

On behalf of the authors, we would like to thank the anonymous reviewer 1 for the valuable suggestions, which helped us to improve the manuscript further. Here, we will list all the comments, demonstrate all the probable misunderstandings, and their questions for our manuscript. Then, all corresponding modifications are done based on each comment and discussions. Here, the reviewer's comments is written in bold italics and our answers are highlighted in red as below.

Response to Reviewer #1

We are very grateful for reviewer 1 carefully check our manuscript and give us an opportunity to improve the quality of our manuscript. Appropriate changes have been made in the paper to account for your comments. For now we would like to provide a reply to the issues addressed in your comment. The main comments of reviewer 1 refer to that the lack of corresponding accuracy assessment and the quality of representation should be improved. Here, we write a new section for post-processing and accuracy assessment according to the recommended references. The SNR and direction based post-processing are described, some inappropriate pixels have been discarded based on that. The general statistical assessment is shown in Table. 2. Thereafter, all the figures (Fig.1-Fig.8) have been reproduced with relative better quality than original ones, the clear and concise representation recommended from reviewer 1 is considered as well.

Detailed comments

Title:

Please change the title of the paper appropriately to sustain the content of the paper.

Monitoring: Are you really monitoring?

Recent: Do your results really reflect recent variations? Maybe it is better to state the observation periods to be compared with.

Surface Displacement: Please clarify in your paper what is the result of your measurements. A displacement map (= principal result of your work) is nowhere shown in the paper. Good examples of cartographic representation can be found the references provided in your paper. Since both observation periods (1993-2003, 2003-2009) are different in time span, the displacements obtained have to normalized. The result is a velocity (change in length/time unit). The authors should better use the working unit velocity (m/year) for reasons of comparison. Nyainqêntanglha Mountains: Please add ... in the Nyainqêntanglha Mountains (Tibetan Mountains, China). Readers should know where this mountain range is located at.

Re: Changed. Title of the article “Estimating variations of the glacier surface displacements in the Nyainqêntanglha Mountains (Tibetan Mountains, China) between 1993-2003 and 2003-2009”. This change can interprets the location of the study area more concisely as well.

Normalization:

According to our understandings, your mentioned normalization is that the mean values of displacements and their changes should be computed for each individual glacier, not for all measurements. We have followed your suggestion and calculated these individual means for each glacier. However, we propose to study the variations of displacements, not the velocities. Thus, The unit of the map is supposed to be (m) as before.

Abstract:

The Abstract should better describe the real content of the paper.

Re: It has been rewritten.

line 2: Tibetan Plateau, China

Re: It has been modified to Tibetan Plateau, China.

line 12: please name the feature tracking method used

Re: The feature tracking method used here has been entitled.

line 13: 'sub-pixel accuracy' has to be validated in the paper

Re: The inappropriate and invalidated word 'sub-pixel' has been removed.

line 14: omit repetition of the names of the glaciers

Re: The repetition has been modified.

line 20: specify the space-borne optical imagery you were using, i.e., Landsat imagery

Re: It has been specified.

line 20: rephrase 'are promising for potential detection' please be concise, the reader is interested in clear statements

Re: It has been rephrased.

Introduction:

The Introduction should more focus on the topic of the paper. The problems should be highlighted. The paper could benefit from an ending paragraph highlighting the outline of the paper (which is also very helpful in structuring the paper itself).

Re: The new paragraph has been added in the introduction corresponding to that.

line 10: reconsider the phrasing '... is assumed to made of ..'

Re: It has been rephrased.

Study area:

Figure 1 is of bad cartographic quality. A location map (showing Asia/China) indicating the test site is missing. The drawing should clearly show the situation/topography

Re: The new Figure 1 has been reproduced based on the reviewer's comments.

line 18: phrase '... magnitude of the glacier length was about 10 m ..' unclear

Re: This part has been rephrased.

line 20: ... that the ice cover ...

Re: This part has been rephrased.

Data and methodology:

Please give details about the image processing software you were using.

How did you implement your feature tracking method (programming language, etc.)?

Re: It has been added the content in the beginning of the second paragraph, new paragraph in the end of section 3.2 and written new section 3.3 for that as well.

3.2 Feature-tracking method

p. 1560, line 11-15: Please add appropriate references to your statements given.

Why are optical imageries more useful (?) for tremendous (?) ice surface displacements monitoring?

Re: Four references have been cited here for this statement (Paul, Bolch et al. , Scambos, Dutkiewicz et al. 1992, Scherler, Leprince et al. 2008, Quincey, Copland et al. 2009)

p. 1561, line 15: Omit the sentence 'Nevertheless, ...'

Re: It has been omitted.

p. 1562, line 17: explain acronym TPSS Please explain your accuracy assessment!

Re: The explanation has been added before the acronym TPSS

Have you tested your algorithm at stable areas where there is no movement.

The reader might be interested in a comparison of your method with other potential methods. Why should one use the proposed method?

Re: For this issue, I think it indicates that the reviewer concern about the reliability of this algorithm.

The COSI-Corr has been applied in some successful method to derive the glacier surface displacement for different types of glaciers (Leprince, Barbot et al. 2007, Leprince, Muse et al. 2008, Scherler, Leprince et al. 2008, Quincey, Copland et al. 2009). Moreover, the capability of the COSI-Corr algorithm has been compared with potential methods (e.g. normalized cross-correlation (NCC),) globally (Heid and Kaab 2012). The advantage and limitations of different methods address specifically. We mask out the glaciated mountainous area and water bodies in the scene and assume

this area as relatively more stable ground than glaciated mountainous area, the statistics of the displacements on the stable ground are shown as below:

	93_03			03_09		
	EW	NS	SNR	EW	NS	SNR
Count	72790	72790	72790	72790	72790	72790
Mean	-0,05	-0,24	0,98	-0,46	0,62	0,99
Sigma	7,55	6,85	0,01	5,17	5,01	0,01

p. 1563, line 13: considerate?

Re: Changed.

Surface displacement observations

Please add a large-scale displacement vector map showing at least one of the glaciers.

Accuracy assessment is missing!

p. 1564, line 11: 425.60 m, is the given precision significant?

Re: Yes.

The reviewer is confused by the term displacement when change is the focus.

Please normalize all your numbers/results to [m/year] in order to make them comparable.

Re: The relative figures have been reproduced.

p. 1564, line 11: spelling 'lager'

Re: Changed.

Table 1: source of data is missing.

Re: The description of Table 1 has been modified.

Table 2: The content of this table is completely unclear to the reviewer. Please use velocity term [m/year]!

Re: The Table 2 has been reproduced. Here, we study the variations of displacements, the unit remains as [m].

Figure 2: This figure can be improved. Does this figure reflect the content of the paper/title of the paper? Where is the part of change detection?

Re: Figure 2 has been reproduced.

Figures 3-9: Very bad cartographic quality! Annotations are not legible. Figures should be drawn larger.

Re: Figure 3-9 have been reproduced.

What is the scientific rational behind the figures 7 and 8. Please give explanations.

page 1565, line 11: Please explain in more detail why you did resample the displacement maps.

Re: Please see relevant description in section 3 and 4.

Discussion

p. 1565, line 24: please consider rephrasing of '... remain a considerable in ...'

Re: Rephrased.

p. 1565, line 26: Please consider normalization (= velocities) for comparison!

Re: The normalization has been considered.

Please give clear statements about the quality of your results obtained. Is the method applied beneficial. The reviewer does not trust very much in the results obtained (see Fig. 4). For the interpretation of the results the expert knowledge of glaciologists would be of great interest. Maybe, the appropriate experts can be asked.

Re: Results and Discussion sections have been modified based on your comments.

Conclusions

P. 1566, line 24: The sentence 'Our research ...' does not make sense to the

reviewer.

Re: Rewritten.

P. 1567, line 10: 1990s are indeed located in the last century ...

Re: Rewritten.

References:

Heid, T. and A. Kaab (2012). "Evaluation of existing image matching methods for deriving glacier surface displacements globally from optical satellite imagery." Remote Sensing of Environment **118**: 339-355.

Leprince, S., et al. (2007). "Automatic and precise orthorectification, coregistration, and subpixel correlation of satellite images, application to ground deformation measurements." Ieee Transactions on Geoscience and Remote Sensing **45**(6): 1529-1558.

Leprince, S., et al. (2008). "In-flight CCD distortion calibration for pushbroom satellites based on subpixel correlation." IEEE Transactions on Geoscience and Remote Sensing **46**(9): 2675-2683.

Paul, F., et al. (2013). "The glaciers climate change initiative: Methods for creating glacier area, elevation change and velocity products." Remote Sensing of Environment. (In press)

Quincey, D. J., et al. (2009). "Ice velocity and climate variations for Baltoro Glacier, Pakistan." Journal of Glaciology **55**(194): 1061-1071.

Scambos, T. A., et al. (1992). "Application of Image Cross-Correlation to the Measurement of Glacier Velocity Using Satellite Image Data." Remote Sensing of Environment **42**(3): 177-186.

Scherler, D., et al. (2008). "Glacier-surface velocities in alpine terrain from optical satellite imagery - Accuracy improvement and quality assessment." Remote Sensing of Environment **112**(10): 3806-3819.