

Interactive comment on “Assessing the application of a laser rangefinder for determining snow depth in inaccessible alpine terrain” by J. L. Hood and M. Hayashi

Anonymous Referee #2

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This paper makes an important contribution. The measurement of snow depth in complex terrain is not a trivial task and due to safety concerns we need alternate techniques in steep terrain. My biggest concern is that there is limited to no discussion about the possible errors associated with the measurements nor the specifics of the resolution of the data (vertical and horizontal). I recommend some revision to address the resolution issues before this paper is published.

1. Does the paper address relevant scientific questions within the scope of HESS? Yes
2. Does the paper present novel concepts, ideas, tools, or data? Yes
3. Are substantial conclusions reached? Yes, for the most part

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4. Are the scientific methods and assumptions valid and clearly outlined? Yes
5. Are the results sufficient to support the interpretations and conclusions? Yes
6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Yes
7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Most of the time
8. Does the title clearly reflect the contents of the paper? Yes
9. Does the abstract provide a concise and complete summary? Yes
10. Is the overall presentation well structured and clear? Yes
11. Is the language fluent and precise? Yes
12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes
13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Perhaps figures 3 and 4 could be combined
14. Are the number and quality of references appropriate? Yes
15. Is the amount and quality of supplementary material appropriate? N/A

Specifics:

- page418, line 8; p419, l22: data is a plural word, so use “were” instead of “was” and ‘have’ instead of ‘has’
- p419, l12-15: provide references for the “extensive resources”
- p419, l22: how are the datasets differenced? This is important
- p420, l2: what resolution?

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- p420, l 5: is 10 cm enough? Vertical and/or horizontal?
- p420, l 8: “rely on manual point data retrieval instead of scanning” define or describe this difference.
- p420, l19: how much is a modest price? A tripod/terrain lidar unit is between \$100,000 and \$250,000
- p420, l25-26: how the 58% of inaccessible terrain on the map
- p421, l18: how are the data interpolated? Deems et al. (2006) used a different technique that Trujillo et al. (2007).
- p421, l20: “excellent signal return” - mention albedo and surface influences
- p421, l24: “4.3-m at a shooting range of 500 m” - discuss the error, which is a function of the resolution and the tangent of the apparent slope
- see Deems et al. (2008 J. Hydromet.) Among others.
- p422, l17-18: what is the basis for this uncertainty?
- p423, l2: what is the basis for the basin average SWE of 575-700 mm?
- p423, l7: define “spindrift”
- p424, l7: is there settling of the tripod/laser during the survey, as “the laser is set up at the snow surface.”
- p424, l25: what is the precedent for using a “local polynomial interpolator?” What is the difference between the interpolation resolution and the measurement resolution?
- p425, l1: Is it verification or validation?
- p425, l8: how were the points “differentially post-corrected?”
- p425, l9: how was the “positional error” measured/recorded?

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- p425, I10: how was the nearest corresponding pixel to the manual measurement determined?
- p426, I2-3: what is the basis for the “spatial pattern?”
- p426, I9-11: maybe measure more points, and consider the error of the handheld GPS unit.
- p428, I9-12: " The spatial resolution of the laser rangefinder ..." How do you know this? Is this your work? If not, then provide a citation.
- p428, I17-19: “Onset of snow melt earlier ..." this is not a conclusion. Bring this up in the discussion, but not in here.
- p428, I23: should be “in ... watersheds do not yet exist.”
- p429, I27: provide a more complete reference for “lascraft”
- Table 1: state vertical and horizontal resolution range
- Table 2: state which is “snow on” and which is “no snow.” How do you know that the setup is at the same location? Is the point density interpolated or raw?
- Figure 1: a slope map would be useful.
- Figure 3: what is the basis for the error bars? How do you know you are at the same point?
- Figure 4: what happened to the depths less than 1.2 m? There are 28 points here, where are the other 16 from previous. You could like combine Figures 3 and 4. Why are there 4 measured points with $ds > 2m$ that are outliers here? What about the other two from Figure 3?
- Figure 6 and 7: be consistent with the snow depth range so we can visually compare differences.
- Figure 7: what is the basis for these lines?

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