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Interactive comment on "Terrain changes from images acquired on opportunistic flights by SFM photogrammetry" *by* Luc Girod et al.

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This paper presents the idea of "opportunistic flights" where photos are acquired by allowing a camera to "hitch" a ride on a pre-booked research flight and using a low-tech approach to collect non-metric photos. The paper is well written and illustrated, with appropriate quantitative approaches. There are several points the authors make that are worth highlighting: âĂć Errors are associated with the level of accuracy inherent in the method, the poor quality camera and a low contrast scene with high dynamic range âĂć The novelty lies in linking the timed GNSS points to the most appropriate photos

It's a good use of "extra" imagery and low cost acquisition of data that can bolster research is to be lauded. It is not too dissimilar to the original aims of SfM which had volunteered geographic information (VGI) in the form of photos scraped off websites

as a source for point-cloud reconstruction. So, yes, there is NO novelty in using SfM to acquire (poor) quality photos of glaciated terrain and generate DEMs from them. The question is, is there enough novelty in synchronizing the camera and GNSS clocks to warrant a full paper?

âĂć Section 2.1: covers the hardware and would benefit from examples of appropriate cameras (not in the conclusions), the estimated accuracy of the GNSS and optimal camera network design âĂć Section 2.3: the authors have identified a lag in the EXIF time stamps of the photos on the GoPro used. Crucially, were any other cameras tested? Is this a problem on a Ricoh GR, Nikon Coolpix A or Sony A7? If it isn't, then this is a non-issue. Don't use the GoPro. This is a serious weakness as it simply demonstrates a numerical technique to overcome a limitation in a cheap camera. âĂć The technique itself is well described, well illustrated and well implemented âĂć There is actually no experimental design outlined – yes, you provide detail to the method used to correct the GNSS points, but at the start of section 2, give a brief paragraph in outline form detailing *exactly* how the data will be analysed and how it will be assessed âĂć A standard technique would be to test immobile points on the image with known coordinates. Can these not be extracted from the UltraCam imagery in sufficient detail? âĂć Or, use GCPs extracted from the UltraCam imagery to perform the geocorrection? Its surprising that this hasn't been undertaken to see how it compares to the use of the Garmin GNSS data. Again, if this is sufficient then the correction isn't needed âĂć Section 4.1: provide estimates of the pixel size for the flight heights, along with estimates of motion blur using standard photogrammetric methods âĂć Section 4.1: the original images should be made available and they should be summarised (statistically) to highlight the range of aperture, shutter speed and ISO settings. Also note the effective aperture and focal length âĂć The camera is poor and ill-suited to the work you have used it for. You ideally need to use one of the cameras noted above or in your conclusions âĂć Did the sensor saturate on any of the photos? âĂć Whats the dynamic range of the GoPro at the highest ISO settings you used? âĂć It would be useful to see a full list of all the estimated errors and where they come from âĂć Section

5: well presented but it focuses on DoD which both have errors associated with them. One of the big problems here is that you are dealing with “whole system” error, not just the contribution from the GNSS, which is the novel part of the paper. What is the experimental design to test for this? âĂć Why not flip this around and use GCPs from the Ultracam imagery and assess the difference with the GoPro DEMs (in the same way as TS check points)? âĂć The glacial examples are interesting in and of themselves but they don’t add to the technical aspects of the paper and can be removed âĂć A table outlining all the DoDs generated would help to see what was compared with what

Overall the method used to correct the time lag introduced by the camera is elegant and well described, but the *effect* on the accuracy of the DEM is not demonstrated and the poor camera and large elements of error involved in various stages means that the conclusions that can be drawn are limited. And the method is possibly not needed if GCPs or a different camera are used.

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