Comment on essd-2021-432
Anonymous Referee #1

The authors proposed a comprehensive framework to process GNSS raw data under complex environment conditions to retrieve snow depth, and based on this, the authors produced a GNSS-based long-term snow depth data set over China from 80 stations. The topic is very interesting from a perspective different from traditional microwave remote sensing retrievals. As the authors’ statement, this data set has a unique spatial resolution between point-scale and coarse grid-scale. The new data set is valuable to the science community from this point. I also have confidence in this GNSS-IR technique, which could be a helpful and complementary tool for producing more snow depth products with high spatial-temporal resolution using extended global GNSS networks, particularly from GNSS sites in polar regions or even on scientific expedition vessels.

I recommend this work for publication after revisions.

Several comments are listed below:

- Vegetation and terrain are two significant issues that affect snow depth estimation. The authors only discussed vegetation in Section 5.1. How about terrain effects? I recommend adding in-depth discussions relevant to this issue.
- Around Line 185: “4) For high- and medium-quality sites, the model for deriving daily reflector height is established, and the raw snow depth for each GNSS satellite, each quadrant, and each GNSS frequency is subsequently calculated as the difference value of the referenced height in Step 3) and the height of this step”. I am confused about the descriptions of “height.” Which height was used as the referenced height? The authors should revise the texts to clarify this issue.
Line 350: “The 8-day MODIS NDVI is also involved as a quality flag in the data set to show the vegetation conditions of the site initially”. The authors only gave this vegetation flag. How to use this flag? I recommend adding a few sentences to describe.

Should Section 4.4 be a separate section? I am afraid it is improper to put the data set descriptions inside Section 4.

Figure 17 x-label is not correct? Should it be the current number +10?

I am aware that the authors tried their best to reuse the data from the current GNSS networks. There are still limitations concerning the raw data. I look forward to seeing a longer-time series of snow depth products from more sites and systems (such as from China’s Beidou). I also encourage the authors to find some way (e.g., making a website?) to maintain and share the methods and data sets to broader users?