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**Geoscientific
Model Development
Discussions**

Interactive comment on "PRACTISE – Photo Rectification And ClassificaTIon SoftwarE (V.1.0)" *by* S. Härer et al.

Anonymous Referee #1

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The paper by Härer et al presents and evaluates a suite of modules for georeferencing time lapse mono photographs, which I believe are becoming a key, low cost tool for monitoring environmental change. The software is available in Matlab and could represent an important tool for the ever expanding community of researchers engaged in environmental monitoring using terrestrial photography. To my knowledge, the routine is relatively unique particularly in its attempt to simplify processing for large numbers of photos in mind. There is definitely a need for something like this in the community. The manuscript is reasonably well written although unnecessarily verbose in places which works against clarity and I don't think the strengths of the software are very strongly highlighted. The legibility of the figures are poor. I think eventually the manuscript will be publishable in Geoscientific Model Development. However, there are a number of issues that need to be addressed before being acceptable for publication. Below I

provide some general feedback followed by more specific comments.

GENERAL COMMENTS:

- Figures need to be made larger, in particular the text. In the printed draft copy, very little of the text is legible and I needed to go to the digital copy to resolve it.

- I think there is a terminology issue in this manuscript. First, the authors use the term 'projected' in places where I think the term 'georeferenced' would be more appropriate (which they switch to later in the manuscript, i.e. figure 4). Second, I'm not sure about the phrase 'optimisation of GCPs'. That's not really what's happening here. You're using the GCPs to correct for errors in the initial camera parameters. Finally, I also think that the description of the methodology would be more clear to the reader if there was consistency in the terminology with that used in the literature. I recommend referring to a standard photogrammetry text like Wolf and Dewitt, (2000) for the nomenclature. I make more specific references below.

- The paper lacks a strong introduction and conclusion. For start, I'm not convinced that terrestrial photography has been used quantitatively very often, at least not for monitoring snow and ice, largely due to the difficulties the authors' discuss. I believe there is huge potential here which highlights the value of the presented software but I don't feel the authors have made a very strong case. It is also not made sufficiently clear how the software improves on previous work (e.g. why is the viewshed approach preferable?). It is implied that PRACTISE is an advancement over Aschenwald et al. (2001)'s approach because it relied on GCPs. However, the reader later finds that PRACTISE does to some extent as well. While the 'DDS optimisation' is written up as an added feature, it appears to be a very necessary step in the procedure. If the mean RMSE after 'optimisation' is 5.3 pixels and this corresponds to 0.79 m in the DEM, then I assume that the pre-correction RMSE (as high as 93 pixels) would be equivalent to >10 m which is quite significant. I appreciate that the use of GCPs will only be required when one wishes to link changes to real ground space and possibly where

camera movement is a problem. However, I think this needs to be made more clear in the introductory paragraphs of the paper. The conclusion mentions fast and easy processing but this is the first time this advantage of the software is explicitly stated.

- I'm also unsure the classification routine and results are that interesting. RGB image classification of snow is notoriously difficult (especially 8-bit) and the challenges are well known and reported in the literature. What's interesting about this manuscript is that after running PRACTISE you have a georeferenced series of mono images (maybe even thermal IR which has interesting applications) that can then be used for any number of change detection routines and I think this should be more strongly emphasised. I would almost rather see a short paragraph on each of the routines that have been developed rather than the example of snow monitoring.

SPECIFIC COMMENTS:

Page 172

- Line 2-3 – ". . .to derive the status of spatially distributed..." is an odd phrase. Consider, ". . . for measuring and monitoring spatially distributed. . .".

- L7-8 – It's not clear what is meant by a one-to-one analysis of projected model results to photographs.

- L12 – is it for unknown viewing orientation or is it imprecise viewing orientation and position?

- L15-16 – I'm not sure I agree with the terminology here. In my mind the DEM points are not projected onto the image plane and classified but rather the image georeferenced using the DEM and then the image is classified.

- L16 – The resulting georeferenced and classified image?

- L17 – georeferenced images rather than projected data?

Page 173

- L9-12 – the link made here is pretty tenuous. I'd suggest removing this or provide a more robust argument.

- L18-19 – all photography is centrally projected and there is nothing inherent about horizontal angles (or more correctly phrased, high oblique) in terrestrial photography. A camera can be pointed in any direction dependent only on what you want to observe.

- L25 – in photogrammetry, you would call the camera target position the principle point. Perhaps include this?

Page 175

- L2-3 – I think you mean unaffected by weather conditions

- L4-5 – these terms need to be more clearly defined. The viewpoint? Is that the coordinates of the camera itself? If so, why not simply describe this as the camera position? What is the rolling angle? I have no idea what this is. Typically, camera attitude is described using three angles, either pitch, roll and heading or omega, phi and kappa. I suggest adopting the standard terms to make your meaning clear. For example, outer camera properties are typically called exterior orientation parameters (and similarly interior orientation parameters).

- L6 – '. . .determined using latitude and longitude.' This does not make sense. Do you mean you derived the coordinates of C and T using the DEM?

- L9 – focus length should be called focal length. I think you should also acknowledge here that lens distortions (which can be very significant) are not taken into account. - L11-12 – delete 'display different recording situations, i.e'. and just say to show different weather conditions and snow cover extents.

- L18 – here you refer to georectification which is think is more correct.

- L22 – there must be huge errors here if these coordinates were extracted visually from an orthophoto (what is an official orthophoto?). Especially, T which presumably is

in the middle of a snow field? Couldn't the former be provided independently?

Page 176

- L3-4 – this sentence is unclear

- L4-11 – The flow of steps is a bit confusing here too. The way the authors have listed the steps here suggests that viewshed happens first, followed by the georectification and then the classification. When does the accuracy assessment happen in this work flow? The section numbers suggest this happens after the rectification but before the classification. However, you discuss this after the other three steps but it says that this happens first. Not clear.

- L15 – it should be highlighted. . . not considered.

- L17 – what is the external data that replaces the need for the viewshed?

- L21- 22 - I think the way this is stated is unnecessarily complicated. Do you simply mean that the photograph is divided into 8 sectors based on the compass directions N, NE, E, SE, S, SW, W and NW? The Figure caption (Page 194) similarly needs to be clarified.

Page 177

- L2-11 (and Fig 2) – The methodology here is hard to follow. First, the term si,j in Fig 2a has not yet been defined in the main text at this point which makes the figure difficult to understand. Is this the DEM or the photo space we are looking at? I initially assumed that i,j was referring to the image space since this these variables are often used this way. Also, are each of the rings mentioned in Fig 2 one pixel wide? But think I see now that both i,j and m,n refer to row/columns in the DEM space? Based on Fig 2b, I would think that the point r's position relative to dm,n should be rm,n-1 and rm-1,n-1.but I may be missing something. Maybe just that m and n need to be defined.

Page 177

- L2 – Has Co been raised before?

Page 181

- L14 – to correct instead of to optimise?

- L24 – produces good results

Page 182

- L3You cannot use the term latter with more than two items. Rephrase.

- L4 – If these are truly guesses, I find it hard to imagine the utility of PRACTISE without the DDS optimisation. This needs to be made clear in the introductory paragraphs and discussion.

- L8 – exemplary isn't really the right word. Say. . . 6 GCPs are used in this DDS optimisation example.

- L21-22 – what other land surface variables are possible? Do these routines exist and are they available? I think it's worth mentioning these somewhere.

Page 183

- L3-6 – This sentence is awkward. What about saying on L5 that you use images captured under different lighting conditions?

- L21-23 – a short description of these routines would be useful to the reader.

Page 184

- L3-12 – this paragraph here demonstrates to me that the DDS routine which is dependent on GCPs is critical for acquiring quantitative information from the imagery. For example the error of 93 pixels is some 2

- L8-9 – I don't think this is at all surprising. Guessing the initial camera orientation values were never going produce good results. I'm more surprised that the improvement

wasn't greater.

- L13 – the reader cannot take part in the visual investigation because of the quality of the figures. They need to be much larger.

- L16 – not clear what you mean by this being 'valid'. This sentence doesn't make sense.

- L19 – not sure what you mean by, "... very strong effect of the erroneous classification..."

Page 185

- L12 – I'm not sure the software has a large number of features!

Page 190

- Delete except noted otherwise since they are all in meters?

- Why don't C and T have a z component seeing as you're getting them from the DEM? Is this UTM? If so, what is the zone?

Page 193

- Legends, and scales are very small. Is the inset of the camera necessary? It's not really providing much information to the reader? The reader also doesn't know what UFS is at this point. Is it necessary to point this out in the figure and the DEM? Isn't it better to specify that the camera station is within the limits of the DEM?

Page 194

- Simplify as suggested above.

- As I've stated in the text, the relationship between i,j and m,n is not clear.

Page 195

- Wouldn't it be more appropriate to show the camera location here rather than labelling

it UFS?

Page 196 and 197

- Black and grey is hard to differentiate in the printed copy. Since this paper would need to be printed in colour anyway... why not use colour to differentiate?

Page 198

- Is this figure necessary?

Page 199

- I think this figure is important and should be larger.

Page 201

- Figure is totally unusable due to its size. Font size of the axes are ridiculous... this shouldn't have made it through the initial editorial.

- Purpose of black box, which cannot be seen in the printed copy, should be added to the caption.

- Reference to panel (d) needs to be added to the caption.

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