in observed snow depth over North America, Geophys. Res. Lett., 33, L16503, 2006.

Interactive comment on The Cryosphere Discuss., https://doi.org/10.5194/tc-2020-202, 2020.