

## ***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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Heid and Kääb (2011) provide an important data set that provides critical baseline data and methodologies. This data set or the first time quantifies the expected but velocity response of glacier to climate change. As anticipated the significant ongoing negative mass balances are driving reductions in velocity. This well written paper is a valuable contribution. The comments below focus in particular on two areas where expanded discussion and data set characteristic descriptions would be useful

3032-15 and/or 3035-21: As noted velocity differences are not derived for all parts of the glacier. This is fine and the data set is substantial and adequate as is. The data set

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needs to be better defined as to the distribution of the data points along the length of the glacier. I would suggest either simply: 1) identifying the percentage in each range for the ablation zone, accumulation zone and near the equilibrium line or 2) plotting the distribution as a percentage of the distance from the terminus to the glacier head. In the Pamir Range of the 3148 how are they distributed. In the figures it appears that the ablation zone was the focus of most or all of the measurements. The velocity response of a glacier to climate change varies along the length of the glacier. If most of the thinning is in the ablation zone that is where most of the velocity change would be. When the thickness change is more evenly spread along the glacier a more uniform change in velocity occurs.

3035-12: Johannesson et al., (1989) indicated a response time ( $T_m$ ) that represented 2/3 of the adjustment to a step change in climate. The two methods the utilize focused mainly on the terminus area and used glacier length, near terminus velocity, glacier thickness and near terminus ablation rate. This measure is separate from the initial response time ( $T_s$ ), which can be very rapid indeed. Just clarify this with a bit more discussion. The observed range of response times for the various size glaciers should be briefly discussed. For example Raper and Braithwaite (2009) or Pelto (2006) provide field baseline observations and calculations of the response time.

Two additional minor points:

3026-11: Rewrite-We find that the mapped glaciers in the five regions with negative mass balance have over the last decades decreased there velocity at an average rate per decade of: 43% in the Pamir, 8% in the Caucasus, 25% on Penny Ice Cap, 11% in the Alaska Range by 11% and 20% in Patagonia.

3039-13: The method could also identify glacier velocity declines toward zero in the accumulation zone, which would indicate glaciers that cannot survive as they no longer have an accumulation zone that generates motion (Pelto, 2010).

References:

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