Re-review of the study by Smith et al.

General comments

The revised study by Smith et al. is now much more focussed and provides a thorough description of the developed algorithm and its performance compared to other datasets. Considering earlier versions of the ms, I think this reduction had really been beneficial. The authors have also further modified the computational part towards a more automated processing line, thus facilitating its application to other regions. Although the used constant thresholds for the band ratio result in a reduced accuracy of the outlines in the accumulation region (e.g. missed ice in shadow), the improved mapping of debris-covered glacier tongues seems worth applying the method. My only larger recommendation is to also include a comparison of the results of the method presented here to results from other simple approaches (e.g. Nr. 2 and 5 in Table 2). This would help to see whether the calculation of velocity fields beforehand is worth the effort or not. As now clearly stated, it has also to be considered that the results of the algorithm require improvement when working at the scale of individual glaciers, but might satisfy the needs for regional scale applications. Apart from the comparison mentioned above, I have only some smaller comments that are detailed in the next section. Once these are addressed I am happy to recommend acceptance of the ms.

Specific comments

Title and overall remark

Please use glacier / glacierized instead of glacial/glaciated when reference is made to contemporary glaciers. The title should thus be "Improving semi-automated glacier mapping …"

Abstract first sentence

I suggest rewriting the first sentence a little bit: "Studies of glaciers generally require precise glacier outlines. Where these are not available, extensive manual … (GIS) must be performed, as current …"

L5 The dataset is "known as the Randolph Glacier Inventory"

L11: Please cite here the Cryosphere Chapter (Vaughan et al. 2013) instead of the full report (Stocker 2013).

L43: I would recommend to not introducing here a further abbreviation (WWD), also because it is not used any further.

L58: Please add the method used for downsampling (bilinear interpolation?).

L58: Here and elsewhere (e.g. L59, L96, L99): Please insert a space between the value and the unit (30 m).

L74ff: As Matlab is proprietary software, it would be most useful to establish also for the glacier classification steps scripts written in Python or other free software (see L100/1). Maybe this can already be achieved for the final version of the ms?

L92: Hanshaw and Bookhagen, here and elsewhere (e.g. L109): Please cite this study only when it is accepted for TC.

L109: Hall et al. (1987) applied the TM4/TM5 band ratio for glacier mapping first. The TM3/TM5 ratio combined with a TM1 threshold was introduced by Paul and Kääb (2005).

L111: I suggest inserting here a comment on its general use: For normal the two thresholds are adjusted manually to the image conditions of each individual scene to obtain the best

results. When the automated processing line is based on constant thresholds, large errors can occur in regions of cast shadow (see also example in Paul et al. 2015).

L128, 248 and elsewhere: Instead of 'glacier debris tongue' I would write 'debris-covered glacier tongue'.

L145: As there is always snow on-glaciers and clouds off-glaciers do not matter, I would write here more precisely: "It is important to note that images must be cloud free over glaciers and snow free off-glaciers for this step."

L173: centrelines?

L182: I can imagine that this step is as efficient as the neighbourhood analysis used by Paul et al. (2004): Everything that is not connected to a glacier is removed. I suggest to shortly explaining what the differences in performance are.

L195: What about using neighbourhood analysis instead? A gap that is completely surrounded by debris is assigned to the debris class given its slope is below a certain threshold. This would likely fill gaps of any size within the debris.

L205 & 363: path-row combinations

L214: The void-filled SRTM DEM is in some mountain ranges with steep topography of very poor quality (where the voids had been filled). Has this not caused any trouble in the regions analysed here?

L218: If possible I suggest adding a section for a glacier-by-glacier comparison of glacier area. The elevation related statistics are fine (please consider showing elevation on the y-axis for Figs. 10 to 12), but the standard deviation of the area differences would be most useful when it comes to using the algorithm for regional-scale change assessment.

L219: over two distinct

L224-226: I suggest numbering these three comparisons (e.g. (a), (b), (c)) for a more easy reference and recognition later on.

L232: When I look at the primary (spectral) classification in Figs. 2 and 8, I would argue that the difference is due to the not-mapped ice in shadow for many of the north-facing small glaciers. A lower TM1 threshold would have helped to include these regions. Please rewrite if this is agreeable.

L237: It could also be well the case that the CGIv2 under-classifies these regions.

L252: Though correct, I think it is rather obvious that a method that also maps the debris-covered part will be better than a pure spectral classification. A more interesting comparison would be against one of the other methods summarized in Table 2. Can this be done for a sub-region? After all, it is still not clear whether the higher workload required for this method is worth the effort compared to more simple approaches (e.g. Nr. 2 or 5 in Table 2).

L264: What are 'component vertices'? Can the method be described in somewhat more detail?

L287: Here I disagree a little bit, the neighbourhood analysis is an implemented routine and very quick. The entire processing line described in Paul et al. (2004) also only takes a couple of minutes. This is also the reason why I have suggested above a comparison of results to other 'more simple' methods.

L311: between terrain on and off glaciers

L332: debris-covered glacier tongues … centre

L347: analysing?

L347: "powerful tool": I well see the potential of the method, but think that its real test comes when applying it to the often slow moving or even stagnant debris-covered tongues in the Himalaya. I suggest adding this information here.

L446: Kaab should be Kääb; L450: Bris, R. L. should be Le Bris, R.
L487: Stocker, D.Q. should be Stocker, T. (but please replace with Vaughan, D.G.)

Tables

Table 1: I suggest writing "Landsat acquisition dates" (in the caption and the left column

Table 2: The Paul et al. (2004) method was actually applied to a Landsat full scene (33,000 km^2), but results were only presented for a sub-region to see something.

Figures

Fig. 1: Please add location of sub-regions in Fig. 1.

Fig. 2: Please indicate where the debris-covered tongues are (arrow, circle)

Fig. 3: Has the slope map already been median filtered? If not, maybe do it.

Fig. 3 & 4: I suggest adding the outlines from Fig. 2 on top to see the differences.

Fig. 6: For better visibility I suggest using yellow instead of red.

Figs. 11 to 13: The caption already includes a substantial amount of interpretation (last sentence). I suggest removing this here and provide the information in the main text.

Figs. 14 and 15: Please use different colours for the lines. I suggest the red one could be yellow and the purple one white. Maybe add arrows to highlight discussed features.

Cited references:

Paul, F. and Kääb, A. (2005): Perspectives on the production of a glacier inventory from multispectral satellite data in the Canadian Arctic: Cumberland Peninsula, Baffin Island. Annals of Glaciology, 42, 59-66.

Paul, F. and 24 others (2015): The Glaciers Climate Change Initiative: Algorithms for creating glacier area, elevation change and velocity products. Remote Sensing of Environment, 162, 408-426.

Vaughan, D.G. and 13 others (2013): Observations: Cryosphere. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the IPCC. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.