

Interactive comment on “Increased rate of acceleration on Pine Island Glacier strongly coupled to changes in gravitational driving stress” by J. B. T. Scott et al.

M. Pelto

mauri.pelto@nichols.edu

Received and published: 2 March 2009

This paper presents the first field based measurements of velocity from Pine Island Glacier (PIG). This outlet glacier is crucial due to it being the largest outlet glacier or WAIS that does not have a major ice shelf fronting it. The acceleration, thinning and grounding line retreat have been previously noted. The paper provides a valuable additional step in quantifying the changes in velocity and surface elevation of the glacier. This data set will be of continued value going forward to identify the mechanisms behind the changes in PIG behavior. The paper lacks some important background information that cannot be left out in contemplating the causes of the observed velocity and

C1

surface elevation changes and their implications. The following are suggestions that would make this valuable new data set more compelling.

The paper mentions grounding line retreat in the first sentence of the abstract and paper, but does not return to that specific issue. The paper does not provide new data on grounding line retreat, but given its prominence at the start of the paper, some reference in the introduction and conclusions must discuss the identified grounding line retreat. Do we have sufficient data to identify the rate of its retreat for different periods and compare to the thickness or velocity changes observed?

There must be some mention of the basal topography, which is important to the entire setting and potential hazards posed by PIG. This study does provide new data on basal topography or basal conditions making the reasonable assumption that basal conditions are not changing over the short study time span. Core et. al., (2001), Shepherd et. al.,(2003) and Rignot (2008) have noted the basal topography, most importantly a plain that extends some 30 km inland from the current grounding line, which they all see as raising the potential for rapid inland migration of the grounding line. Beyond this point is the deeper trough that extends under the rest of the study area and trunk of PIG with its own implications, note Figure 3 of Shepherd et al., (2003).

227: In the review of velocities changes is there not some comparable data from Luchitta et. al., (1995), that can extend the velocity record for at least PC55 to the 1992-1994 period?

228-11: Where and when were the 20 m ice cores taken?

232-8: The horizontal displacements of P55 and P111 are mentioned in reference to Figure 4, but in Figure 4 it is flow direction positions that are referred to. Further the y-axis refers normalized detrended inline position. This needs to be clarified we do not need three different terms applied.

233-17 and Figure 4: It is noted that changes in the longitudinal stress gradient have

C2

been measured. How and where is this information? The calculation of longitudinal stress from strain rates has been mentioned, is this the source?

Table1: I would like to see the 2006/2007 season mean velocity data shown as well.

Figure 1: Color scale needed for the background velocities.

Figure 2: PC171 and PS169 should be next to each in the diagram, work from the terminus up glacier, not down glacier and then back up. Either in this diagram or a separate figure the increase in velocity for the various periods should be shown alongside the increase in thinning. This will help at the simplest level to indicate how consistently correlated the thinning and acceleration are. Velocity is equally important to thinning and plotting the change in velocity in terms of percent as discussed in the text from various previous studies for whatever location possible is as important as the thinning rate. Grounding line retreat changes if possible should be shown here

Interactive comment on The Cryosphere Discuss., 3, 223, 2009.