Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2019-20-RC1, 2019

Earth Surface Dynamics Discussions

Interactive comment on "Introducing PebbleCounts: A grain-sizing tool for photo surveys of dynamic gravel-bed rivers" *by* Benjamin Purinton and Bodo Bookhagen

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Received and published: 16 May 2019

This is an excellent contribution which comes at timely point when many technologies are coming together. The new method rests on a genuine innovation in grain size mapping, a clever use of a k-means cluster. The paper is mostly well written and has an excellent level of technical detail. This might be demanding for readers, but a detailed reading of this work is effective in lifting the black-box effect that can arise from advanced image processing workflows with a large number of steps and parameters. One of the major benefits of this work is the fact that it is open-source and written in the popular Python language. This is very timely because Basegrain, the current best

option for grain size mapping, is written for windows-7 and no longer in active development. Despite the fact that the creator of Basegrain is very collaborative and willingly shares the Matlab source code, the river sciences community will soon need an updated option with a major preference towards an open-source solution. PebbelCounts seems poised to fill this gap.

I have a few suggestions about corrections but these are not major:

1- I found equations 1,2 and 3 to be laborious and not really necessary. Non-metric RGB cameras destined for the consumer or 'prosumer' market have square pixels. As observed by the authors, differences in X and Y resolution are negligible. This whole section could be cut short to a single equation.

2- A better reading of your bibliography. This bibliography is in fact quite complete. But I get a distinct impression that many papers were skimmed, deemed relevant, and cited. I am often struck by points of discussion or relevant findings of other authors which are missing in the text despite the fact that these authors are cited. Another explanation may be that the discussion lacks many key points of a good discussion where elements of other authors will need more consideration. Specifics of this will be seen below.

3- The accepted term for 'top-down' imagery in the remote sensing community is 'nadir'. Please use that term.

4- The drone/SfM elements of the paper are not well organised. The UAV/SfM paragraph in the introduction could be moved. SfM is now so ubiquitous that it should not shock the reader if you say in the methods that SfM was used for data acquisition. The overall reflection of how this could apply to drones in an SfM workflow needs to be moved to a section in the discussion. This is an area where many elements of the cited literature are not mentioned. Important points are: i- Acquisition geometry. There is now a large volume of literature on the image geometry that produces the best 3D models from SfM. This remains important here since DEM- distortions will propagate to the orthoimage. So in parallel with the robotic photosieving work, there should be a rec-

ommendation of a mixed acquisition with nadir imagery for the actual grain delineation but with oblique views for maximum SfM quality.

ii- Be honest and realistic about scale coverage. The paper states an ambition of covering areas up to 10 000 m2. At the same time the method rests on SfM with surveyed ground control to generate an orthomosaic with a constant resolution. This is in fact an ambitious goal. The acquisition of 80% overlapping imagery with surveyed GCPs and at sub-mm resolutions over a hectare is a multi-day (or multi-camera) job. This is why the robotic photosieving approach of Carbonneau et al (2018) does not advocate a orthomosaics but uses scaled individual images.

iii- Use of a Mavic as the only reference is perhaps overly pessimistic. Carbonneau et al (2018) mention that a Phantom 4 Pro (20 Mpix imagery) could acquire 0.7mm/pix imagery at 2m altitude. With active collision avoidance, that becomes a workable, if very low, flying altitude. This problem should resolve itself as sensors with more than 20MPix become more available.

5- Improve the discussion. The discussion needs a much improved start and overall reorganisation. A good rule on writing a discussion is to start with a sentence or two that distil the major findings that you want the reader to take away from this paper. A discussion needs to go over the substantive elements of the findings and their meaning and contrast to the work of other authors before going into issues. Here, the authors need to start the discussion with a section that tells us what they have achieved and gives the reader a better sense of how PebbelCounts compares to other methods. Without necessarily running other methods on their data, we at least need a summary table that presents errors reported in literature and compares them to the current work. This is the section where you need to show an enhanced understanding of the literature.

6- 3D data The section at the end of the discussion on the integration of 3D information does not sit well. Move it to the introduction with the intention of stating that you will not be using 3D clouds or DEMs. It would be worth citing the work of James Brassington

and Damia Vericat who have developed particle sizing based on TLS. But also you could mention that Woodget et al (2018), already cited, found that 3D information did not improve particle size estimates. This section could be the place in the intro where you discreetly place a few SfM/drone citations but just to further justify that this will be an image-based method

These minor corrections should make the paper ready for publication.

Patrice Carbonneau May 2019

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