

The Cryosphere Discuss., referee comment RC1
<https://doi.org/10.5194/tc-2022-78-RC1>, 2022
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Comment on tc-2022-78

Anonymous Referee #1

Referee comment on "High-resolution imaging of supraglacial hydrological features on the Greenland Ice Sheet with NASA's Airborne Topographic Mapper (ATM) instrument suite" by Michael Studinger et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2022-78-RC1>, 2022

Review of the manuscript: "High-resolution imaging of supraglacial hydrological features on the Greenland Ice Sheet with NASA's Airborne Topographic Mapper (ATM) instrument suite" by Studinger, Manizade, Linkwiler and Yungel.

General Comments

This study combines lidar data from NASA's Airborne Topographic Mapper instrument with high-resolution optical imagery from Operation IceBridge to develop methods for mapping and calculating depths of supraglacial hydrology over the Greenland Ice Sheet. The authors argue that, although, airborne surveys have limited temporal and spatial coverage they offer a level of detail which lower resolution, spaceborne instruments cannot.

The data and code provided will allow for replications of the methods/results and the appendices provide context to the main manuscript. The introduction and references provide a solid overview of the available literature, while the title accurately describes the contents of the paper.

The manuscript is generally clear and easy to follow; however, some sentences and sections are difficult to read and are highlighted in Technical Corrections. To the best of my knowledge the methods presented are novel with a sound conclusion. I have some specific comments and additional technical corrections which are listed below.

Specific Comments

Although the authors state: 'The robustness of the hydrological feature identification is suitable for the purpose of this paper, since the goal is not to perfectly delineate hydrological features, but to identify lidar granules for analysis.' I feel the study would benefit from some validation/accuracy metrics for the approaches to determine 'snow and ice' from 'water' and the water depths presented in Figures 7, 8 and 9. The conclusion could then be improved by including the results of these computed metrics.

Figure B3 summarises the methods coherently and should be considered for transfer to main manuscript.

Whether Section 3 is part of the methods section is unclear. The manuscript would be improved with a paragraph (at the beginning of the section) describing the methods, as in Sections 2 and 5. Additionally/alternatively the clarity of Section 4 could be improved with sub-headings. Similarly, Section 5.2 could benefit from further subheadings.

Technical Corrections

Line 22: insert comma between 'months' and 'seasonal'.

Line 34: insert comma between 'scale' and 'the network'.

Line 46: insert comma after 'cryoconite'.

Line 47: insert comma after 'crevasses'.

Lines 48-50: suggest rewrite of the sentence beginning 'Yang and Smith'.

Line 50: suggest rewrite to 'However, the recent increase in availability of...'

Line 51: insert comma after 'streams'.

Line 52: insert comma after 'wide'.

Lines 65-67: suggest rewrite of the sentence beginning 'Airborne'.

Line 74: insert comma after 'strategy'.

Line 76: insert comma after 'Spring campaigns'. Should 'summer' be capitalised as 'Spring' is, for consistency? Should 'flow' be 'flown'.

Lines 80-83: suggest rewrite of the sentence beginning 'We analyze'.

Line 93: should 'angle' be 'angles'?

Line 114 & 140: Section headings are confusing. Are these sections both 'Methods'? If so, suggest re-label as 3.1 and 3.2. Methods section could then have an introduction as other sections do.

Figure 3: '[]' is confusing following 'NDWI_{ice}'.

Line 134: replace 'expense' with 'expensive'.

Line 139: suggest remove 'the purpose of'.

Line 157: suggest replace 'Over' with 'For' and 'in estimating' with 'to estimate'.

Line 158: insert comma after 'cases'.

Lines 161-163: suggest rewrite of sentencing beginning 'For some'.

Line 178: suggest insert 'the' before 'ground test'.

Lines 257-259: suggest rewrite of the sentence beginning 'The gaps...'.

Line 266: suggest replace 'reaching maximum' with 'reach the maximum'.

Line 297: suggest add 'the' before 'recording'.

Line 300: insert comma after 'lake', before 'there is a'.

Line 309: replace 'shows' with 'show'.

Line 312: suggest replace 'part' with 'parts'.

Line 316: suggest remove 'back'.

Line 317: suggest insert 'those' between 'as' and 'found'.

Line 338: suggest insert 'as' between 'acts' and 'a specular'.

Appendix:

Figure A2: Y-axis labels should contain a unit within '[]'.

Line 380: In Figure A2 caption the sentence 'For T6 28084 waveforms were stacked and for T7 48703' should be rewritten to be more clear.

Line 423: suggest insert comma after 'In pressurized aircraft'.

Line 441: The line '<https://doi.org/10.5281/zenodo.6248436> (Studinger et al., 2022).' appears out of place, with multiple blank lines above it.

Line 457: suggest insert comma after 'altimetry'.

Line 480: Should 'Sensitivity analysis' be presented as a heading like 'Range bias', 'Gaussian fit' etc.? If so, it should be formatted as sections above and the colon removed.