

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2021-354

Anonymous Referee #1

Referee comment on "Comparison of manual snow water equivalent measurements: seeking the reference for a true SWE value in boreal biome" by Maxime Beaudoin-Galaise and Sylvain Jutras, The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-354-RC1>, 2021

The study compares SWE measurements of three different snow samplers and what the authors call the snow pit method. The authors conclude that large diameter samplers are the best method for estimating "true" SWE.

While the topic of the study is relevant in the field of snow science, I strongly believe the study in the current form is not adequate for TC due to the following reasons:

- The main finding of the study is not new, already others (e.g. [org/10.1002/hyp.13785](https://doi.org/10.1002/hyp.13785)) came to the same conclusion.
- The authors question, already in the title, the reference for the true SWE by assuming the true SWE is the one undertaken with what they call the snow pit method. The snow pit method as it was used in this study uses a density cutter of 250 cm³. As "prove" for their assumption they reference seven studies, of which only two also used similar-sized density cutters. The other studies did not specify a reference or the size of the cutter used or used a much larger cutter (up to 3500 cm³). The volume of the cutter and also its usage horizontally (per layer) or vertically with a plate plays an important role. If used horizontally, as in the current study, the application in a continuous manner is crucial. Sentences like "density measurements were made in each contrasting snow layer that was thicker than 5 cm" leave the impression that these measurements were performed in a subjective manner, which can cause large errors (doi.org/10.5194/tc-10-371-2016) and could explain the partly contrasting results to earlier studies.
- The authors use the same height (h) in their formula 1 und 2, which is definitely wrong as the height of the sampled core can always be different from the height of the snowpack. One reason that h in formula 1 & 2 is different is given in the study by the fact, that for the HQS "it is necessary to insert a plate in a slot at its base to prevent snow loss", which implicates that not the entire height of the snow pack could be measured.

- Since the height of the snow pack, also in a perfect field like the one at NEIGE site, can spatially vary (due to radiation, wind or rain events) it is important to reference the measured density to a fixed snow height or to specify the uncertainty involved by the varying snow height.
- There is no information given about the type of snowpack (e.g. typical stratification, mean density) or about the distribution of the measured snow heights.

I'd recommend the authors to fully rewrite the study, to focus more on the new ULS snow sampler and to publish in another journal.