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Interactive comment on “Photogrammetric determination of spatio-temporal velocity fields at Glaciar San Rafael in the Northern Patagonian Icefield” by H.-G. Maas et al.

R. Anderson (Referee)

robert.s.anderson@colorado.edu

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This is a data-rich manuscript that sets out to demonstrate the utility of photogrammetry in this setting. My main complaint about the manuscript is that it fails to analyze the data so painstakingly collected. Their major conclusion that the thinning can be attributed to melt rather than to dynamic thinning is not supported by the data. First, I would like to have seen a Figure 7 in which they plot the velocity data in Figure 6. They tell the audience in words that the speeds decline from 16 m/d at the terminus to 6-7m/d 800m behind the terminus. This gradient in speed, $du/dx = 0.012/d$, will inevitably lead to thinning – dynamic thinning – that they have no analyzed. If the ice is incompressible,

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then $du/dx + dv/dy + dw/dz = 0$. Ignoring cross-valley speeds v , this leaves us with $dw/dz = -du/dx$, which may be integrated to yield the vertical speed w . If the ice is indeed 200m thick ($=H$) at the terminus, as they state, and the surface speed is representative of the mean speed (as it should be if sliding is responsible for the motion, as it must be with these speeds), this suggests $w = H(-du/dx) = -200 * 0.012 \text{ m/d} = \text{about } -2\text{m/d}$. We are left with no discussion of this, which far exceeds the reported 3.5m/year rate of surface elevation drop.

There is also no theoretical discussion of how such thinning will affect glacier speed, and why. In this regard I would highly recommend embracing the view of W.T. Pfeffer in his analysis (in JGR) of thinning-induced acceleration, based upon his work on Columbia Glacier in Alaska.

Technical corrections page number Line number comment

2416 13 high temporal resolution 15 signals were observed 17 due to ice dynamics but rather to enhanced melt

2417 8 any significant advance 9 glacier advanced 11 retreated a total 13 1980s has been 18 glacier has been attributed 23 glacier velocity

2418 11 research presented here. . .determination of spatio- 13 installed on the hillside north of the 14 sequences, similar to 25 was screwed robustly to the rock 26 due to restrictions imposed

2419 2 be acknowledged when 20 motion field in this setting

2420 25 Therefore, some additional visible

2423 11 that the glacier might be in near-flotation 16 allows us to determine 26 In contrast, Jacobshavn shows dynamic thinning that dominates the signal.

2424 3 precision, image 10 [you provide no support for this submarine melting component] 13 Rafael, supporting the bathymetric data that suggest the glacier is grounded

at the terminus.

Interactive comment on The Cryosphere Discuss., 4, 2415, 2010.

TCD

4, C1438–C1440, 2011

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