

Earth Syst. Sci. Data Discuss., referee comment RC2
<https://doi.org/10.5194/essd-2022-68-RC2>, 2022
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Comment on **essd-2022-68**

Anonymous Referee #2

Referee comment on "Microwave radiometry experiment for snow in Altay, China: time series of in situ data for electromagnetic and physical features of snowpack" by Liyun Dai et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2022-68-RC2>, 2022

Microwave radiometry experiment for snow in Altay China: in situ time series of data for electromagnetic and physical features of snow pack and environment

Dai et al. 2022

This manuscript presents a comprehensive dataset of snowpack physical characteristics from a single site for one snow season. The dataset includes microwave and optical radiation data, traditional physical characteristics measured from snow pits, meteorological observations and soil conditions. The dataset contains the variables required for most physically-based snowpack models. In general, the authors do a nice job of describing what was done and why. The manuscript is well prepared and easy to follow, however, it would benefit from English language editing. There is also a fair amount of repetition and the article could be condensed for improved readability.

While I do not have any major concerns, I have a few minor comments. Additionally, I have provided a number of minor editorial suggestions for the authors to consider.

- **Data access:** I was unable to access the data directly using the links in the manuscript. I was able to access the data here <https://data.tpdc.ac.cn/en/data/df1b5edb-daf7-421f-b326-cdb278547eb5/> , using the doi as a search term.
- The authors describe the dataset as a 'consolidated' dataset. I am not sure 'consolidated' is the best term to describe it. The dataset is comprised of numerous asci files and excel spreadsheets in various directories. It is more of an 'assembled' dataset. There was some 'consolidation' when multiple observations were averaged but to me that is part of the natural data management process.
- Did the authors consider any other file formats such as NetCDF or data management

strategies? For example, could the daily measurements not have been consolidated into a single netcdf file? I found the various directories and files a bit cumbersome.

- Did the data undergo any QA/QC or are they posted 'as is'. Please discuss.
- Please provide instrument precision and accuracy information where possible. This information could be included in Table 2.

Manuscript consistency

- Check for consistent use of upper and lower case throughout.
- Use consistent units for air temperature.
- Suggest 'entire snow season' or 'full snow season' instead of 'whole snow season' throughout
- Suggest 'snow layer' instead of 'layering snow' throughout

You state that measurements of meteorological and soil parameters were requested from the ANRMS. Why these measurements were requested? In the context of your experiment, why is it important to have these data, in combination with the measurements of snow physical characteristics and microwave data? Please state in manuscript.

With three difference snow density measurements can you provide any guidance on which ones might be most appropriate for different applications?

The phrase 'the collected data in this study include ground-based brightness temperatures, 4-component radiation, snow pit data, meteorological data and automatically observed layering snow and soil temperatures.' or similar repeats multiple times. Could use less frequently to shorten the text and improve readability.

Minor line items

L24-26: Sentence not clear. Do you mean 'evolution' processes?

L25: suggest either 'for evaluating' or 'to evaluated and improve'

L77: do you mean evolution of snow parameters? Unclear.

L85: Longer time series of data compared to what? Unclear.

L204: To make it even more clear that a new snow pit was dug each day suggest writing 'In the black field, a new snow pit was dug each day.' This is an important part of your experiment so want to make it absolutely clear.

L207-211: Nice. Thank you for this description and detail.

L216: What was the constant interval of the snow density measurements?

L217: Please specify which software was used.

L246: for clarity suggest 'at 5 cm intervals starting 5 cm above the snow-soil interface

Section 3 – When listing each dataset, please be consistent and include how each is stored. Also, maybe cross-reference with earlier sections, Tables and/or Figures.

L293-295. Were the 17 samples at any sort of fixed frequency or just random dates?

L288: Was any QZ/QC conducted? If not, perhaps add a sentence stating that the data are provided 'as is'.

L335: grain size of all fresh snow that fell during the 2015/2016 snow season or a specific event?

L354: when did this 'stable phase' occur?

L365-366: I find these sentences rather confusing. It's not clear what you are trying to say.

Do you mean the diurnal range decreased from the top to bottom layers and as the snow depth increased there were more layers with diurnal temperature variations?

L387-390 (4.3 Brightness temperature): Fig 11a shows the brightness temperatures continuing to increase after 15 Jan when the snow density became stable (Fig 8). Any insight as to what might be causing this? What do the crystal sizes show?

L448: which phenomena?

Tables and Figures

Table 2

- Given the scope and aim of the journal, please include instrument precision and accuracy where possible. Could add as column to Table 2.
- Snow tube (L238 lists Chinese Meteorological administration, add this to Table 2) and snow fork models and manufacturer? Are these also produced by China Huayun? Please list the NR01 manufacturer.

Figure 1 caption: 'in Asia' (delete 'the'). Delete 'Note: The map in the up right corner is ArcGIS self-contained map.

Figure 4:

- Please spell out CNR4 in the caption as I don't think it is used elsewhere in the text.
- Consider annotating the figure and sub-figures. i.e. upper left is 4-component radiation sensor, right is the snow profile sensor, center is the primary meteorological station, etc.

Fig 9. Please clarify in the caption that 0 cm is the snow/soil interface.

Figure 10

- caption: remove 'variation'

- specify in the caption that 5 cm is 5 cm below the surface

Figure 11

- the pink lines in Fig 11a (TBDh and TBDv) are not in the legend
- there is no a or b on the figures

Additional minor editorial suggestions

Please consider these minor editorial suggestions. These suggestions are not exhaustive. Consider additional proofing beyond what is listed here.

L25-26: suggest **'to evaluate and improve** snow depth and SWE ...

L36: suggest produced or developed instead of 'was achieved'

L37: **'at'** instead of 'in'

L37-39: suggested revision: 'This unique dataset includes continuous daily snow pit data and coincident microwave brightness temperatures, radiation, and meteorological data, at a fixed site over a full snow season.'

L39-40: is expected to serve the evaluation and development of microwave

L48: 'processes'

L 49: **'is** controlled'

L 50: 'and variations in snow characteristics cause uncertainties in albedo estimation'
(drop 'the' x2)

L51: '**at** global and regional scales'

L56: '**of** electromagnetic and ... improve understanding **of** the...'

L61: **to** produce

L62: **have** been

L63-64: The Cold Land Processes Field Experiment (CLPX)
(<https://nsidc.org/data/clpx/index.html>), one of the most well-known experiments, was carried out from winter of 2002 to spring of 2003 in Colorado, USA (Cline et al., 2003).

L65-66: snow pits were collected **in** February and March of 2002 and 2003 to coincide with airborne...

L67: **to test and develop** instead of 'develop/test'

L70: In northern Canada, (drop 'region' and Canada instead of Canadian)

L76: pit observations **were** used **to** evaluate

L81: boreal forest spanning an entire winter season

L82: **at** 3 or 4 day intervals

L85: were fixed field (drop 'of')

L85-89: Unclear. Possible rephrasing – ‘The experiments were conducted in a deep snow area and the weekly observation interval permits observation of general snow evolution characteristics but might miss some key details that occur at sub-weekly scales.’ . Delete sentence starting with ‘furthermore on L87-89.

L90: To understand the evolution of

L98: continuous

L100: location, parameters, **and** parameter measurement

L101: **at** the National

L103: the possible **applications**

L107-108: was performed during the 2015/2016 snow season

L110-111: which is approximately 6 km from the foot of the Altay mountain in northwest China (Figure 1).

L112: **provides** snow water resources for **these** four countries.

L114: 40 cm, with a maximum over 70 cm.

L117: with **areas** of

L120-121: was set up in the middle of the field, facing

L126: The blue field **was** (try to use consistent verb tenses)

L127: precipitation, **soil layer** temperature, **and** soil moisture

L129: observations **of** snow depth (or daily manual snow depth and SWE observations)

L132-136: This does not need to be its own paragraph. Append to end of previous one.

L138: between **them is** less than 100 m

L157-158: The **automated** data collection frequency was set **to** 1 minute.

L167: suggest 'the automated snow temperatures collected in the red field'

Table 2: '**feet**' instead of 'feets' (**6 feet above ground**)

L171-172: The soil and weather parameters are routine observations conducted at

L179-182: Suggest deleting. This same text repeats often and is not necessary here.

L184: Before **the** (or Prior to the)

L186: in clear sky conditions (delete 'the')

L190: fixed in the middle of the orbit (delete 'place')

L196-198: Therefore, the snow are snow characteristics were considered homogeneous within the field of view of the antennas.

L202: snow layering, layer grain size and type, and snow layer density.

L203: making **a** snow pit

L206: delete 'for observers to conveniently observe.'

L207: snow profile **is exposed**

L212-214: Combine with previous paragraph. Could also rephrase to: '...the natural snowpack stratification was visually determined and the thickness of each layer measured using a ruler.'

L217-218: with an 'Anyty V500IR/UV' camera (Figure 2a)

L221: In this experiment, a ruler with 0.5 mm marking was used as a reference

L227-228: Each layer had at least 10 groups of longest and shortest axes length; the final grain size was the average of these values.

L247: Table A2 is an example record table for snow density.

L247-248: Three observations were conducted for each layer.

L255: suggest 'Snow layer temperatures were collected using temperature sensors in the red field instead of ...'

L256: sensors **were** set up

L258: , and 55 cm from the base of the soil-snow interface.

L259: typo – need space between The and NR01

L260: far infrared

L282: reorganized **and** consolidated **for ease of use**.

L295: angle, **and** brightness temperatures

L314: **is** described

L327-331: awkward text. Suggest rephrasing. Possible change: 'During this snow season there were seven snowfall events, each formed a distinct snow layer except for the third event whose layering became indistinguishable from the second layer (Figure 6 gray). The fourth event was the biggest, after which time the snow depth started to decrease and snow density increased.'

L333: within all layers increased during the

L335: perhaps top to bottom instead of up to down? And for other occurrences of this phrasing.

L336-337: The biggest long are short axes were 6 cm and 4 cm, respectively, and occurred in Layer 1 during the melt period.

L339: above 0°C ?? not clear

L339-340: snowpack melt accelerated

L350: suggest 'instruments' instead of 'equipment'

L351: and remained stable after reaching $\sim 0.2-0.25$ g/cm³.

L352-535: From March 14 on, snow densities abruptly increased and the maximum value reached was over 0.45g/cm³.

L364: Snow temperature in the top layer had the largest diurnal variation.

L371-372: remained stable and below 0°C during the snow season but had large fluctuations before and after snow on/off.

L373: do you mean temperature difference? Suggest: 'The temperature difference between 5 cm and 10 cm was much larger before snow cover onset than during the snow cover period.'

L375: suggest 'snow cover period'

L376: I found this sentence a little confusing. Suggest 'Within the snow cover period, there were two soil moisture peaks, one from 12-14 Dec and another from 1-20 Jan.'

L384: 1:00 am local time?

L384. Suggest starting a new sentence with 'Figure 11b'

L385: Maybe list the three frequencies in parentheses to remind the reader.

L386: Data **show**

L386-387: Tb18h shows an obvious decline after Feb 18, and Tb18v after Mar 3 (Figure 11a).

L389: snow density became stable on Jan 15.

L391-392: suggest '...exhibited a distinct cycle of daytime increases and nighttime decreases, resulting from high daytime air temperatures (above 270K) and associated melt-freeze cycles.'

L395-397: suggest 'After March 14 there was another big rise in air temperatures and even the nighttime air temperatures were above 270 K. During this period of accelerated snowmelt the liquid water within the snowpack did not refreeze completely at night and

both the brightness temperature and brightness temperature difference showed irregular behaviour.'

L412-413: suggest 'Although the magnitudes differ, the general temporal patterns are the same, even the abrupt change between 3 and 4 Mar is captured by both instruments. The correlation coefficients at both ...'

L423: **downward** short-wave

L426-427: Can you put the snow on and off dates in parentheses?

L428: **by** the end of the snow season

L423: models

L437: the dominant control (delete 'factor')

L438: **did** not correspond

L439: do you mean brightness temperature **difference** of the dry snowpack?

L440: do you mean maximum difference (instead of gradient)?

L443: had similar **variations**

L444: **time** periods

L445: and was less stable

L449: were absent **from Dai et al (2021)'s** simulation so the dynamic ground...

L450: **predominantly** instead of dominantly

L451: conditions

L455: influences

L456: **the** climate system

L456-458: The factors altering snow surface albedo are

L459: ,while others considered snow albedo to depend mainly on snow aging.

L463: albedo **models**

L465-466: within different layers **had** different growth rates **during** different **time periods**

L473: at **a** fixed site

L474: which provide **a detailed** description of

L480-482: delete 'Actually'.

L474-487: combine into a single paragraph.

L484: 'Existing studies report that ...

L486: These data provide a good opportunity to

