

Revisions of: Brief communication: delivering a Digital-Twin-ready snow reanalysis

By: Avanzi et al.

Dr. Benoit Montpetit

1 General Comments

This brief communication presents DTE-Snow, a digital twin of Earth framework to deliver a reanalysis of snow water resources. This framework relies solely on EO data and various models, including the assimilation of snow depths derived from C-Snow, which derives snow depths from temporal changes in backscatter from Sentinel-1. The manuscript is well
5 written and presents the framework well. That said, some of the information can be misleading in my opinion and could be refined in the text.

2 Major Comments

My first comment regards all the datasets and models used. There are lots of acronyms and it gets confusing quickly. To have a good understanding of the impacts of the datasets and models, it would be good to have the uncertainty on the different inputs
10 and model outputs. It would be good to include the different models, the downscaling steps and the uncertainty on the different inputs/outputs in Figure 1.

My biggest concern with this manuscript is that the authors imply the DTE-SNOW is to derive SWE, but nowhere do they show the results of the framework to estimate SWE. This is quite misleading and needs further clarification. Obviously, many studies have shown that assimilating snow depth information will improve SWE estimates, but this is not proven in the current
15 manuscript. The authors only show that they can generate a good reanalysis of snow depth. That said, a good reanalysis of snow depth is an excellent step towards providing quality snow information for decision-making. The messaging has to be refined here or a comparison with SWE datasets has to be conducted to demonstrate the capability of DTE-SNOW to provide SWE. The latter could be done in a different study where there's a focus on snow density, which is a different challenge to snow depth to retrieve SWE.

Abstract: For those unfamiliar with DTE, I suggest to start the first sentence with something along the lines of: "In the context of developing a Digital Twin of the Earth System (DTE) under the Destination Earth (DestinE) initiative, we present DTE-SNOW, [...]"

1.20: you could be even bolder here and say that "snow is the only component of the water cycle to not have a dedicated EO mission". If a reference is needed, you can cite [Montpetit et al. \(2026\)](#), but with the reference limitation, it is not necessary in my opinion, and it is a known fact, especially in the cryosphere community.

1.59: you can remove the parentheses around "dry"

1.92-97: it is clear from figure 3 that DA_C-Snow has a better agreement for snow depths ≥ 2.5 m. It would be good to provide the correlation coefficients for values ≥ 2.5 m only to show the considerable improvement when assimilating C-Snow. I would even do this at ≥ 2 m since the scatter plot seems to break away from the 1:1 line around 2 m for the open-loop.

L.131: "remotely sensed dataset"?

References: TC guidelines states a maximum of 20 references, which is exceeded here. Not sure how rigid TC is on this guideline.

Figure 1: Figure 1 is misleading. This suggests that SWE is the main driver of DTE-Snow, but in the results, only snow depth is being assessed. The conversion to SWE is not straightforward, especially in such diverse landscapes.

Figure 2: Figure 2b is not necessary in my opinion. We can see clearly the variations in SWE, and even without knowing the elevations (a DEM could be used as a basemap here), we can infer changes in altitude.

References

Montpetit, B., Derksen, C., Vionnet, V., Carrera, M., Meloche, J., Leroux, N., and Bergeron, J.: Updates on Advancements of the Terrestrial

40 Snow Mass Mission, Tech. Rep. EGU26-8577, Copernicus Meetings, <https://doi.org/10.5194/egusphere-egu26-8577>, 2026.