

## Comment on **essd-2021-432**

Anonymous Referee #3

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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-RC3>, 2022

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### General comments:

The authors present a new snow depth dataset using a network of GNSS stations in northern China. The data were derived using a varied of established methods depending on data quality and instruments available at the different stations. They furthermore propose a method to automatically control the data quality. The quality of the obtained snow depth data is evaluated comparing the different GNSS snow derivation methods with each other and to in situ manual measurements and passive microwave data.

The presented dataset is a valuable contribution to the research community and the paper should be accepted for publications after the following points are taken into consideration.

The RMSD (Figure 9 and 10) and STE (Figure 11) should be given also as relative errors (%), allowing a better comparison to other studies. This is particular important since the snow depth in the studied area is particularly low compared to other snow-covered areas in the world. Moreover, data points with < 5cm were included in analysis and seems to be the majority of the datapoints (See figure 10). However, later it was stated that the obtained results are not reliable for snow depth < 5 cm (line 493). I see a contradiction here. Due to the high density of points with very low snow depth the reported deviations can be misleading. Consider also providing the analysis only for datapoints above a certain threshold. It would be also useful to add a regression line to the scatter plots in figures 9 to 11.

It would be nice if more recent data would be included in the dataset.

The site info are given only in .doc an .xls formats. It would be good to have that information also in non-proprietary format as text file or csv.

**Detailed comments:**

Line 153-155: I don't understand what the authors mean with: " ... we preserved the high-quality and medium-quality sites as much as possible..."

Figure 5: Please indicate which sites are considered high quality or low quality in figure caption.

Line 276: Please explain why the site bgfc is has stable h0 only at specific orientations.

Line 284: a value range of 0.5 m is still pretty large if it is considered that the snow depth to be measure is generally lower than 0.3 m. Can you comment on this point?

Line 316: Specify the length of the moving window. 10 datapoints, hours, days, ...?

Figure 7: The oscillations/noise are much bigger than the reported errors. Can you comment on this?

Lines 321-340: Is the volumetric soil moisture not changing over the year? How is this accounted in the data derivation. What is the effect of soil freezing?

Line 354: Please indicate relative to which quantity the standard error is calculated?

Figure 12: I find quite unusual to compare the seasonal evolution of the snow depth only for the mean of the 17 sites since in this way oscillations and outliers are probably smoothed away. It would be good to see also the comparison of the 3 methods for single sites, which would give an indication of the validity of the data in the single cases.

Figure 13: It would be good to indicate the standard deviation or RMSE for the mean and max values.

Figure 15 and section 4.3: It is true that the GNSS dataset deliver a higher data rate than the other methods. However due to the lack of reference data at the same rate it is impossible to judge the quality of the 2h dataset. In fact there are several discontinuities in the GNSS derived snow depth (sharp decrease and increase of snow depth) that are normally not seen in snow depth data from a snow storm. It is in fact not possible to judge what changes are due to the real snow depth evolution and which changes are due to artefacts that could be due to i.e GNSS satellite configuration or snow deposited on the GNSS antenna. It is unfortunate that the in-situ snow depth data are not available at higher rate which is normally possible for laser snow depth instruments.

Line 550: It is not clear what the authors mean with this sentence.

Figure 19: I'm missing a yes or no on the diagram arrows indicating in which direction is taken after a decision.

Conclusion: Please indicate also the (relative) error of the GNSS data compared to the in-situ and PMW data. Not only the internal consistency between the different GNSS systems.