The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2017-209-RC2, 2017

The Cryosphere Discussions

Interactive comment on "Brief communication: Mapping river ice using drones and structure from motion" *by* Knut Alfredsen et al.

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Received and published: 10 November 2017

This is a timely and interesting paper describing an efficient and economical method for using inexpensive aerial drones to map river ice. I am quite certain that this method will prove to be a valuable new tool for river ice researchers. The method does not appear to be novel but its application to mapping of river ice is new and innovative. Accurate estimates of the aerial extent of various ice types can be made and under the right circumstances estimates of ice volumes are possible. The authors point out that the method allows for repetitive measurements to be made of the same reach because data can be acquired quickly and relatively easily. This will allow researchers to study the evolution of ice covers and the associated processes in much more detail than was previously possible.

The authors could consider discussing the following questions: How does the limited range of these inexpensive drones impact the applicability of this method to large rivers? I have deployed a similar drone on the Peace River, Canada and the width of the river exceeded the range in some places.

In extremely cold weather battery life can drop by 50%. Did the authors encounter any difficulties because of this effect?

Would a higher resolution camera improve the accuracy of this method?

The paper is well written and the topic will be of interest to readers of the journal. I recommend publication after the authors have addressed the minor revisions suggested below.

Specific Comments:

Page 1-Line 23: Delete "wrought with".

Page 2- Line 29: ". . .and show examples of output of the method." Awkward wording.

Section 2.1: Please provide more complete descriptions of the study reaches e.g. widths, slopes, geomorphology etc.

Page 3-Lines 21-23: Unclear - there is only one camera on the drone so increasing the number of cameras is clearly done in the software. Please explain this more fully.

Page 3-Lines 28-29: Are the 9 points referred to here called Control Points in Table 1? This is unclear.

Page 4-Line 1: Should this read ". . . index greater than 0.8. . .". Seems odd that when a quality index is greater than 0.8 that images were excluded. If space permits a brief explanation of how this quality index is computed would be helpful.

Page 4-Lines18-21: The authors write that "...the digital elevation model is considered good. . .". They are referring to the errors listed in Table 1 but a brief discussion of how

they arrived at this conclusion would be helpful to readers who are not familiar with DEM's.

Page 4-Line 33: Delete "varied from".

Page 5-Line 1: Change to ". . .were 1.12. . .".

Page 5-Lines 2-5: The meaning of "outermost" and "outer part" are a bit unclear.

Page 5-Line 22-23: Why was access to the Sokna reach difficult or impossible? Is it difficult to get to the stream or is it the ice conditions that make it unsafe?

Page 5-Lines 30-33 & Page 6-Lines 1-3: It is not clear to me how determining the open water elevation helps to assess the thickness of anchor ice dams. Anchor ice dams are anchored either to the bed or large rocks so how is their thickness related to the open water elevation? Perhaps I am missing something here but the middle section of this paragraph confused me.

Page 7=Lines 1-6: Much of this is repetitive. Perhaps it could be deleted?

Page 7-Lines 14-15: This is unclear, ". . .could benefit process understanding and model development and also the calibration and validation process." Please clarify.

Figure 1: Unclear, is camera position the location of the drone when a single image was taken? What is the red arrow in the lower left corner? If it is flow direction, please relocate it and label it or refer to it in the caption. Note that flow direction should be indicated in all figures.

Figure 2: Label the plots A, B and C. Where are the last 10 m in the plots? Or perhaps the last sentence of the caption can be deleted since I think this information should be in the text.

Figure 3: The last sentence in the caption has some grammatical errors.

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