

LETTER TO AUTHORS

Journal: Earth Surface Dynamics

Special Issue: 4-D reconstruction of earth surface processes: multi-temporal and multi-spatial high resolution topography

Paper Title: *Determination of high resolution spatio-temporal glacier motion fields from time-lapse sequences*

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Dear authors,

Thank you very much for submitting a reviewed version of your manuscript esurf-2017-33. First of all, I would like to congratulate for your intense work answering all comments from the referees and reviewing the first version of the manuscript accommodating the majority of their suggestions.

I have received and reviewed all reports provided by the referees. The two referees that reviewed the first version of the manuscript accepted to review the new version of the paper. Additionally, the paper has been reviewed by a third referee to have an independent view of the manuscript (i.e. a view of a specialist on the topic that has not seen the first version of the paper). The two referees that reviewed the first version of the manuscript agreed in that the paper has gain clarity. Although referee #1 commented that 'the paper still suffers somewhat from the difficulty to condense more than one decade of research in one coherent and self-contained manuscript', at the end, both referees have accepted the paper as is.

In terms of the new referee (#3), although the referee considers that the paper has an excellent scientific quality, the final decision of this referee has been considered for publication after major revisions. After evaluating the three reviews my final decision is the paper can be accepted after minor revisions.

These minor revisions are based on Referee's #3 recommendations. I consider these recommendations/suggestions can improve the scientific significance and quality of the work. In the following sections I have provided a summary of the strengths and few suggestions the authors should address before the paper is finally accepted for publication. All of these are based in the positive suggestions provided by referee #3 (note that some of the referee's sentences are literally used/provided in the following sections).

Strengths:

- Referee #3 considers that the authors have an excellent track record in this area, in terms of applying rigorous approaches in demanding conditions, and in developing novel algorithms capable of coping with real-world issues such as shadowing.
- Referee #3 indicates an underlying strong support for a review-style paper within ESurf (particularly for this special issue) to highlight the authors' work to a highly relevant end-user community. The referee pointed out that the goal of the paper is not to deliver new glaciological understanding, but to provide an overview of the methods and their applications and could be of value to a wide range of ESurf readers. This was also answered and discussed in the answers you provided after the first review of the manuscript, making clear the objective/goal of the paper, which I confirm fits very well to this Special Issue and it can be of wide appeal to the readership.

Suggestions:

- Increased conciseness in places and providing insightful, quantitative comparisons with other published work would substantially strengthen the paper and increase its impact. As a suggestion, that I also share, referee #3 proposes: "the introduction provides a number of other scenarios where time-lapse photography has been used, but this is done in a somewhat descriptive list-like manner (paragraph 3, Page 2). A more critical analysis of these preceding works (and this maybe only really needs to be of the glaciological ones) would help put the authors' contributions in better context. For example, the basic details of the papers could be collated in a table - e.g. to list process being monitored, stereo/mono, image interval/duration, feature or area matching and algorithm, approximate accuracies achieved etc., - then the key advantages/limitations of these works discussed in a way that highlights how the authors' advances addresses particular limitations. Image registration/camera stability is an obvious area in which previous authors have done work; a clear recognition of this would enable the quality/flexibility of the approaches covered in the review to be discussed/compared rather than just described. How much better are the authors' camera registrations than those achieved by others? What do we need to do to improve things?"
- Referee #3 suggests renaming the discussion to case studies. I'm aware the authors already changed the name of this section to discussion following a suggestion of one of the referees in the first review of the manuscript. Additionally, in page 25, first paragraph, it's already stated 'The discussion is based on the results of previous case studies on determining glacier motion data with the method presented here'. Therefore, in my opinion, I do not think renaming the section is an essential change. Having said that, one suggestion I do think would improve the manuscript is trying to be more critical in the conclusions, as pointed out by the referee, highlighting the advantages or advances of the authors' specific approach in comparison with similar work (as the referee commented, "Can the authors pick out the key contributions from their work (e.g. dealing with shadows) and focus on these to give a more concise and inspiring summary of their advances?").
- Finally, the referee also suggests if the software (stated in page 28, acknowledgments) is already available and if there is any possibility to be linked directly in this manuscript. As the referee indicated, "this would be an excellent way of providing

something substantially new within the work; I encourage the authors to try and do this”.

Minor queries/suggestions:

Additionally, referee #3 has provided some minor queries/suggestions that in my opinion also deserve consideration:

- P2; paragraph 3: volcanological applications could also be relevant, e.g. .papers by Walter’s group on domes: 10.1111/j.1365-246X.2011.05051.x; 10.1002/2016JB013045; 10.1002/jgrb.50066; or USGS: doi.org/10.1016/j.epsl.2009.06.034; or other on lavas: 10.1007/s00445-011-0513-9; 10.1016/j.isprsjprs.2014.08.011
- P2; Line 32: Should this be James et al (2016)? This work dealt with very difficult imagery, for which fully automated tracking was not possible – an interesting comparison for discussion elsewhere in the paper?
- P5; L5: Ensure that photogrammetry terminology is either avoided or explained carefully at first use. Here, maybe rephrase/explain ‘inner accuracy’?
- P6; L11: Replace ‘avoid’ with ‘reduce’.
- P8; L9: The phrasing could indicate that the algorithms cited are specifically for glacier point tracking, whereas the references are for general image registration. Rephrasing would clarify, e.g. ‘A wide range of algorithms are available for point tracking in image sequences (e.g....’
- P10; L5/19: ‘imported’ → ‘important’
- P18; L14: So which variants from P 7 can be employed with PhotoScan?
- P18; L19: ‘to warrant up-to-dateness’ → ‘To ensure continued validity’?

Finally, I would like to acknowledge all the work the authors have done that clearly improved the first version of the manuscript, and to thank all the positive comments and suggestions provided by the three referees that helped in improving the scientific significance and quality of the manuscript. Having said that, before to finally accept the paper for publication, I would like the authors consider the suggestions that referee #3 provided that clearly will help in improving the strength of this manuscript.

All the best

Damià Vericat

(acting as associated editor of the Special Issue *4-D reconstruction of earth surface processes: multi-temporal and multi-spatial high resolution topography*)