Responses to the comments from Anonymous Reviewer #2

As the key source of freshwater, snowmelt water resource in China has never been quantified on a national scale. This study used a simple temperature index model to calculate the snowmelt in China. The model is shown to perform acceptably well in China when the outputs were validated by snowfall, snow depth, snow cover extent and snow water equivalent. The results of this paper have important significance for understanding the distribution and variation of snowmelt in China. The simple model in this paper is interesting and the description of the model is comprehensive, and I think the method provides useful guidance for calculating snowmelt water resources outside China. In general, I think this work is valuable and of interest to the great community, and the manuscript is well written and worthy of publication in HESS. My comments are listed as follows:

Response: We would like to sincerely thank you for the valuable comments and suggestions to improve our manuscript. We have revised the manuscript according to your helpful comments. The responses following a point-by-point to the comments are provided below.

1. Line 11: the spatial resolution, 0.5 seconds? Shouldn't it be 0.5 minutes? Please check it throughout the manuscript.

Response: Thank you for pointing this out. It was our mistake. The units in Line 11 and elsewhere in the manuscript have been corrected in the revised version.

2. Line 16: change the unit "m^3" to "m^3 $year^{-1}$", and revise it throughout the manuscript.

Response: Thank you for your comment. We will use m^3 $year^{-1}$ instead of m^3 in the revised manuscript.

3. Line 19: Should it be "snowmelt water resource"? or "snowmelt time", "snowmelt rate"? "snowmelt" isn't clear, I think.

Response: Snowmelt is water produced when snow melts. In this sentence, we think the appropriate word is snowmelt.

4. Line 38: “contributes” to “contribute”.

Response: Thanks, we have revised it.

5. Line 61: “snow meltwater” to “snowmelt”.

Response: Changed.

6. Line 64: change “aslo” to “also”.

Response: Changed.

7. Line 93: Figure 1a showed the mean snow depth from 557 meteorological stations in China. The mean snow depth is little significant, and it is better expressed by accumulated snow depth or the maximum snow depth. Figure 1c. Please use 3 as superscript in cm^3.

Response: Thank you for this comment. We have revised the the mean snow depth to the maximum snow depth in Figure 1a, and we have revised the unit in the Figure 1c. The revised figure is as follows:

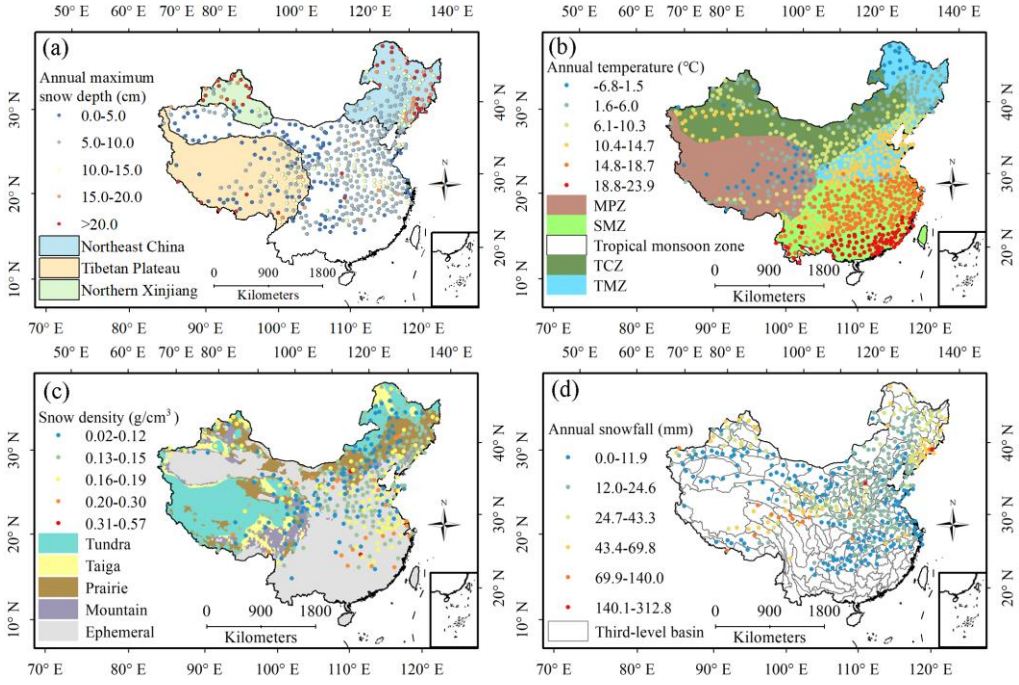

Figure 1. The three main stable snow cover regions and the mean snow depth in China (1951-2009) (a); China’s five climatic zones (MPZ, mountain plateau zone; TMZ, temperate monsoon zone; TCZ, temperate continental zone; SMZ, subtropical monsoon zone) and mean annual air temperature (1951-2017) (b); the snow cover classification and mean monthly snow density in China (1999-2008) (c); the third-level basins and mean annual snowfall in China (1961-1979) (d).

8. Line 95: “mean snow density in China” is monthly or yearly? It should be introduced clearly.

Response: It is monthly. We have revised it.

9. Line 101: The data link “https://doi.org/10.5281/zenodo.3114194forprecipitation” can not be connected.

Response: The data link is https://doi.org/10.5281/zenodo.3114194.

10. Line 115: The threshold temperature in China in this study should be shown in this manuscript by figure or table, or partly shown, I suggest.

Response: Thank you for your suggestion. We have added a figure to the Supplement, and the added figure is as follows:

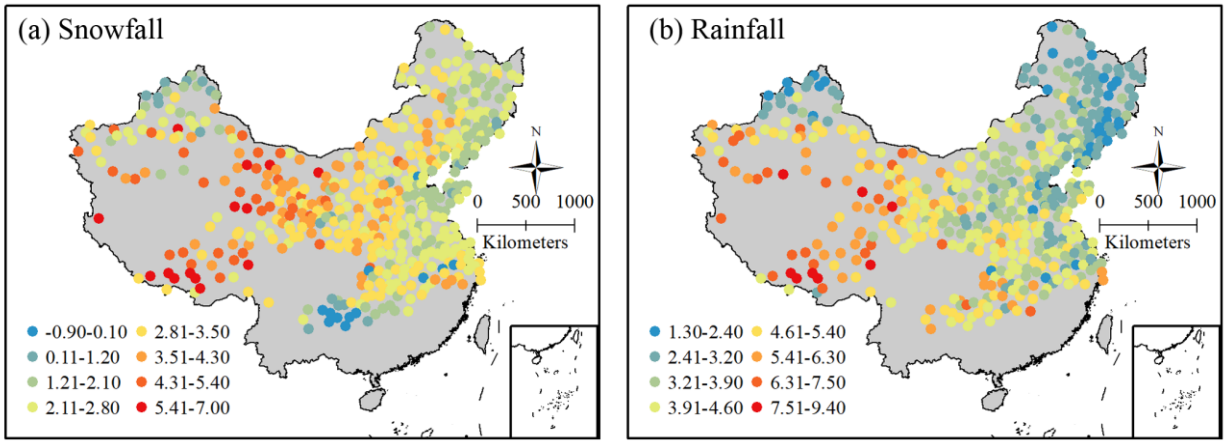

Figure S2. The threshold temperature (℃) for snowfall (a) and rainfall (b) at 485 meteorological stations in China.

11. Line 117: What is the interpolated method?

Response: The interpolated method is IDW method. We have revised the sentence as follows: The threshold temperatures of each calculated cell were interpolated using the parameters from the meteorological stations via inverse distance weighting (IDW) method.

12. Line 124: Please delete “by”.

Response: Deleted.

13. Line 129: The original dataset is snow depth, and the authors used this dataset to verify the snow cover extent. Please explain that.

Response: It is difficult to observe the snow cover extent on the ground, and space remote sensing constitutes an efficient observation technique. The snow cover extent can be generated from the snow depth dataset, and we use this dataset to validate snow cover extent output by the model.

14. Line 135: downscaling was finished by yourself or others? It should be elaborated in detail.

Response: The downscaling was done by ourselves. The L139-142 in the original manuscript introduces the downscaling method, and we have revised the sentence as follows: In this study, we use the delta downscaling method to determine the monthly future meteorological data (2006-2099) based on the high-spatial-resolution temperature and precipitation dataset and the simulations of the five CIMP5 models during the historical period (1951-2005).

15. Line 151: The unit of DDF is mm $^{\circ}C^{-1}$ day^{-1}, but the unit in equation (4) (Line 164) is cm $^{\circ}C^{-1}$ day^{-1}. Please check.

Response: Both units are correct. To make the two units consistent, we changed Eq. 4 and Eq.5 as follows:

$$DDF = 11(\rho_s/\rho_w) \quad (4)$$

$$DDF = 10.4(\rho_s/\rho_w) - 0.7 \quad (5)$$

16. Line 182: *NSE* equals one is not understandable, *RMSE* is not small for the temperature value. And the table does not reflect the monthly difference, but it has said monthly parameter in the title.

Response: *NSE* equals one in Table 1 because we retained 2 digits after the decimal point by rounding. *RMSE* in the Table 1 are not the statistical analysis between the calculated and measured monthly mean temperature, but the statistical analysis between the calculated and measured monthly accumulated positive air temperature (PDD). The values of *RMSE* may be not small for the mean temperature value, but they are very small for the monthly PDD (Fig. 2b). The parameters in Table 1 have no seasonal differences and they are used to calculate monthly PDD.

We have revised the numbers by retaining 4 digits after the decimal point, and the revised Table 1 (Table 2 in the revised manuscript) is as follow:

Table 2. The parameters required for the calculation of the monthly accumulated positive air temperature (*PDD*) and the statistical analysis between the calculated and measured monthly *PDD* in four different climatic zones of China.

	T_1	T_2	*a*	*b*	*c*	R^2	*MAE*	*RMSE*	*NSE*
MPZ	-7.99	5.79	0.79	15.37	56.38	0.9966	5.87	10.85	0.9958
TCZ	-10.85	9.89	0.52	15.29	85.38	0.9975	7.96	15.32	0.9968
TMZ	-10.41	9.51	0.52	15.45	81.43	0.9973	8.45	16.56	0.9964
SMZ	-4.05	8.56	0.22	23.12	49.63	0.9993	2.67	7.63	0.9989

Note. MPZ, mountain plateau zone; TMZ, temperate monsoon zone; TCZ, temperate continental zone; SMZ, subtropical monsoon zone; T_1, T_2, a, b and c, parameters in the equation (6); R^2, coefficient of determination; *MAE*, mean absolute error (°C); *RMSE*, root mean square error (°C); *NSE*, Nash-Sutcliffe efficiency.

17. Line 259: 263 (5.7%). 5.7%? please check.

Response: Thank you for pointing this out. It's 57.5%. We have revised it.

18. Lines 268-276: The number of meteorological stations used for snow depth verification was 264, far fewer than the 557 stations in Figure 1a. Why choose so few meteorological stations for verification?

Response: We have collected observational snow depth data from 557 meteorological stations, however, at some meteorological stations, short snow cover duration and shallow snow result in very little data on snow depth. When performing snow depth validation, meteorological stations with little data were not selected, and data from 264 stations were finally selected for validation. According to Fig. 1a and Fig. 4, most of the meteorological stations that have not participated in the verification are in central and southern China where the climate is relatively warm.

Meteorological stations located in the three main stable snow cover regions are rarely excluded from verification.

19. Line 316: Delete the extra word “with”.

Response: Deleted.

20. Line 327: It is better to cite Fig.7b before Fig.8 in the manuscript.

Response: In line 315 in the original manuscript, we have cited Fig. 7a for the first time. In line 319, we have cited Fig. 8 for the first time. Fig. 7 is cited before Fig. 8, and we do not think it is necessary to cite every sub-figure in Fig. 7 before Fig. 8.

21. Line 387: “4.2.2” to “4.3.2”.

Response: Changed.

22. Line 415: “were shown” to “are shown”.

Response: Changed.

23. Line 340: How is the density used when using the model from point to surface in China? Do you use the average value for the five typical regions from different sites or other methods? It should be explained in detail.

Response: Sorry, we can't understand this comment. The line 340 in the manuscript is the caption of Fig.8, and we do not see any relationship between the caption and this comment. And there is no “five typical regions” in our manuscript. If the reviewer is asking how we use snow density, we can answer that. We use the snow density to calculate the DDF values at the meteorological stations separately and then interpolate those to each calculated cell via IDW.

24. Lines 409-451: 4.4 Future changes of snowmelt under different climate scenarios. The historical period is from 1951 to 2017, while the future periods are different decades, namely the 2030s, 2050s, and 2090s. The comparison periods are inconsistent. I suggest changing

"historical period" to "reference period", and setting the period of the reference period to be the same as those of the future comparison periods.

Response: Thank you for this comment. In the revised manuscript, we evaluate the snowmelt in China over projected climatic scenarios in different time frames i.e., near-future (2010-2039), mid-future (2040-2069), and far-future (2070-2099) in comparison with the reference period (1980-2009).

25. Why did you select the 2030s, 2050s, and 2090s? It should be introduced clearly.

Response: In the original manuscript, the 2030s, 2050s, and 2090s were selected to represent the near-future, mid-future, and far-future periods, respectively, to analyze the possible impact of future climate change on snowmelt. According to the comments from the Reviewer #1, in the revised manuscript, we use 2010-2039, 2040-2069, and 2070-2099 as near-future, mid-future, and far-future periods, respectively.