

***Interactive comment on* “Brief communication “Application of mobile laser scanning in snow cover profiling”” by S. Kaasalainen et al.**

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The presented paper shows the application of a mobile laser scanning (MLS) system for snow depth mapping. As it is a new approach it is worth publishing, however to know if the presented method is feasible or not, in my opinion, some further clarification is needed.

If a new method of measuring snow depth is to be presented, a thorough accuracy investigation is required. To fulfill that goal, the paper presents a repeatability test. (Repeatability is defined in “International vocabulary of basic and general terms in metrology”, VIM, as the closeness of the results of two successive measurements of the same object carried out under the same measurement conditions). However, this test was done while the mobile unit was not moving. For clarification, please explain

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if just the laser scan data was investigated or the data after post processing also including GPS and IMU data. Such single profiles, as shown in figure 3, can easily be made by a terrestrial scanner from just one position. Therefore it would be better to have accuracy estimations for results obtained when the whole measurement system is moving (since this is the new part of the method presented). As you mention, the absolute repeatability of the measurements is several centimeters (Kukko et al. 2007). This is the minimum error of such moving systems I know of. So, at the moment you start to move your sledge, the relative accuracy is several centimeters or more. Beside the fact that one profile can be obtained every 6 cm (F. Domine, Referee) errors mainly occur due to weak IMU data. As a result, to determine snow roughness parameters (for horizontal roughness; F. Domine, Referee) this repeatability test may not be sufficient. If you do present differences in snow height for two consecutive measurements (figure 3) you at least need a reproducibility test. (Reproducibility is defined as the closeness of two results of measurements based on the same object carried out under changed measurement conditions (International vocabulary of basic and general terms in metrology, VIM)). In your case, the altered conditions included differences in sledge trajectory, meteorology, time of day and separate registration including separate post processing of IMU and GPS data, which you could actually present using deviations in the data from measurements of your control points (route sign pole tops, corners of signs, bridge railing and asphalt points). Another possibility would be presenting snow height measurements using alternative methods for comparison (see and perhaps cite: Prokop et al. 2008, A comparison of measurement methods: terrestrial laser scanning, tachymetry and snow probing for the determination of the spatial snow-depth distribution on slopes. ANN GLACIOL, 49, 210-216). A comparison to alternative methods might be too much effort for a brief communication, but in your conclusion you could mention the differences in accuracy validation.

You further conclude that scanning data can be acquired at distances of up to 20-30 m. This is certainly true for the scanner you used. However you could mention that scanners exist with a greater range for the distance measurement (e.g.: www.riegl.com).

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Interactive comment on The Cryosphere Discuss., 4, 2513, 2010.

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