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The Cryosphere
Discussions

Interactive comment on "Worldwide widespread decadal-scale decrease of glacier speed revealed using repeat optical satellite images" *by* T. Heid and A. Kääb

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General comments

This submission presents multi-temporal glacier velocity data for selected regions of the world and makes a semi-quantitative assessment of their relationship with mass-balance. The data presented are certainly novel, being the first of their kind across such a wide area. Comparison between regions is necessarily superficial (given the lack of hard data available), but analysis of the spatial variability in flow within regions is comprehensive. The overriding research question is clear and the methods are sound. Interpretations are mostly well supported by glaciological theory and with reference to

previous studies and the conclusions are logical and substantial. I would be pleased to see this work published in The Cryosphere, but have some suggestions on how the submission could potentially be improved.

Specific comments

1. The title does not accurately reflect the content of the submission. The analysis is not 'worldwide', and the velocity changes are not universally negative. If you remove the word 'worldwide', you could probably then justify the decrease being widespread.

2. The analysis of the Karakoram could be much better integrated with the general text. In several places there is some description/discussion of the other case studies, followed by the Karakoram as if it were an after-thought. It could also be included in Figure 2.

3. There are large sections of description that could easily be tabulated (or the reader referred elsewhere) to shorten the article overall (indicated below).

4. Some of the data are derived over very long time periods – so long that there could have been several velocity variations during that time. Perhaps there needs to be some acknowledgement of this, or even better, some snapshots of intervening periods supplied, particularly since the main conclusion relates to the acceleration/deceleration pattern?

Technical comments

Introduction: paragraphs skip from method considerations (paragraph 1) to the application (2), back to the methods (3) and back to the application (4). Some reworking of the structure may be beneficial in this section.

Page 3026

Lines 13-15: 'in average' should be 'on average'

Page 3027

Lines 16-22: the justification of the use of optical feature tracking over DInSAR is a bit strange. Why compare it specifically to Differential InSAR, rather than just InSAR – this has also been successfully applied? And if you are going to compare it to SAR techniques, how about SAR feature tracking? I wonder if it is better to just state the advantages of the approach you use, rather than point out the disadvantages of one (or more) other(s).

Line 23: 'it is thus' should be 'there is thus'

Line 26: 'has else also' should be 'also has'

Page 3028

Lines 1-5: here you are talking about mass balance and equilibrium, but with some confusion. How can a glacier be in equilibrium, but also with a negative mass balance for example? Needs some attention.

Lines 8-16: you could shorten this considerably by referring to a table. The table would then be useful for cross-referencing your velocity results to later in the paper.

Page 3029

Lines 5-12: Again, the image characteristics could be summarised in a table. Further, I'm not sure you need to justify the use of Landsat over ASTER so much – this is a whole page or more worth of text. . .

Line 22: why was 7.3 m a requirement? Perhaps needs explanation (or removal)?

Pages 3030-3032

The methodological descriptions are good quality, but if you have submitted another paper to RSE can you not simply provide a brief summary and refer readers to the full description elsewhere? This would save three pages.

Page 3033

Line 14: 'allow thus' should be 'thus allows'

Page 3034

Line 20-21: Quincey et al., 2009 did discuss increased mass, but it would be better to cite Hewitt, 2005 who looked at the regional perspective.

Lines 25-27: You refer to a speed-up of the Stanghan and Skamri glaciers, but in Figure 3 they are depicted in blue, unless I'm looking at the wrong glaciers. If I am, maybe you can improve the label positions?

Page 3035

Line 10: receding is probably better than retreating, as the terminus position can remain unchanged (retreat implies terminus change).

Line 12: Johannesson et al., 1989 were referring to terminus position changes rather than velocity so I'm not sure this is the correct reference.

Lines 15-16: A summary of the available mass balance data for each region would be useful here for comparison – in the form of a table perhaps, as suggested above.

Lines 26-28: This comment on sliding could be improved. First, what is a 'way of sliding'? This doesn't make much sense. Second, how would sliding change 'independently of mass balance changes'? Because of increased meltwater? Maybe clarify. Third, what are 'surge-type activities' as opposed to surges? Do you suggest that these glaciers lie somewhere on a continuum between 'normal' and 'surging'? Maybe you need to be more explicit.

Page 3037

Line 25: 'by' should be 'be'.

Page 3038

Lines 3-5: why are these glaciers dynamically unstable because their speed is always

high? Can't they just be fast-flowing?

Page 3039

Lines 1-14: This paragraph is not really necessary – the conclusions would be improved if you could keep them short and punchy.

Table 3: is there an extra 'decade' in the fifth heading along?

Figure 2: why not include the Karakoram data here? In addition, the caption does not need 'Box plot showing'.

Interactive comment on The Cryosphere Discuss., 5, 3025, 2011.