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The Cryosphere Discussions

Interactive comment on "Petermann Glacier, North Greenland: massive calving in 2010 and the past half century" *by* O. M. Johannessen et al.

M. Pelto

mauri.pelto@nichols.edu

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Johannessen et al (2010) examine the calving history of Petermann Glacier. This history if thorough in its analysis, including providing regional context would be of importance. At present the paper is cursory in its documentation of the terminus change analysis and of the basic characteristics of Petermann Glacier. Petermann Glacier is significantly different in its dynamics from the marine terminating outlet glaciers of west and southeast Greenland that have received the majority of our attention. Nowhere in this paper is the thickness of the glacier mentioned either at the calving front or at the grounding line. The thin calving front $\sim$70 m is similar to that of Ryder and Steensby Glacier and has a different calving behavior as a result from thicker, faster moving outlet glaciers further south in Greenland. Again no context is given with respect to these

or other Northern Greenland glaciers with a large thin floating terminus. Nowhere is the volume flux mentioned. The actual velocity of the glacier, usually the key parameter reported in a calving analysis is not reported. The authors note that the velocity and terminus position have has been relatively constant until 2010. The average annual velocity would then provide a good first estimate of the area of ice that would have to calve each year for the terminus to maintain its position. Contrasting this with the actual calving record provided in Figure 3 is essential.

170-21: The volume flux past the grounding line and at the terminus should be noted, using the published record. Johnson et al (2011) note that nearly 2/3 of the volume loss occurs due to the high basal melt in the first 20 km below the grounding line, the glacier thickness declines from 600 m to 200 m in this region. The volume flux at the calving front for Petermann Glacier is ∼0.6 km3 (Higgins, 1990), whereas Jakobshavns yields close to ∼40 km3. This is a vast difference that should be discussed at least briefly.

171-4: It is critical to examine the published velocity record of the Petermann Glacier. The record does span a significant time period and has illustrated relative consistency within +10%. The velocity has been reported in the 900 m/a range near the calving front by Higgins (1991), Johnson et al. (2011), Rignot and Steffen (2008) and Joughin et al (2010). Given the 53 year period reported on and the observed velocity of ∼900 m/a, the 16 km width of the fjord near the calving front would suggest that to maintain its calving position the glacier would have needed to produce on the order of ∼800 km2 during the interval. The sum of the major calving events noted in this paper up to the 2010 event that led to terminus retreat provides ∼50% of this total. Does this suggest many minor events or a missing major event? This is the quantititative analysis that must be completed in an examination of the calving history of Petermann Glacier. This area that was lost must be accounted for.

171-8: Patrick Lockerby was the first to report the iceberg discharge from the Petermann Glacier in 2010 and should be mentioned here as well.(http://www.science20.com/chatter_box/arctic_newsflash_petermann_ice_tongue_loses_huge_chunk)

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171-13: At some point in the paper the type of icebergs produced should be mentioned. The large calving events reported are tabular icebergs. The thin nature of the floating terminus tends to produce this type of iceberg.

173-5: Must define how this massive 1991 calving events was identified. This is the main new piece of information to the recent calving history of this glacier that the paper offers.

174-11: The unique nature of the melange of ice particularly along the northeast margin of Petermann Glacier is worth mentioning. Such a melange is also a part of the terminus of Ryder Glacier.

174-17: Johnson et al. (2011) provide estimates of the basal melting and should be cited here also.

Interactive comment on The Cryosphere Discuss., 5, 169, 2011.