

Earth Syst. Sci. Data Discuss., referee comment RC2
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Comment on **essd-2021-432**

Kristine Larson (Referee)

Referee comment on "A new snow depth data set over northern China derived using GNSS interferometric reflectometry from a continuously operating network (GSnow-CHINA v1.0, 2013–2022)" by Wei Wan et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-432-RC2>, 2022

I think this is an excellent paper describing a new snow depth dataset. My comments below - tagged by page number/line - are meant to improve the readability and value of the paper.

Some of my comments are directed to the figure captions. I think the goal should be to allow people to read/look at the figures without reading the paper. So this means they have to explicitly say how many sites are in the figures and so on.

My main technical comment is that the authors describe whether they set an azimuth mask for each site. I do like that they are investigating new ways to evaluate the QC for their sites, but we really need to know a little bit more about how they did that (peak ratios e.g.). I agree that setting the bare soil values is complicated - using NDVI is a good way to get a handle on whether the vegetation is dead and thus a better proxy for bare soil.

I would also ask the authors to add a few more sentences about how they dealt with the non-repeating ground tracks for Glonass satellites.

I do echo the comment of the previous reviewer. For this dataset to be truly useful, it needs to be easily found. For soil moisture, I could point to the International Soil Moisture Network. Even though my soil moisture project has ended, the ISMN has provided a way for researchers to use our soil moisture data without contacting me directly. I do not know the best place for snow data, particularly for the international community.

A new snow depth data set over northern China by developing a comprehensive framework using the complex GNSS station network

I would suggest a slightly different title. We don't use complex in quite this way. Yes, the dataset is complicated - but really the issue is that the sites were not located in an ideal way for snow sensing. Maybe :

"A new snow depth data set over northern China derived using GNSS interferometric reflectometry from a continuously operating GNSS network."

This is a suggestion - not any kind of required change.

page 3, line 67 I think you should explicitly say in the US (the reader should not need to go to the website to find out that SCAN and SNOTEL are only in the western US).

page 4, line 92 For **typical** GNSS sites the spatial footprint is $\sim 1000 \text{ m}^2$. (rather than saying recognized).

page 4 last couple sentences my copy has the commas in 9,000,000 and 4,200,000 as ` rather than ,

page 6, line 138

and the stations have turned into a certain amount since 2012.

better to say " and the station build phase was completed in 2012. " ???

page 7

I think it is sufficient to say you used the broadest ephemeris. They should be the same everywhere and it should not matter where you got them from.

page 7, last line. the RINEX files may truly only have 10 degree data - but was that imposed when the file was made or when the GPS station was set up? It is pretty unusual to set that at the RINEX creation stage (not saying it wasn't done, just asking to be clear).

Page 8

Shouldn't there be references for these data, SMAP, NDVI data etc?

Add a reference for Lomb Scargle Periodogram

As part of your quality control, I think you have set a mask for each site, but you don't really say it. Why not make it clear? You should not bother calculating reflector heights if they are not useful for snow sensing.

page 9

mean Peak-to-Noise Rate (PNR)

I think you mean peak to noise ratio, not rate

page 11

line 219 are analyzed in Table 1,

You really mean to say that they are listed - not analyzed

Even though, the SNR model has been verified to have higher accuracy than the L4 and F2C models (Liu et al., 2021).

remove "Even though"

It is worth mentioning that, for GPS and GLONASS satellite, the reflector height is given per satellite, quadrant, and frequency band, while for BDS satellite, the reflector height is given by quadrant only because the BDS MEO satellite changes its trajectory day by day.

GLONASS does not have a daily repeatable ground track. What do you do to account for this?

Figure 13

The caption of Figure 4 should be expanded to describe the subplots, especially the ones with data in them. I know what is in the figures, but most people would not.

I also suggest using grid lines in the plots.

page 14

The majority of the CEA antennas are settled down on a standard rooftop, with the GNSS receivers being put in the accompanying small house. It explains why most of the CEA sites are not suitable for snow depth retrieval.

I suggest you say "set upon a rooftop." Settled is used for something that starts at one height and slowly changes, like snow settling.

page 16

Figure 6 shows the rule being applied to six individual sites with various surroundings,

You say this before you define the rule. I think you really need to define the rule first.

Figure 6

How do we know that these are good retrievals? Maybe some of the periodograms have poorly defined peaks?

page 16

the three sites at the bottom of Figure 6, i.e., uqwl, qhdl, and qhbm, show continuously changed hX values. It

indicates that it is unreliable to determine a true hX by the Lomb-Scargle spectrum due to complex environmental 280 conditions.

I know what you are trying to say here, but I think it is simply a matter that you are computing reflector heights at sites where you should not bother. The sites are surrounded by too much clutter.

When you are using your rules to find good sites, do you prepare and save azimuth masks? It is not clear to me that you do.

page 18

0 ~ 12 am or 12 ~ 24 pm within one specific day.

You should say 0-12 UTC and 12-24 UTC.

Figure 7 is this for one site? Which one?

Figure 9 add the number of sites this represents in the caption. My recollection is that you don't have that many that observe both GPS and Glonass.

Figure 10- Couldn't part of the difference between L1 and L2 be due to the phase centers not being in the same place? Did you assume the phase centers were the same? How many sites are shown in these figures?

Figure 11 add the 1 to 1 (diagonal) line as you had in Figure 10.

How many sites are represented in each figure? This information should be in the caption or in the figure.

page 23

In addition, the peak of the PMW snow trend for each snow season moves to the right,

Say instead that the peak is later in the season rather than moves to the right

Figure 12 Explicitly say in the caption how many sites are shown.

page 24

This result indicates that the laser measurements in operational meteorological observations are not always reliable.

Could say "this result is a reminder that operational laser measurements of snow depth are not always reliable.

page 30

First, the minimum elevation angle of GNSS satellites should be set to $5^\circ \sim 15^\circ$ to preserve the multipath effect as much as possible because only data with low elevation angles can show the surface reflection.

I don't understand this sentences. If you had said "set to 5 degrees" I would agree

because you said you are setting a minimum, which should be a single number. I do not know why you mention 15. Despite the fact that these organizations unfortunately used an elevation mask of 10 degrees, your paper demonstrates that stations with an elevation minimum of 10 degrees can be used (though not optimal).

Third, the cycle slip of GNSS observation can severely reduce the data quantity available for snow depth retrieval.

I don't understand why a cycle slip would by itself reduce the data quantity for SNR?

page 31

Also, the snow depth results on snowy days could, to some extent, affect the accuracy.

What do you mean here? I don't disagree with you - but if you say it, you have to explain why you say it.