

## ***Interactive comment on “The equilibrium flow and mass balance of the Taku Glacier, Alaska 1950–2006” by M. S. Pelto et al.***

**M. S. Pelto et al.**

Received and published: 3 July 2008

We appreciate the time and effort of the referee who has presented a number of constructive criticisms and suggestions that will be fully addressed in a resubmit, we will comment on a few of the issues here. We feel the paper is important not just because of the 50 year mass balance record, but also because of the 50 year velocity record. This record is unique in its scope in North America. The record indicates a consistency in velocity that is not evident in other velocity records over time at South Cascade, Nisqually, Columbia, and Blue Glacier. The resubmit will address this under emphasized point using the larger context of velocity through time changes via a graph or table.

The referee correctly notes the appropriate caution with regards the Taku Glacier mass balance record. The final paper will hopefully more adequately define the strenghts

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Discussion Paper



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and weaknesses of this data. The first point noted is the dearth of measurements outside of the lower neve zone. However, there is not a dearth in the upper neve above 1400 m, sufficient annual data points, five points, exist that extrapolation of the balance curve is not necessary. Further, detailed surveys of more than 100 points in several years in the upper neve limit the lateral extrapolation as well. It is true that coverage in the ablation zone is limited to occasional examination and does require extrapolation of the balance curve annually, based on the occasional measurements. We will accept the gracious offer of the referee to use their 2003-2005 terminus ablation data as a validation for our terminus ablation record. A second weakness noted is that the measurements occur approximately four to six weeks before the end of the significant ablation season. This is a logistical issue that cannot be solved. The adjustments to mass balance measurements made are based on shifts in the ELA and ablation measurements completed each year. The lack of data in the ablation zone and the early timing of the mass balance measurements are just as pronounced on the Lemon Creek Glacier, where the accumulation zone measurements are completed earlier than on Taku Glacier. On Lemon Creek Glacier, the mass balance record constructed using the same methods as Taku Glacier, have been verified as cumulatively accurate using laser altimetry (Miller and Pelto, 1999; Sapiano et al., 1998) and annually accurate using a climate model by Mark Dyugerov (pers. comm.) and Wendell Tangborn using his PTAA model (pers. comm.). On Taku Glacier similarly the cumulative record is independently validated by Motyka and Echelmeyer (2003) and Larsen et. al., (2007), and the annual data through the GPS method noted. The problem with utilizing the surface elevation data for mass balance assessment due to bed erosion is not applicable to the Profile 4 region, which is the only region it is utilized in this paper, as it would to the terminus region where the erosion has been observed. A third weakness noted is that students complete the measurements. This is true for many mass balance programs, in this case students do most of the digging, but are always supervised by at least one senior researcher, and all mass balance calculations for every year have been completed in the same manner by the same researcher (Pelto). Two additional points are

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Comment

that the methods have been consistent for the entire period, thus the record is precise if not accurate. Lastly, in this paper we are only concerned with the mass balance in the accumulation zone where spatial data coverage is reasonable and has been verified with detailed surveys in many years. We will include a diagram of ELA data as well.

The referee points out some references on the terminus region of the glacier. This paper is not focused on the terminus region of the glacier, but on Profile 4 near the equilibrium line, and what happens above that point and not the detailed terminus dynamics that are examined in excellent detail by Roman Motyka and others in several papers. The original reference on the role of the tidewater glacier cycle and AAR on the advance of the Taku is Pelto and Miller (1990), not Motyka and Beget (1996). A resubmit, as the referee notes, must better consult the work of Motyka and Echelmeyer (2003) and Larsen et al. (2007), which provide supporting independent data. We suffered from focusing too much on getting our data coherently presented and will more adequately reference the noted studies, including Nolan and others (1995), which came to a similar conclusion based on a temporally limited velocity set and a portion of this programs mass balance record.

Larsen, C.F, R.J. Motyka, A. A. Arendt, K.A .Echelmeyer, and P.E. Geissler,. Glacier changes in southeast Alaska and northern British Columbia and contribution to sea level rise. *J. Geophys.Res., Earth Surface.* 112, F01007, doi:10.1029/2006JF000586, 2007.

Miller, M. M. and M.S. Pelto,. Mass Balance measurements on the Lemon Creek Glacier, Juneau Icefield, Ak 1953&#8211;1998, *Geogr. Ann.*, 81A, 671&#8211;681,1999.

Motyka, R.J., and J.E. Beget,. Taku Glacier, southeast Alaska, U.S.A.: Late Holocene history of a tidewater glacier. *Arctic and Alpine Research*, v. 28, no. 1, pp. 42-51, 1996.

Motyka, R.J. and K.A. Echelmeyer,. Taku Glacier on the move again: Active deforma-

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tion of proglacial sediments. J. Glaciol., 10(164), 50-59, 2003.

Pelto, M. and M.M.Miller.. Mass Balance of the Taku Glacier, Alaska from 1946 to 1986, Northwest Science, 64(3), 121&#8211;130, 1990.

Sapiano, J.J., W.D. Harrison, and K.A. Echelmeyer,. Elevation, volume and terminus changes of nine glaciers in North America. J. of Glaciol. 44(146), 119-135, 1998.

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Interactive comment on The Cryosphere Discuss., 2, 275, 2008.

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2, S184–S187, 2008

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