Geosci. Instrum. Method. Data Syst. Discuss.,
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Geoscientific Instrumentation Methods and Data Systems Discussions

Interactive comment on "In-situ measurements of the ice flow motion at Eqip Sermia Glacier using a remotely controlled UAV" *by* Guillaume Jouvet et al.

Anonymous Referee #3

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Review of Jouvet et al., Geosci. Instrum. Method. Data Syst., August 2019

I wrote/submitted this review before reading the two other reviews to avoid any cross-influence.

Summary

In their paper, Jouvet et al. present an innovative way to measure glacier movement by landing a UAV on a glacier and recording his position through time using a dGPS antenna. This technique is thus able to measure glacier displacements in regions that are inaccessible or too dangerous to human beings (highly crevassed regions of fast glaciers for example). The authors present the deployment, the data processing, the

results of 4 hours of data acquisition and the strength and limitations of this method.

Although the results are not breathtaking, I think this paper is worth publication. Publishing this experience will save a lot of time to colleagues who want to perform similar measurements in the future. It also points to an alternative methods (dropping GPS units using UAV) that may have a higher potential. The paper is also well-written.

General comments

My single general comment relates to the need to convince the readers that, despite some strong limitations, the method may still prove useful for the community. In the introduction (2.7 to 2.16), several limitations of existing methods to measure surface displacements are listed. I was expecting the novel method to solve these issues. Not really the case. In fact this part of the introduction and the corresponding discussion could focus on the actual/specific glaciological process(es?) that could be better understood using this technique. For example, does the community need continuous measurements of glacier movement at temporally high resolution just upstream/before very large calving event? If yes, why? Currently I feel like the "classical" UAV method, applying image correlation to repeat high resolution imagery has a stronger potential but maybe it cannot reach the temporal resolution of some of the processes of interest? If yes, to be explained. To summarize, can the authors tell why this method can make a real contribution? Right now with only a few hours of data and the constrain that the landing site is only 1-2 km away from the operator I feel that the limitations are very strong and may hamper acquisition of glaciologically useful measurements.

Specific comments.

3.12. "Centimer accuracy" seems optimistic given that horizontal errors of 23 to 45 cm (3.31) are obtained. Reconcile the two statements. "Decimeter accuracy"?

4.4. "once the images and DEMs are obtained"

4.26. Why choosing a single-frequency (less precise) unit? Lower cost?

5.7. What was the distance of the UAV to the base station for this test? Similar to the distance to landing site on glacier?

5.10. I think the landing spot should also be selected for his scientific interest. Maybe obvious but worth mentioning (see general comment also).

5.22. Why so late (22h)? To limit wind? It is cooler at night so not so good for the battery. Was there a scientific reason behing this choice of the time of the day?

6.12. “measured”

6.14. Was the direction also stable through time?

6.22. maybe “ability” rather than “accuracy”

7.19. Can the authors quantify a bit “long” and “large”?

8.6. The problem with a subglacial lake drainage is that (as far as I know) the event cannot be exactly forecasted. So how can the operator decide when he will land his UAV?

8.9. Can the authors clarify what sort of automatization they have in mind?

Figure 1. I wonder whether a shaded relief map or a slope map will not be better to illustrate the quest for the best landing site. Did the authors look at them?

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