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Interactive comment on "Repeat UAV photogrammetry to assess calving front dynamics at a large outlet glacier draining the Greenland Ice Sheet" *by* J. C. Ryan et al.

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It's a great paper, showing how some simple, low cost tools can transform the way we study calving glaciers. My comments are minor and mostly relate to the measurement techniques.

- page 2244, line 8. Better to say 'ground sample distance (gsd)' than resolution here - page 2248, line 18. Could you state the nominal accuracy of the GPS? - page 2248, line 27. Replace 'trialled' with 'tested' or similar - page 2249, last paragraph. Could you clarify total flight times and distances. It seems you say the commute distance is 20 km but the total sortie was 40 km, leaving no time for measurements.

- Section 2.4. Here you have not discussed what is probably your largest error source, which is caused by not knowing when the picture was actually taken. Moving 20 m/s with exif data at integer second guarantees at least 10 m of somewhat random error, if not more, say if the camera clock and gps clock were not synched to a fraction of a second.

- Section 2.4. It would be nice here if you would state the misfit that agisoft gave between your photo centers and what it calculated, both before and after using your ground control. Also, what tolerance did you specify in the ground control pane for both your photo centers and ground control? These make a difference in the result. Did you 'Optimize' in agisoft?

- Section 2.6. In sorting out accuracy vs precision, can you say whether manually shifting two of the DEMs to match the bedrock improved the comparison? It is unclear here whether you mean your 'conventional' gcp was used here, but was this for manual alignment after DEM creation or to improve DEM creation itself?

- Section 5. In terms of future improvements, I suspect the only thing that will take your already good results to the next level of precision is to improve your photo center positions to the decimeter or centimeter level. This requires knowing exactly when the photos were taken and having a decimeter or better GPS flight track. Whether you need that or not is an open question, considering how much you have learned without it.

My only glacier comment is to consider monitoring the vertical velocity of the ice cliff top in future campaigns using your techniques. These glaciers are trying to do two somewhat conflicting things: 1) get flat as fast as they can and 2) calve whatever ice is in danger of getting overtopped by the water it is entering into to get flat. A tidewater glacier entering deeper water means the cliff top is more rapidly heading towards the water than if it were entering shallow water, so the glacier gets rid of it more quickly, which to me largely explains the so called tidewater glacier cycle. Same with faster

or slower moving ice. Slow moving ice with a level bottom will allow the cliff top to get so close to the water you can get in and out of boat from it. These typical convex embayments that form on the calving face buttress motion, but more importantly slow the vertical velocity of the cliff edge thus slowing calving, until everywhere around the convex edge has about the same height above water. At least that's my pet theory – calving rate is controlled by the vertical velocity of the cliff top. Now what controls that velocity is another question, but in general I think a much more straightforward one to answer. In any case, you now have the tools to make those measurements and see whether its worth considering further. Or maybe this has already been proven or disproven, I'm 20 years out of date on these things.

Interactive comment on The Cryosphere Discuss., 8, 2243, 2014.