This manuscript introduces a dataset collected from an Integrated Microwave Radiometry Campaign for snow (IMCS) conducted at the Altay National Reference Meteorological station (ANRMS) in Xinjiang, China. The dataset could be very useful for the evaluation and development of microwave and optical radiative transfer models and snow evolution process models.

The topic of the study is interesting and well fits the scope of the journal, especially for this special issue. The manuscript is well written, logically organized, and the details of field campaign are easy to follow. The data processing is careful and well documented. However, there are still some concerns that need to be addressed. Thus, I am supportive of the publication after a minor revision to further improve the quality or make it more clear for the readers to understand the results. Below are my suggestions:

Thanks for these constructive suggestions. We have revised the manuscript according to your comments.

General comments

1. Title: change "in situ time series of data" to "time series of in situ data"; delete "and environment".

   Re: Thanks for the recommendation. We revised it.

2. L59-L89: It's suggested to provide a table to summarize the main characteristics of those mentioned experiments and the experiment presented in this paper.

   Re: Thanks for the suggestion.

   We added a table to summarize the five experiments.

   These experiments are summarized in table 1.

   Table 1 Summary of existing experiments for microwave and optical radiation and physical feasutes of snowpack

Campaign	Location	Temporal range	Observation content
CLPX	Different sites in Colorado,	February and March of 2002 and 2003	Inconsecutive multiple sensor observation, including microwave radiometry over snow, and matched snow pit measurements were conducted at different sites with short temporal range.
SnowEx-year 1	Grand Mesa, and Senator Beck Basin, Colorado	February of 2017	Inconsecutive multiple sensor observation, including microwave radiometry over snow, and matched snow pit measurements were conducted at different sites with short temporal range.

CMRES[1]	Mobile observation at Forest, open and lake in the northern Canadian region	November of 2009-April of 2010	Mobile microwave radiometry and snow pit observation within footprint of radiometer. Short temporal range and inconsecutive observation
NoSREx	Fixed site in Sodankylä, Finland	Snow season during 2009-2013	Consecutive microwave radiometry and SAR observation over snow, and weekly snow pit measurement
JERBS[2]	Fixed site in Japan	Snow season during 1999-2000	Consecutive optical radiation observation over snow and consecutive snow pit measurement at 3 or 4-day interval.
IMCS	Fixed site in China	November of 2015-March of 2016	Consecutive microwave radiometry and optical radiation observation, and consecutive daily snow pit measurements.

Note: [1]CMRES: Microwave radiometry experiment on snow cover conducted in northern Canada

[2]JERBS: Experiment of radiation budget over snow cover in Japan

L115-116: Did the author measure the surface heat flux, e.g. sensible and latent heat flux?

Re: No, we did not set up instrument to measure the surface heat flux, and the data collected by the Altay meteorological station also did not cover it.

3. Figure 1: the pictures in the blue, red and pink boxes are too small to identify the exact instrument. Maybe the authors can divide this figure to two figures.

Re: The purpose of Figure 1 is to describe the measurement position of all parameters. The instruments used for measuring parameters in this study in blue and red boxes are clearly showed in figure 4 and figure 5. The microwave radiometer in pink box was magnified as a picture on the upper left corner. In order to make the microwave radiometer more clear, we enlarged the content of red box and insert the enlarged picture in section 2.3.1.

Figure 2 Ground-based microwave radiometer observation.

4. L151: It's suggested to merge Section 2.2 and 2.3, and the presentation can be grouped by the measurement parameters, e.g. microwave radiometry, snow pit...

   Re: Thanks for this suggestion, we merged section 2.2 and 2.3 to section 2.2 Measurement methods, and instruments were separately described in subsections of matched parameters.

   Please see detailed revision in section 2.2 in the revised manuscript.

5. L183-198: what's the calibration accuracy for the microwave radiometry? Incidence angle of the radiometry measurement should be provided. It seems too large for the sky temperatures at L-band which is generally around ~5K.

   Re:

   1. In order to fulfil the requirement of low maintenance regarding absolute calibrations, the instrument is equipped with a two-stage thermal control system for all receivers with an accuracy of ±0.05 K over the full operating temperature range. The calibration accuracy for the microwave radiometry is 1K. The differences between before-calibration and after-calibration Tb values were within 1K for L band, 0.5 K for K and Ka bands.

The sky calibrations were performed under the clear sky condition. During the experiment, we did multiple times of sky calibration. The L band radiometer didn't work at the beginning of the experiment. We contacted Germany company to solve the problem. It took a long time to fix it, and the tb at 1.4 GHz were obtained from 30, January, 2016. So, two sky calibration was for L band, and they were performed at 3, February and 6, March. However, the values changed largely. On 3, February, sky Tb at L band were 7-8K, and 15-16K, for horizontal and vertical polarization, respectively. on 6, March, they are -1~3K and 1~5 K.

However, on March 27 and 31 when there is no snow cover, we did another sky scanning, the brightness temperatures at L band were -1~1 and 5~8K for horizontal and vertical polarization, respectively. We also doubted it, but the objective of this experiment focus on snow cover, L band showed little sensitive to snow characteristics, so, we did not deeply consider this problem.

We revised this sentence to describe the problem, so data user will consider it.

"This radiometer was sky tipping calibrated. In the clear sky conditions, the sky brightness temperatures are approximately 7.8±1K and 15.7±0.7K at 1.4 GHz for horizontal polarization and vertical polarization, respectively; those were approximately 29.7±0.3 K and 29.3±0.9 K at 18.7GHz and 36.5 GHz, respectively."

Was revised to

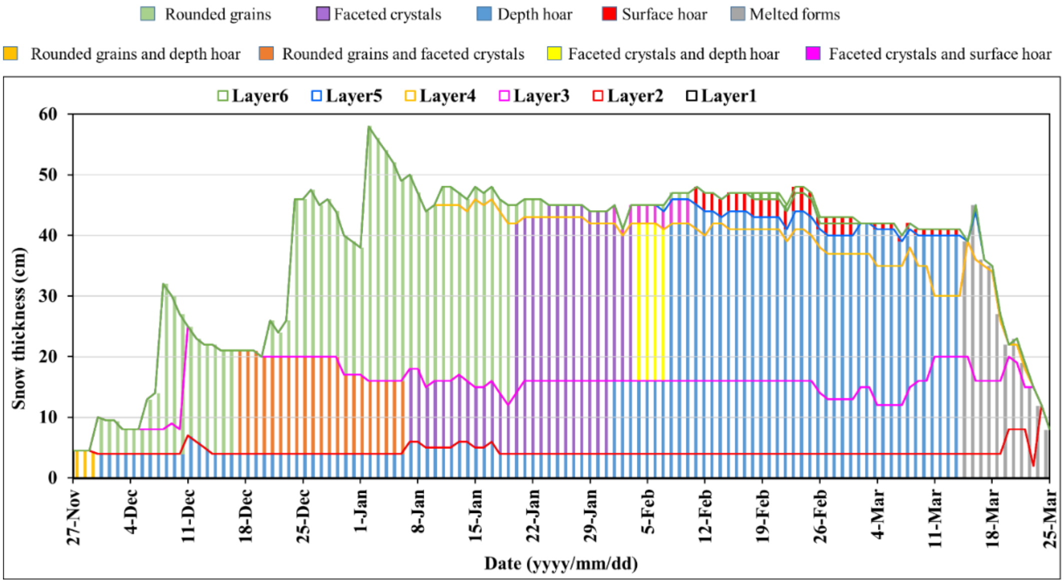
L176-182: " The microwave radiometers at K and Ka bands began working from November 27, 2015, but the L band radiometer did not work until January 30, 2016.These radiometers were sky tipping calibrated, and the calibration accuracy is 1 K. In clear sky conditions, the sky brightness temperatures were approximately 29.7±0.3 K at 18.7 GHz for both polarizations and 29.3±0.9 K at 36.5 GHz for both polarizations. But the sky brightness temperature at L band showed large fluctuation. They ranged from -1 to 8 K for horizontal polarization, and 1 to 16 K for vertical polarization."

2. in this study, fixed incidence observations were conducted every day, and the fixed incidence angle is 50^o. multi-angle observations were conducted on 17 days, and angles include 30, 35,40, 45, 50, 60^o.

6. Figures 6/8/9: These figures can be improved, it's difficult to distinguish the lines.

Re: they are revised to make them more clear.

Figure 6:



Was revised to

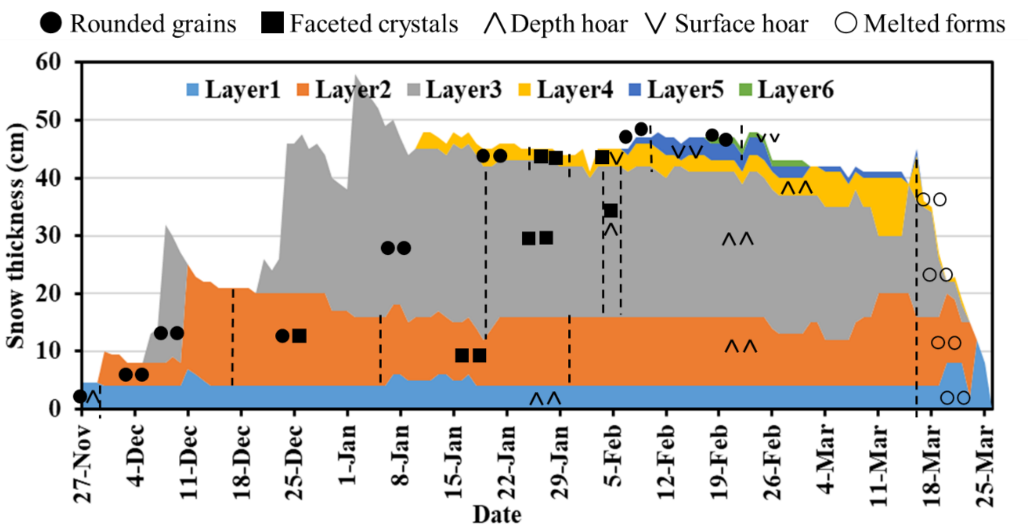
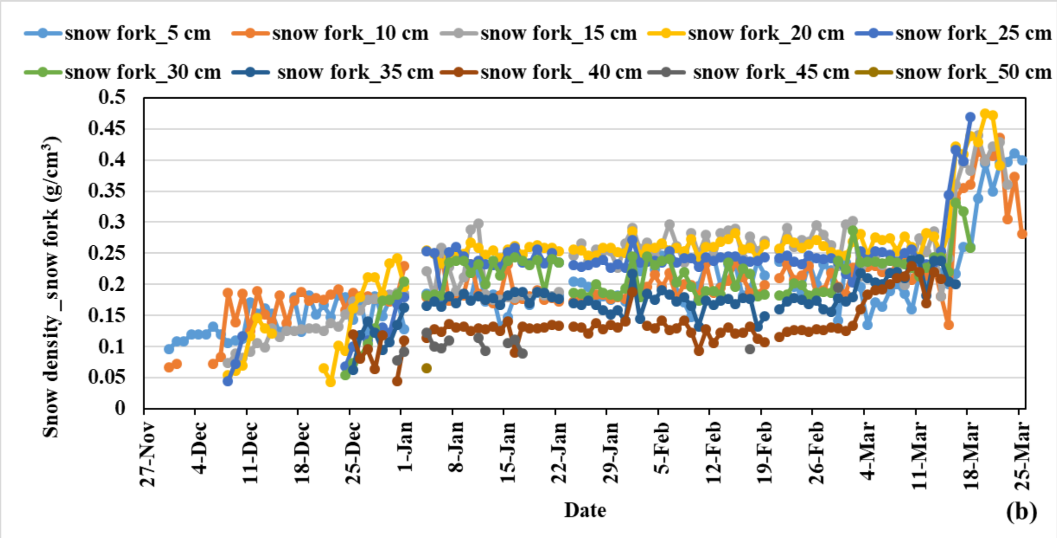


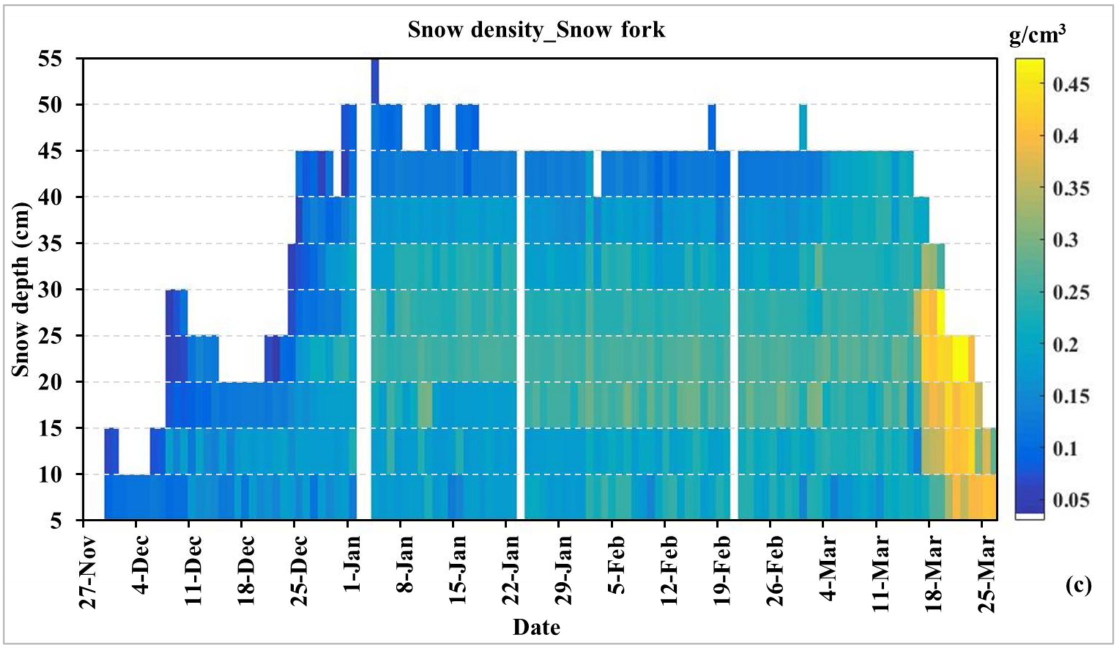
Figure 7: Daily variation in snow layers and grain shape in each layer from November 27, 2015 to March 25, 2016.

Figure 8:

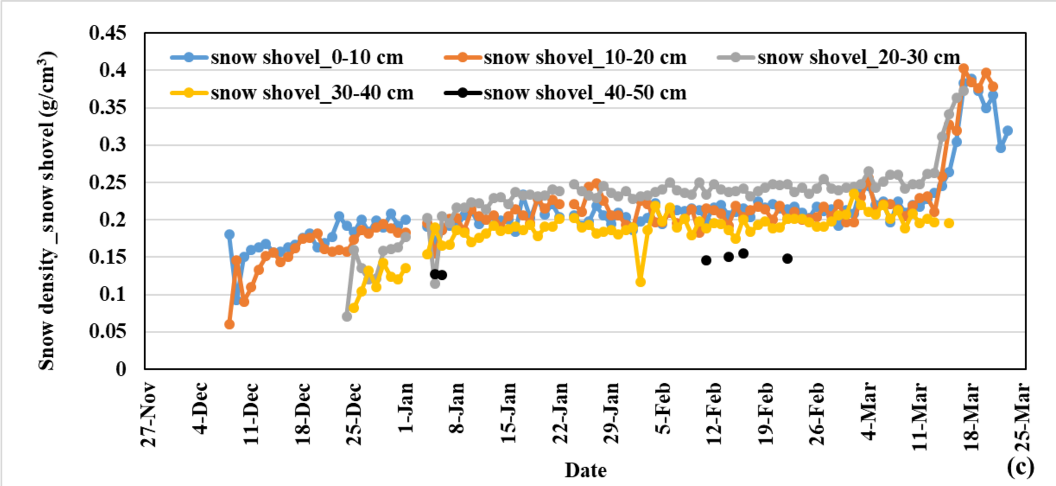
There are 10 layers of snow density in figure 8(bf), so the lines are difficult to distinguish. The folding line figure was changed to image figure.



Was revised to



The line colors in Figure 8(b) were changed to make them more distinguishable.



Was revised to

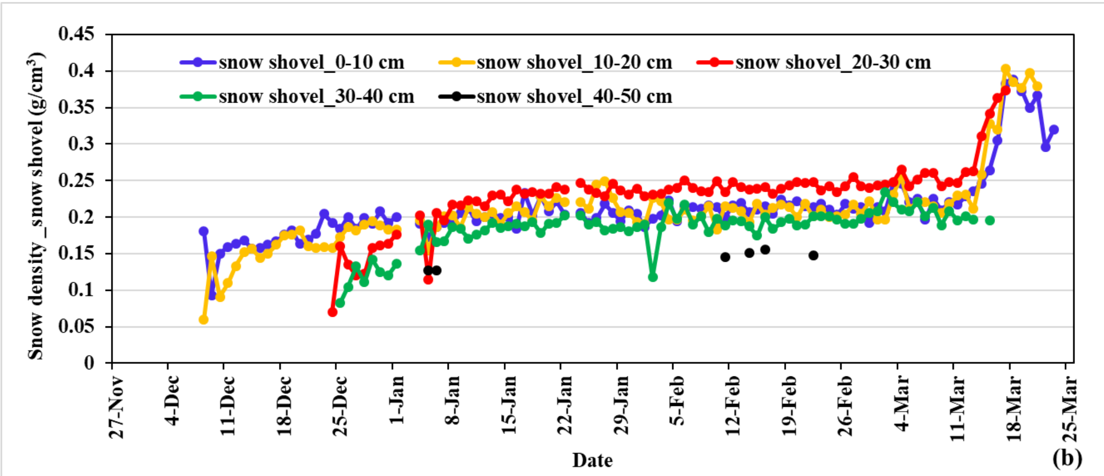
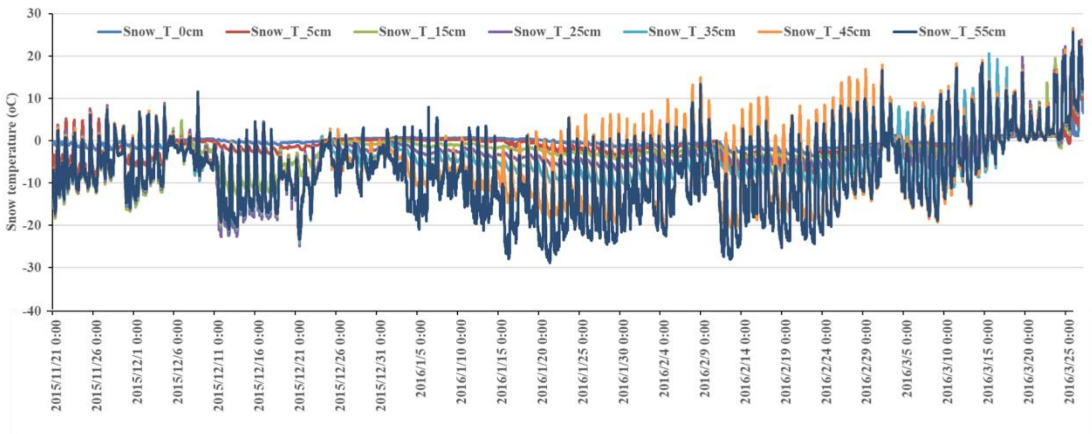


Figure 9: we changed the style of figure 9, and considering another reviewer's suggestion, we simplified the timestamp for x-axis.



Was revised to

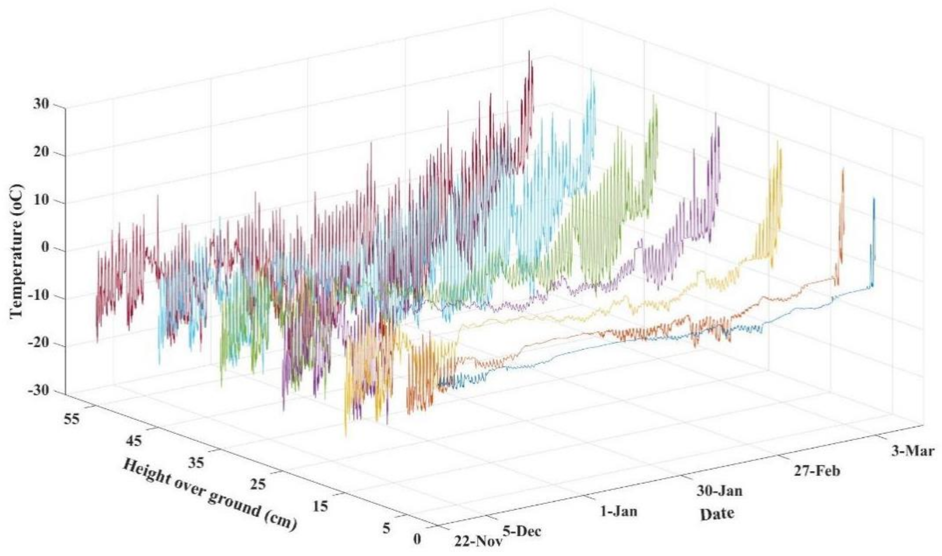
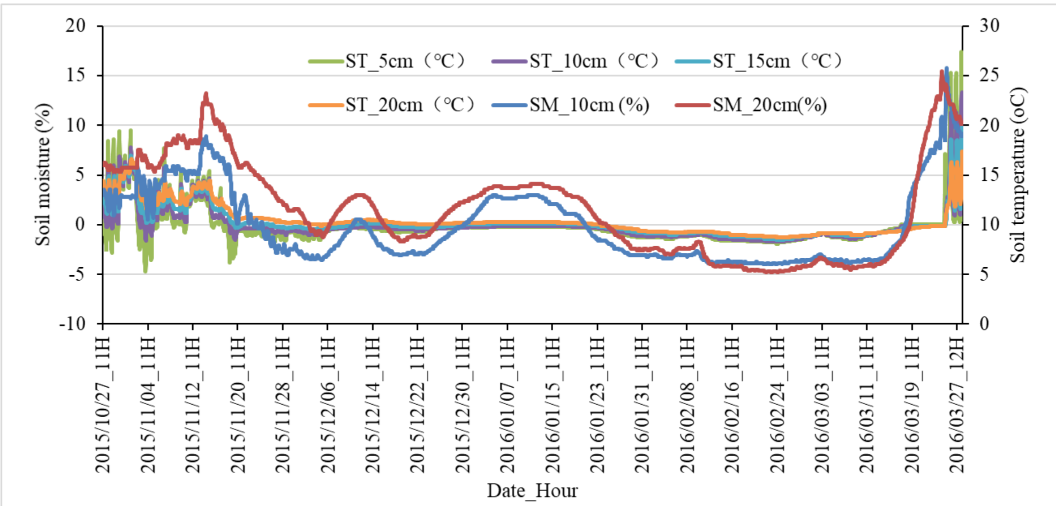


Figure 10: Minutely variation in layered snow temperatures at 0 cm (snow/soil interface), 5 cm, 15 cm, 25 cm, 35 cm, 45 cm and 55 cm above ground during experiment time.

7. Figure 10: This figure can be divided into two figures for the soil moisture and temperature, respectively.

Re: We divided the figure into two figures, and considering another reviewer's suggestion, we simplified the timestamp for x-axies.



Was revised to

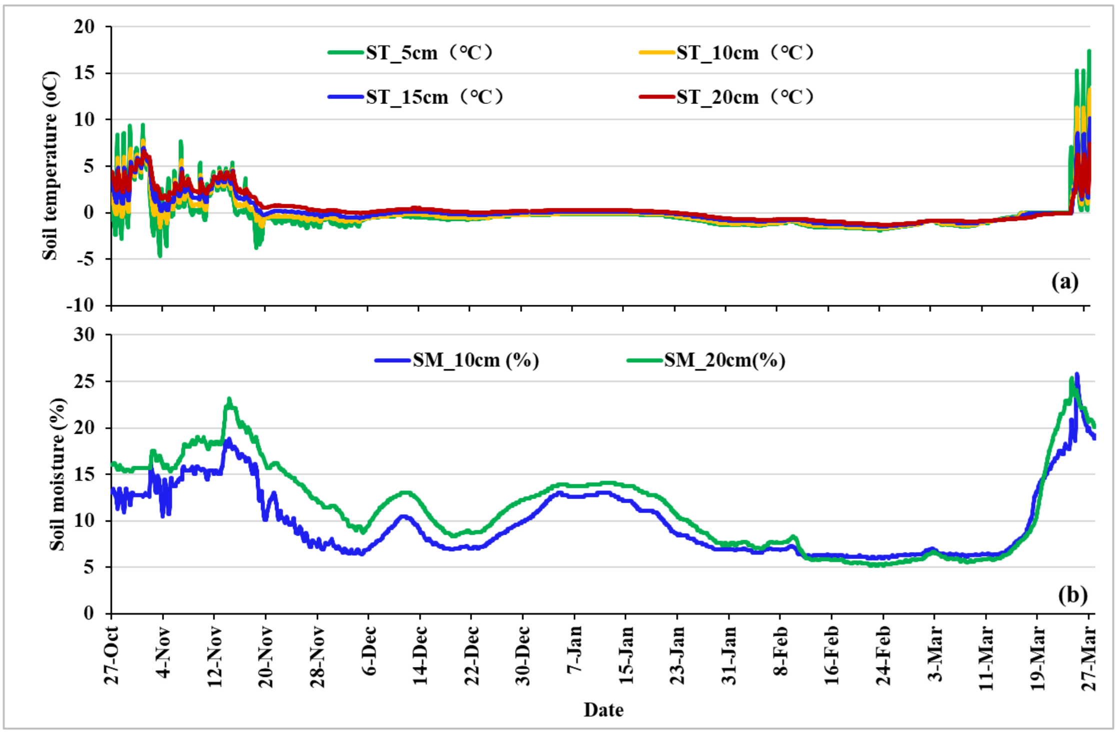


Figure 11: Hourly soil temperature at 5 cm,10 cm, 15 cm and 20 cm below the snow/soil interface (a), and soil moisture at 10 cm and 20 cm below the snow/soil interface (b).

8. Figure 11: I suggest this figure can be divided into two figures. Specifically, Figure 11a can be divided into two figures for the H- and V- polarizations, respectivley. Figure 11b can be another figure, and the whole study period can be divided into several periods for the H- and V- polarizations, respectivley. For example, it can be freezing, thawing periods, and it's suggested to include the snow, soil moisture and temperautre measurements to show the link between these measurements with the diurnal variations of brightness temperature. Besides, what can be the reason cause the large variaitons found around 2016/2/25 and 2016/3/23?

Re:

1. Figure 11a was divided into two figure. One for H polarization, another for V polarization.

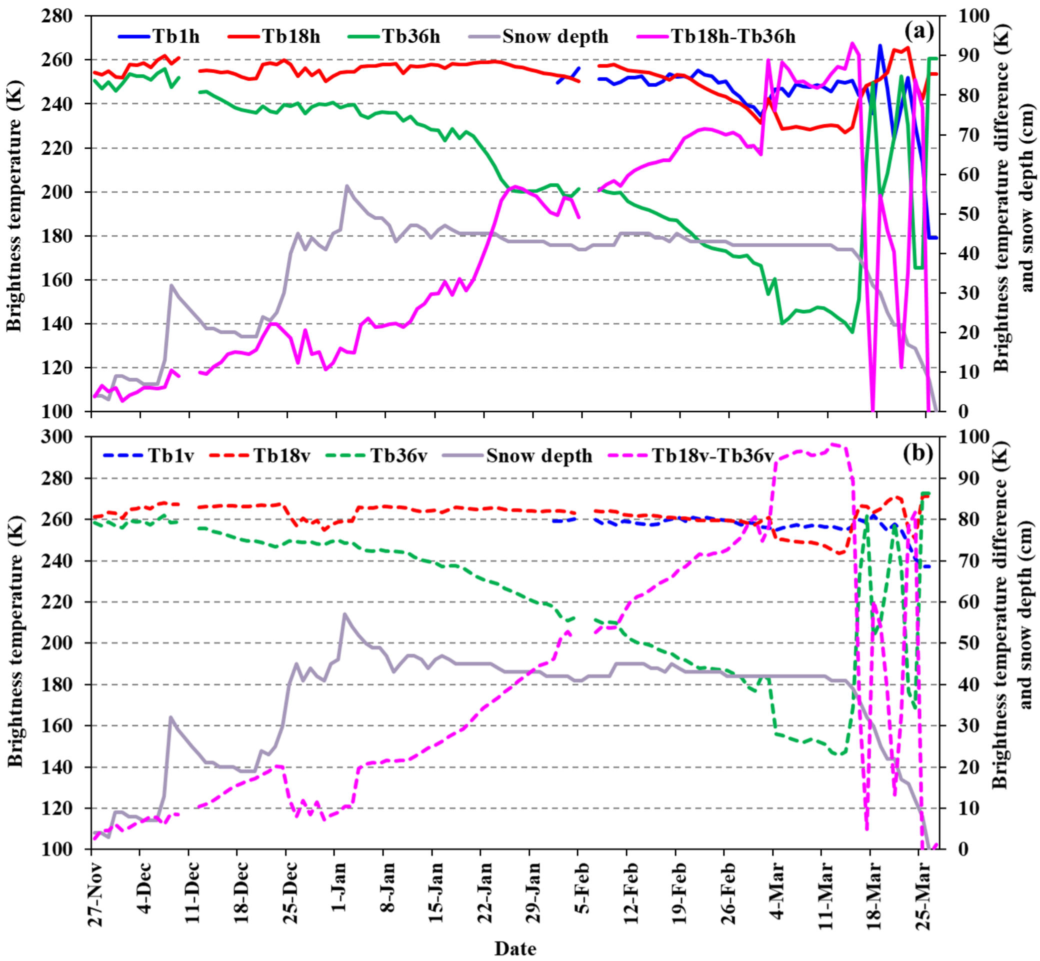
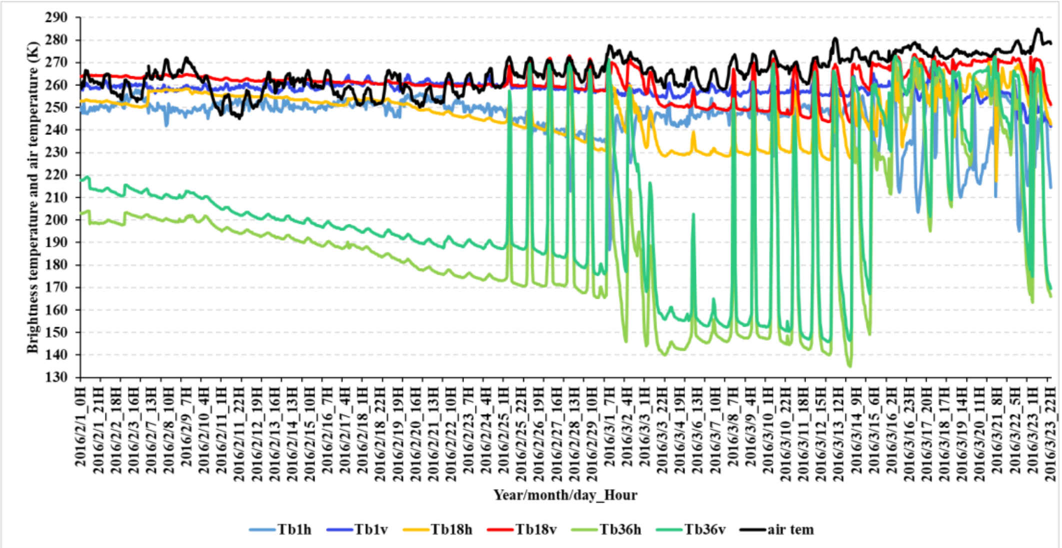


Figure 12: Daily variations in brightness temperatures at 1.4 GHz, 18 GHz and 36 GHz, for horizontal (Tb1h, Tb18h, Tb36h) and vertical polarizations (Tb1v, Tb18v, Tb36v), and the differences between Tb18h and Tb36h (Tb18h - Tb36h, and between Tb18v and Tb36v (Tb18v - Tb36v), at 1:00 am (local time), from November 27, 2015 to March 26, 2016. (a)for horizontal polarization, and (b) for vertical polarization.

2. Figure 11a shows the brightness temperature through the whole snow season. Figure 11b focus on the melting phase. According to the comments, we added the variation in snow depth, soil moisture and soil temperature to link the variation in different parameters.

Figure 11b



was revised to:

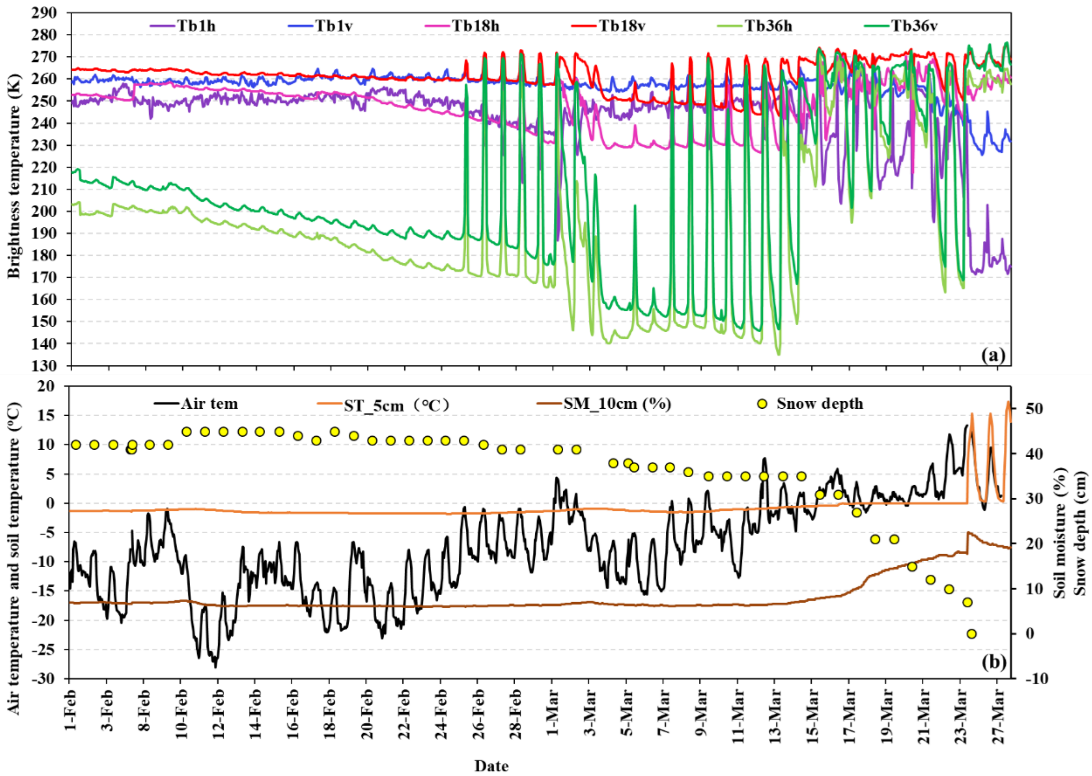


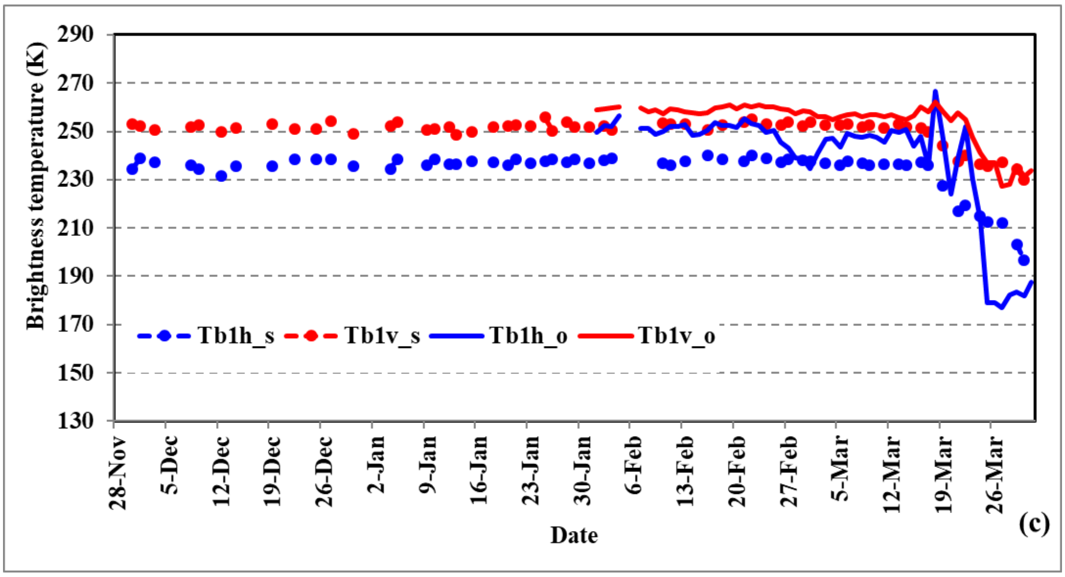
Figure 13 Hourly variation in Tb1h, Tb18h, Tb36h, Tb1v, Tb18v, and Tb36v (a), air temperature, soil moisture at 10 cm and soil temperature at 5 cm, and daily variation in snow depth (b), from February 1 to March 28, 2016.

3. Large variation around 2016/2/25 and 2016/3/23? From the figure, there is no large variation around 2016/2/25, but around 2016/3/1. The reason maybe the continuous melting-refreezing resulting in abrupt increase of grain size. On

2016/3/1 and 2016/3/2, the maximum air temperature increased over 273K, and large melting occurred. The air temperature decreased in the following several days resulted in large increase in grain size. After 2016/3/15, the melting snow would not refreeze at nighttime, so the brightness temperature cannot reflect the scattering of snow grains, and was controlled by liquid water; thus, presenting desultorily fluctuation.

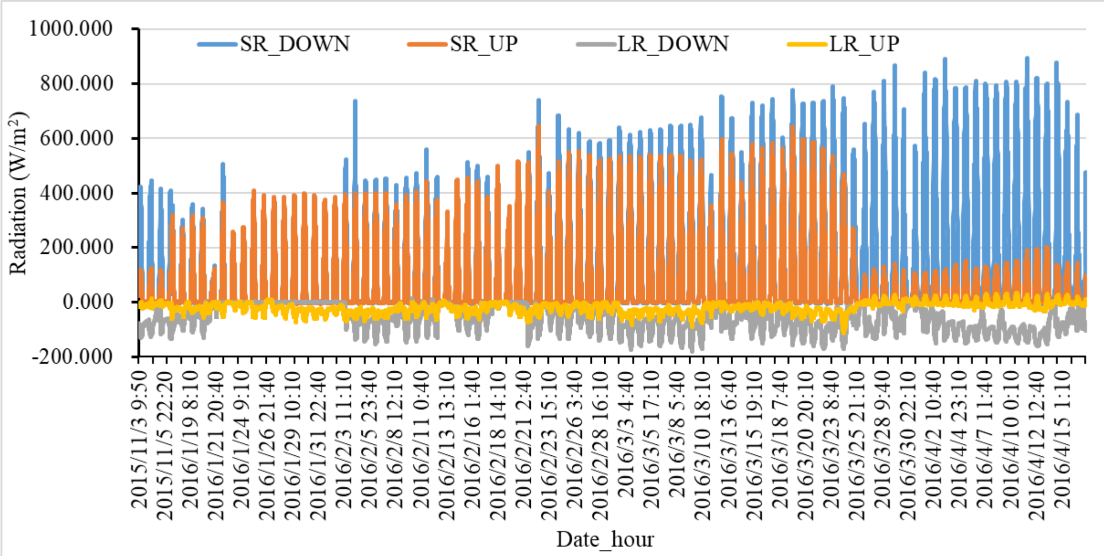
9. Figure 12: It's also suggested to compare the in situ measurements with the SMAP satellite measurements for the 1.4 GHz.

   Re: Thanks for the suggestion. We added the comparison of 1.4 GHz. 1.4 GHz presents similar variation trend, especially in the snow melt period.



10. Figure 13: it's difficult to distinguish the lines. Maybe you can put the shortwave radiation in one figure (e.g. 13a), and the longwave radiation in the other figure (e.g. 13b). Also, it's suggested to include the snow measurements to show the impact of snow on these measurements.

    Re: it will be more convenient for comparison to put the 4-component in a figure. In order to make them more clear, we changed the line color, and added daily snow depth in the figure.



was revised to

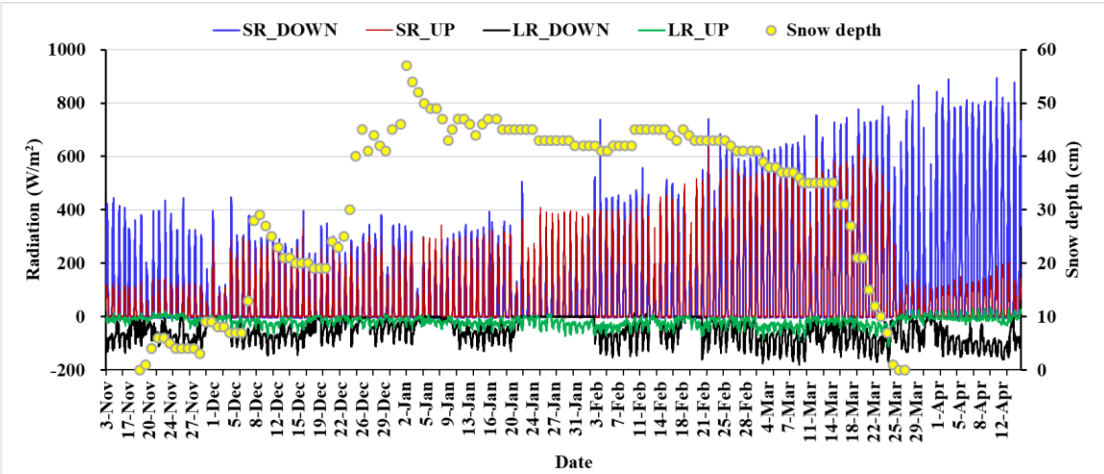
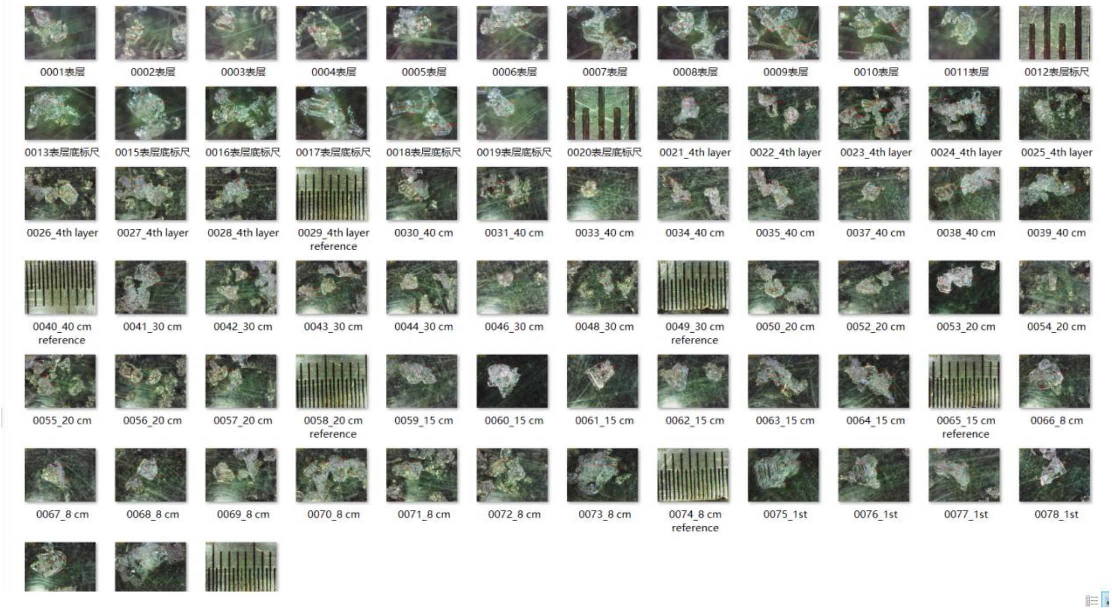


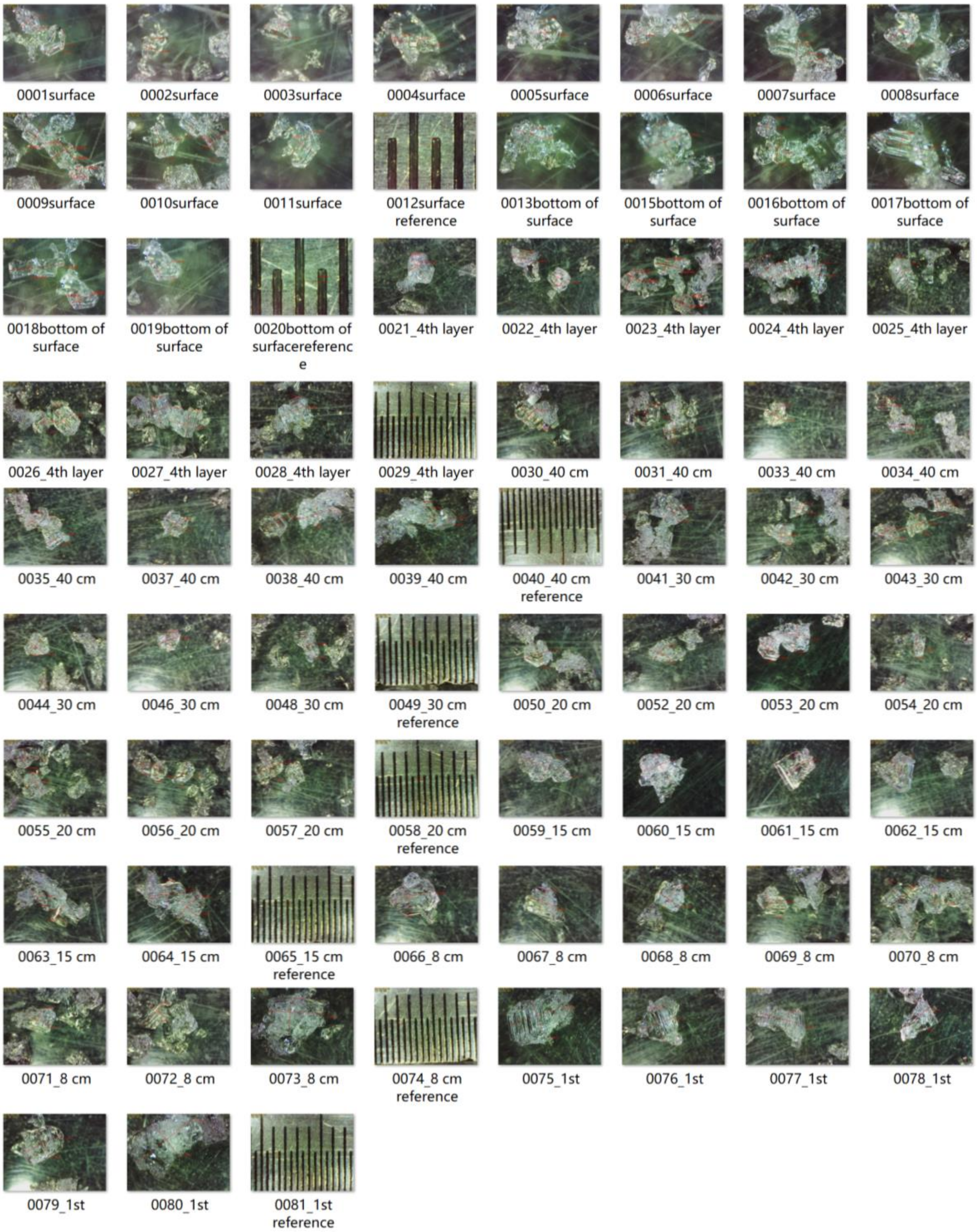
Figure 15: Minutely variation in 4-component radiation and daily variation in snow depth at Altay station from November 3 2015 to April 15 2016.

11. Figure A1: the figure is too small, maybe you can increase the row to cover the full page. Also, some characters are difficult to understand (it seems to be Chinese).

Re: Thanks, we translate the Chinese words, and the photos were



Was revised to



12. Table A2: the figure is too small.

Re:

observation date:	20160111	observation time:	9:03-9:40	weather:	clear	snow depth:	48cm

Snow Folk table

observation height (cm)	liquid water content(%)	snow density (g/cm3)
5	0	0.1923
	0.118	0.1882
	0	0.1882
10	0.461	0.164
	0.46	0.1631
	0.461	0.1361
15	0.123	0.2532
	0	0.2506
	0	0.2417
20	0.24	0.2159
	0.119	0.2155
	0.119	0.2146
25	0.117	0.1977
	0	0.1994
	0	0.1984
30	0	0.1919
	0	0.1966
	0	0.1928
35	0	0.1534
	0	0.1517
	0	0.1472
40	0.325	0.1097
	0	0.1054
	0.107	0.1088
45	0	0.0922
	0	0.0991
	0	0.0928
50		
55		

snow tube table

snow depth(cm)	46.5	47	47.5
snow pressure(g/cm2)	9.1	9	9.5
snow density(g/cm3)	0.1957	0.1915	0.2000

snow shovel table

observation layer (cm)	weight of shovel+snow(g)	weight of shovel(g)	snow density(g/cm3)
0-10	865.04	572.16	0.1953
	858.72	572.16	0.1910
	866.69	572.16	0.1964
10-20	878.58	572.16	0.2043
	887.04	572.16	0.2099
	872.79	572.16	0.2004
20-30	905.34	572.16	0.2221
	903.41	572.16	0.2208
	907.88	572.16	0.2238
30-40	832.75	572.16	0.1737
	838.14	572.16	0.1773
	837.27	572.16	0.1767
40-50			
50-60			

Was revised to

observation date:	20160111	observation time: 9:03-9:40	weather: clear	snow depth: 48cm

Snow Folk table

observation height (cm)	liquid water content(%)	snow density (g/cm3)
5	0	0.1923
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	0	0.1882
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	0.461	0.1361
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	0	0.2506
	0	0.2417
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	0.119	0.2155
	0.119	0.2146
25	0.117	0.1977
	0	0.1994
	0	0.1984
30	0	0.1919
	0	0.1966
	0	0.1928
35	0	0.1534
	0	0.1517
	0	0.1472
40	0.325	0.1097
	0	0.1054
	0.107	0.1088
45	0	0.0922
	0	0.0991
	0	0.0928
50		

Snow tube table

snow depth(cm)	46.5	47	47.5
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observation layer (cm)	weight of shovel+snow(g)	weight of shovel(g)	snow density(g/cm3)
0-10	865.04	572.16	0.1953
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	887.04	572.16	0.2099
	872.79	572.16	0.2004
20-30	905.34	572.16	0.2221
	903.41	572.16	0.2208
	907.88	572.16	0.2238
30-40	832.75	572.16	0.1737
	838.14	572.16	0.1773
	837.27	572.16	0.1767
40-50			
50-60			

13. There were other microwave radiometry experiments conducted in the Third Pole, and the authors are suggested to include it in the Introduction part. Please find below several references for the details.

Zheng, D., Li, X., Wen, J., Hofste, J.G., van der velde, R., Wang, X., Wang, Z., Bai, X., Schwank, M., and Su, Z. (2022). Active and Passive Microwave Signatures of Diurnal Soil Freeze-Thaw Transitions on the Tibetan Plateau. IEEE

Transactions on Geoscience and Remote Sensing, 60, doi: 10.1109/TGRS.2021.3092411.

Zheng, D., Li, X., Zhao, T., Wen, J., van der Velde, R., Schwank, M., Wang, X., Wang, Z., and Su, Z. (2021). Impact of Soil Permittivity and Temperature Profile on L-Band Microwave Emission of Frozen Soil. IEEE Transactions on Geoscience and Remote Sensing, 59(5), 4080-4093.

Zhang, P., Zheng, D.*, van der Velde, R., Wen, J., Zeng, Y., Wang, X., Wang, Z., Chen, J., and Su, Z.* (2021). Status of the Tibetan Plateau observatory (Tibet-Obs) and a 10-year (2009–2019) surface soil moisture dataset. Earth Syst. Sci. Data, 13, 3075–3102.

Zheng, D., Li, X., Wang, X., Wang, Z., Wen, J., van der Velde, R., Schwank, M., and Su, Z. (2019). Sampling depth of L-band radiometer measurements of soil moisture and freeze-thaw dynamics on the Tibetan Plateau. Remote Sensing of Environment, 226, 16-25.

Re: Thanks for the remind. We added introduction of these microwave radiometry experiments.

A paragraph was added in section introduction, and references were added in section reference.

L89-93: In the Tibetan plateau with shallow snow cover, multiple years of microwave radiometry observation at L band were conducted to study passive microwave remote sensing of frozen soil (Zheng et al., 2019, 2021a and 2021b). However, in the long term series of experiment, no snow pit was measured and the microwave radiometry observation was performed at L band which is insensitive to snowpack.

Zheng, D., Li, X., Zhao, T., Wen, J., van der Velde, R., Schwank, M., Wang, X., Wang, Z., and Su, Z. : Impact of Soil Permittivity and Temperature Profile on L-Band Microwave Emission of Frozen Soil. IEEE Transactions on Geoscience and Remote Sensing, 59(5), 4080-4093, DOI: 10.1109/TGRS.2020.3024971, 2021.

Zhang, P., Zheng, D., van der Velde, R., Wen, J., Zeng, Y., Wang, X., Wang, Z., Chen, J., and Su, Z.: Status of the Tibetan Plateau observatory (Tibet-Obs) and a 10-year (2009–2019) surface soil moisture dataset. Earth Syst. Sci. Data, 13, 3075–3102, https://doi.org/10.5194/essd-13-3075-2021, 2021.

Zheng, D., Li, X., Wang, X., Wang, Z., Wen, J., van der Velde, R., Schwank, M., and Su, Z.: Sampling depth of L-band radiometer measurements of soil moisture and freeze-thaw dynamics on the Tibetan Plateau. Remote Sensing of Environment, 226, 16-25, doi.org/10.1016/j.rse.2019.03.029, 2019.

15. Grammar check:

L33: change "sow" to "snow"

Re: it was corrected.

L40: delete "and optical"; delete "evolution"

Re: it was revised.

Comments on the Dataset

L41: the link to the dataset cannot be open, please provide the detailed download link.

Re: Sorry for failing to open the link.

The link was revised to

L41 and L538: http://data.tpdc.ac.cn/zh-hans/data/df1b5edb-daf7-421f-b326-cdb278547eb5/ (doi: 10.11888/Snow.tpdc.270886.)