Replies to the comments of Anonymous Referee #3

Authors' replies are in BLUE color.

Interactive comment on "Variability in snow cover phenology in China from 1952 to 2010" by C. Q. Ke et al.

Anonymous Referee #3

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The authors present a study on spatiotemporal variations and trends in snow cover days (SCD), snow cover onset date (SCOD), and snow cover end date (SCED) using observational data from 672 climate stations in China. The period of analysis is from 1952 to 2010.

Overall the manuscript contains a lot of valuable information and is well organized for the most part. However, I feel there is room for improvement. In the following, I have listed several recommendations and questions to the authors.

> **Replies:** Thank you for your detail review, we will revise the paper according to your comments.

Major recommendations:

2.1 Data: The authors selected 672 stations for their analyses. How many climate stations are contained in the original dataset? This information should be added to the text. When using nearest neighbor interpolation to fill data gaps, was the correlation between the time series tested over common time periods? Especially in the western and northwestern regions with low station density, the nearest neighbor might show a quite different snowfall pattern.

> **Replies:** There are 722 stations in the original dataset, this information is added to the revised manuscript. The correlation between the time series is good in east China, but is not good in the western regions with low station density, therefore we provide a new SCD distribution map of western China to show this except for the interpolated SCD map of China.

2.2 Methods: In this chapter, the authors need to provide information about the correlation analysis. What correlation coefficients have been calculated? If the authors calculated Pearson

Product-Moment Correlation Coefficients, were the data tested for normal distribution? How was the significance testing done?

Replies: We added a paragraph to provide the correlation analysis in Section 2.2 in the revised manuscript.

Yes, 'Pearson Product-Moment Correlation Coefficients' have been calculated by us. We tested the data for normal distribution, "The standard normal homogeneity test (Alexandersson and Moberg, 1997) at the 95% confidence level is applied to the daily SCD and temperature series data in order to identify possible breakpoints." in the second paragraph of Section 2.1.

In order to guarantee the quality of original data, we did not conducted the standard normal homogeneity test at the 90% confidence level, but at the 95% confidence level (much higher). In addition, we implement strict quality controls (such as inspection for logic, consistency, and uniformity) on the observational datasets in order to reduce errors.

Among 722 stations, 672 stations with annual mean SCDs greater than 1.0 (day), passed the standard normal homogeneity test and other strict checks, finally were used for analysis.

3 Results: Fig. 2: What is the time period covered? It needs to be the time period covered by all climate stations used (1980/81 to 2009/10). If not, and the result is based on means over different time periods, comparability is a problem.

Replies: Fig. 2 is based on means over different time periods, we will replace a new map over same time period (1980/81 to 2009/10).

The results of the correlation analysis reported in the subchapters 4.1, 4.2, and 4.3 of the Discussion chapter should be in the Results chapter.

Replies: In the result section, we investigate means, extremes and trends of SCD, SCOD and SCED. In the discussion section, we investigate the potential reasons of SCD variation, the SCD relationships with TBZD, MAT and AO. In our opinion, this structure is OK, if the referee insists on moving the discussion chapter to the result one, we can move and merge two chapters to one section.

Minor recommendations:

Page 4474, row 6: Please omit this part of the sentence "China is the main large snow cover distribution area in the middle latitudes and the Northern Hemisphere [: : :]". There are vast areas covered by snow in other regions of the middle latitudes and the Northern Hemisphere as well.

Replies: We deleted the sentence in the revised manuscript.

Page 4475, row 20: "[: : :] a SCD is defined [: : :]" instead of "[: : :] an SCD is defined [: : :]"
Page 4479, rows 22-23: "The Tarim Basin is located inland, with relatively little precipitation, thus snowfall there is extremely rare (Li, 1993)." Snowfall is not rare in the mountains surrounding the Taklamakan desert. Please correct this.

Replies: Here, according to the pronunciation of the first letter of 'SCD', it should be 'an SCD', which is edited by a language expert. If the referee insists on changing it, we can do it.

We change the sentence "The Tarim Basin is located inland, with relatively little precipitation, thus snowfall there is extremely rare (Li, 1993)." as "The Tarim Basin is located inland, with relatively little precipitation, thus snowfall there is extremely rare except for the surrounding mountains (Li, 1993)."

Page 4480, rows 17-20: The authors define heavy-snow and light-snow years based on the SCD anomaly using two requirements. However, more snow cover days do not necessarily coincide with more snowfall. Therefore, I recommend the authors to name it "year with a positive (negative) SCD anomaly".

Replies: We renamed it as 'year with a positive (negative) SCD anomaly' according to the referee's suggestion.

Fig. 1: Please add the symbol for the climate stations to the legend.

Replies: We added the symbol for climate stations to the legend in the revised manuscript.

My last comment is an idea beyond the scope of this paper. It is an idea for future research.

The authors have already looked at the relationship between the Arctic Oscillation and SCD. I encourage the authors to also look at the Siberian High Intensity (SHI) defined as the mean sea level pressure averaged over the center of the anticyclone (40_N-60_N, 70_E-120_E) (Gong et al. 2001; Gong and Ho 2002) and its relationship with SCD.

Gong, D.-Y.; Ho, C.-H. (2002): The Siberian High and climate change over middle to high latitude Asia. Theoretical and Applied Climatology 72: 1-9.

Gong, D.-Y.; Wang, S.-W.; Zhu, J.-H. (2001): East Asian winter monsoon and Arctic Oscillation. Geophysical Research Letters 28: 2073-2076.

> **Replies:** Thanks for very good suggestions. This paper is enough long, we do not supplement it this time. Next step, we will investigate the relationship between SCD and Siberian High Intensity (SHI). Furthermore, we cited the relevant references mentioned above in the following paper, and discussed the relationship between snow cover and Siberian High Intensity (SHI).
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> Jin Xin, Ke Chang-Qing*, Xu Yu-Yue, Li Xiu-Cang, Spatial and temporal variations of snow cover in the Loess Plateau, China. *International Journal of Climatology*, 2014, online published, doi: 10.1002/joc.4086.