essd-2024-602 Author response to referee comment 3

Original comments are in black, our responses are in blue, proposed additions and modifications in red. Line numbers refer to the original manuscript.

Reviewer 3: Alexander Gottlieb

This paper presents a novel dataset of in situ snow water equivalent (SWE) measurements from North America, Finland, and Russia over the period 1979-2021. The authors clean and harmonize data from 9 distinct sources to provide these measurements in a single file. This represents, to the best of my knowledge, the first publicly-available quasi-hemispheric in situ SWE dataset. As such, I believe it will be of tremendous value to the scientific community and the methods the authors apply seem to have produced a very high-quality dataset. Overall, I would not hesitate to recommend this paper for publication soon. I do, however, have a few minor suggestions that the authors could consider to strengthen the paper even further.

First, while I recognize the tremendous amount of work that goes into wrangling all of this SWE data, there are 2 additional sources that are fairly accessible that could increase the spatial coverage over Europe, particularly in mountainous regions. One is the GCOS dataset from Switzerland, available at https://envidat.ch/#/metadata/gcos-swe-data (citation below) The other is from the Norwegian Water Resources and Energy Directorate: https://www.nve.no/vann-og-vassdrag/vannets-kretsloep/snoe/automatiske-snostasjoner/?ref=mainmenu

Second, the authors do an excellent job of outlining possible uses for their dataset, and there is one more they can consider adding. For applications where spatiotemporally continuous data is necessary, the interpolation of in situ SWE and snow depth data has created some of the highest-quality estimates, such as the 4km University of Arizona SWE product (Broxton et al., 2019). The NorSWE dataset the authors present could facilitate the creation of a high-quality gridded hemispheric products that would be of tremendous value to the research community, and I would encourage them to highlight that as a potential use case.

Overall, I think this is a high-quality dataset that will be very useful, and look forward to the publication of the paper and the use of the data.

Broxton, P., Zeng, X. & Dawson, N. (2019). Daily 4 km Gridded SWE and Snow Depth from Assimilated In-Situ and Modeled Data over the Conterminous US. (NSIDC-0719, Version 1). [Data Set]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/0GGPB220EX6A.

Marty, C. (2020). GCOS SWE data from 11 stations in Switzerland. EnviDat. https://www.doi.org/10.16904/15.

Thank you for your constructive feedback and suggestions of additional data and use cases. As suggested also by Adrià Fontrodona-Bach (Reviewer 1) we will add data from the Norwegian Water Resources and Energy Directorate that we missed. For NorSWE, which was originally compiled to evaluate gridded SWE products, we established criteria to only include snow courses and airborne gamma measurements because they are generally more spatially representative than single point measurements. We later expanded the criteria to also include automated point data because they provide useful information on the seasonal evolution of SWE important for evaluating hydrological models, also an important application of NorSWE data. These criteria omit networks such as the Swiss GCOS data, mentioned by yourself and Adrià Fontrodona-Bach (Reviewer 1), that uses single point measurements. However, due to the significant data gap in Europe and the wide use of the Swiss GCOS data we will make an exception and include these data. The Swiss GCOS sites will be assigned the WMO code 1 (single point manual). Text describing these networks will be added to the revised manuscript and all Figures revised accordingly.

Marty, Christoph (2020). GCOS SWE data from 11 stations in Switzerland. EnviDat.doi:10.16904/15.

You make an excellent point about high-resolution gridded datasets that we did not adequately highlight. Indeed, the University of Arizona SWE dataset is an excellent example of this. We propose to add this use case to Section 7.

L349: *"Further, in situ SWE observations can help inform high quality spatially and temporally continuous gridded SWE estimates, exemplified by the University of Arizona SWE product (Broxton et al. 2019). SNOTEL SWE observations and SD from the US Cooperative network are assimilated with gridded temperature and precipitation data to provide high-quality daily SWE and SD estimates over the Coterminous US at a 4km spatial resolution (Zeng et al. 2018). Data contained in NorSWE could help facilitate the creation of similar datasets at both the regional and hemispheric scale."*

Added references

Broxton, P., Zeng, X. and Dawson, N.: Daily 4 km Gridded SWE and Snow Depth from Assimilated In-Situ and Modeled Data over the Conterminous US. (NSIDC-0719, Version 1). [Data Set]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/0GGPB220EX6A, 2019.

Zeng, X., Broxton, P., Dawson, N.: Snowpack change from 1982 to 2016 over Conterminous United States, Geophys. Res. Lett., 45,12,940-12,947, https://doi.org/10.1029/2018GL079621, 2018.