

## ***Interactive comment on “Juneau Icefield Mass Balance Program 1946–2011” by M. Pelto et al.***

### **Anonymous Referee #1**

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General comments: This paper presents mass balance time series on two glaciers of the Juneau Icefield: Taku Glacier and Lemon Creek Glacier. These time series being the longest continuous glacier mass balance data sets in North America are of broad interest for the glaciological community. From my point of view, the paper correctly deals with the standard of ESSD and deserves to be published. However, hereafter are some comments and edits (identified here by page, line number) that have to be considered by the authors in preparing any subsequent versions.

P. 120, L. 10-11: specify this is for Taku Glacier. Change “consistent balance gradient” by “consistent mass balance gradient”. Add the value of the mass balance gradient.

P. 122, L. 1: Indicate how thick is Taku Glacier at this elevation. Also, Nolan et al., 1995 is missing in the bibliographical references.

C50

P. 122, L. 7: according to the bibliographical references, Miller and Pelto, 1990 should be Miller and Pelto, 1999.

P. 122, L. 7: add a dot after “et al”

P. 122, L. 9: define IGY as the International Geophysical Year

P. 124, L. 9: change “balance gradient” to “mass balance gradient”

P. 124, L. 16: add a space between “50” and “cm”

P. 125, L. 1: indicate where Gulkna and Wolverine glaciers are located and show them on the general map of Alaska inserted in Fig. 1.

P. 125, L. 3-4: March and Trabant, 1996 has to be quoted before Mayo et al. 2004

P. 125, L. 20-12: indicate since when the TSL observation from remote sensing is done

P. 126, L. 4: why do you mention Fig. 2 here?

P. 126, L. 5-10: these are some results. Why are they placed here?

P. 126, L. 11: change “balance gradient” to “mass balance gradient”

P. 127, L. 16-17: “where snow depths are large... to validate the snow pits”. This sentence has to be reformulated, because probing does not validate the snow pits, but are rather used to extend the number of accumulation measurements.

P. 127, L. 21: “Ba” has to be defined here as the average annual mass balance for a considered period of time (it is the same for P. 128, L. 3). Whereas in Table 1, “Ba” is correctly used as the annual mass balance

P. 127, L. 26: “consistent” instead of “consisten”

P. 128, L. 19: change “thickness change” by “surface elevation change, to be consistent with the nature of laser altimetry measurements, and with the following sentence.

P. 128, L. 20 and 25: Arendt, 2006 is missing in the bibliographical references.

C51

P. 129, L. 10: for the cumulative mass balance of Lemon Creek Glacier over the 1953-2011 period, Table 1 indicates -26.6 m w.e. So please change -26.9 by -26.6 in the text.

P. 129, L. 10: add “cumulative” before Ba

P. 129, L. 13: change “The annual balance record” by “The cumulative mass balance record”. Also, the Table 1 indicates -17.9 m w.e. and not -17.1 m w.e. as indicated in the text = please correct.

P. 129, L. 17: change “surface mass balance” by “cumulative mass balance”.

P. 129, L. 17: From Table 1, one can compute a -7.5 m w.e. cumulative mass balance for the 1995-2007 period, and not -10 m (w.e. is missing) as mentioned in the text. Please rectify. The difference with the surface elevation change of -13.1 m is close to 40%, which is not negligible and has to be commented.

P. 129, L. 18-19: remove “ice thickness assessment” because as mentioned in a previous comment, laser altimetry does not provide ice thickness measurements. Also, this last sentence has to be mitigated in agreement with my previous comment on the difference between both methods for the last 1995-2007 period.

P. 129, L. 20: change “balance gradient” by “mass balance gradient”

P. 129, L. 22 to 26. Be consistent with the mentioned elevation: once is from 900 to 1150 m and once is from 925 to 1100 m.

P. 129, L. 23: Be consistent with the probing horizontal interval. P. 125, L. 25 you mention a 100-250 interval.

P. 129, L. 26 and 27: change “balance gradient” by “mass balance gradient”

P. 130, L. 3: change “balance gradient” by “mass balance gradient”

P. 130, L. 7: change twice “balance gradient” by “mass balance gradient”

C52

P. 130, L. 11, 12 and 13: change “balance gradient” by “mass balance gradient”

P. 130, L. 14: the mass balance gradient can be hardly quantified from Fig. 6.

P. 130, L. 15: change “balance gradient” by “mass balance gradient”

P. 130, L. 16 to 26: which DEM was considered for the calculation of the TSL elevation? What is its accuracy and the consequent error on the TSL elevation computation?

P. 130, L. 21: for the first time in the paper “a.s.l.” is used after an elevation! This need to be done everywhere in the paper.

P. 130, L. 22: add “at” before Lemon Creek Glacier. P. 130, L. 27: explain why do you compute rate of TSL rise only for periods longer than 15 days.

P. 131, L. 3: from Table 3, one can see 760 m a.s.l and 975 m a.s.l. instead of 800 m and 980 m for July 29 and September 15 respectively. Please correct.

P. 131, L. 17-18: change the order of the references to be consistent with the chronology. Also, Rabatel et al. JOG, 2005 would be worthy here.

P. 131, L. 26. Again, Rabatel et al. JOG 2005 would be a worthy reference here (in brackets, before Mernild et al., 2013)

P. 132, L. 2: Certainly the fit for Taku Glacier is not as good as the one of Lemon Creek Glacier, but the correlation between ELA and mass balance is surely significant. You can mention it and give an explanation for why the fit is not so good for Taku Glacier. This has to be related to the large scatter for the positive mass balance years. What are the reasons of this scatter? Could it be related to measurements problems? Low density of measurements regarding the important size of the accumulation zone? Please comment.

P. 132, L. 8: change “balance gradient” by “mass balance gradient”

P. 132, L. 12: change “Juneau Icefield glacier” by “Juneau Icefield glaciers”

C53

P. 132, L. 20: the reference “Echelmeyer et al., 1995” is missing in the text. It has to be removed.

P. 137 and 138: Table 2. Why the year 1998 appears between 2005 and 2010, and not in the chronological order? Also, specify that elevation is in “m a.s.l.” and accumulation for each year in mm. Also, you mention P. 129, L. 21, that these probing transects have been made in 1984 and 2011, but the data do not appear in Table 2. Please add these data.

P. 139: Table 3. Some values of Taku TSL rate of rise are missing (for: 7/30/1998, 8/5/2003, 8/19/2008, 8/3/2010 and 8/14/2010). For Lemon Creek Glacier, the rate of rise for 8/10/2005 is wrong. Also, where the values mentioned in the text P. 131 for late May, June and early July 2006?

P. 141: Fig. 1. The general map of Alaska should appear on this figure and not on Fig. 2. Apparently, some dots indicating snow pits are missing on the figure, if one considers what is said on P. 124, L. 28-29 where 17 snow pits are mentioned and only 14 appear on the map.

P. 142: Fig. 2. Glacier outline and contour lines are too fat. Please modify.

The quality of all the graphs (figures 4, 5, 6, 8, 9, 10 and 11) have to be improved for the final version. In many cases, the units of the label of the X and Y axis are missing: elevation, ELA, TSL are in “m a.s.l.”. Mass balance is in m w.e. or mm w.e. (figures 6, 10 and 11) Replace “balance gradient” by “mass balance gradient” everywhere it is needed. On Fig. 11, the 0 mm w.e. mass balance vertical axis seems to be wrongly placed.

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