The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2017-256-RC2, 2017

The Cryosphere Discussions
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EGU

Interactive comment on "Multi-decadal mass balance series of three Kyrgyz glaciers inferred from transient snowline observations" *by* Martina Barandun et al.

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Received and published: 23 December 2017

Barundun et al (2017) provide a valuable reconstruction of the mass balance history of three central Asian glaciers. This increases the value of the record from each glacier and enhances the likelihood that monitoring will continue. This region is at present a gap in our understanding of longer term glacier mass balance change around the globe that the WGMS reports. The study provides a detailed discussion of uncertainties and sensitivities that providing a useful example for other to adopt in a similar data limited environment. The use of snowline observations is a best practice for filling in gaps in a mass balance record as they represent direct observations of mass balance.

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The comments below are numerous, but all are for minor additions or clarifications to enhance this valuable research.

2-8: signification to significance

2-15. Be consistent on spelling of Urumchi

3-3: Change Pelto (2011) to Pelto et al (2013)

Figure 3: Conveys important information, this could just as easily be conveyed in a table if there are production advantages to that.

5-14: Is the superimposed ice evidence indicative of persistent or transient existence?

7-7: Later in the paper it is worth simply mentioning the overall retreat observed on the three glaciers and how that fits into the negative balance regime.

8-18: Given that a couple of the references are related to the study I would add Mernild et al (2013) and Pelto et al (2013) where this is also discussed and are already references used elsewhere in paper.

8-25: Is the contrast with snow to firn weak for the terrestrial camera or just satellite images?

9-4: The initial position being the GPS location at the time of emplacement?

9-9: The extrapolation indicated is spatial. Given the field seasons occur before the end of the ablation season, is this also a temporal extrapolation model or is this different. Just clarify temporal from spatial extrapolations.

9-30: Given the issues described what is the vertical accuracy generally achieved? This is I think discussed at 13.24, but is appropriate here too.

10-8: Is the approach what Pelto (2010) and Mernild et al (2013) utilized which is TSL migration rate * balance gradient? This yields a directly observed ablation rate.

11-1: Why is the DDFs for Golubin very close to the maximum?

12-15: The approach and calibration methods are complex but appropriate. There is a simple validation that moves away from the model, that maybe what was used. That is what Pelto (2010) and Mernild et al (2013) utilized which is TSL migration rate * balance gradient. I do not suggest changing the approach, but this could be an independent validation for a few specific time periods on each glacier that is easy to apply, since both parameters are known.

13-6: Geodetic mass balance calculations do not account for internal accumulation either, unless it is incorporated in the density calculations, which typically does not occur.

13-29: Why this choice of 120 kgm-3, and what are implications vs a less conservative choice?

15-7: "These results demonstrate a relatively low sensitivity of the presented model to daily meteorological input data compared to mean seasonal data. . .

16-10: Section 4 was an excellent detailed summary fo the approach to determining errors and sensitivity. How did that lead to the error numbers here which are somewhat higher than I expected after seeing the details in Section 4.

18-9: The more negative balance years on Golubin and Abramov is where the TSL method generates more negative results. Could this be a reflection of melt low on glacier outside of ablation season that TSL does a better job of capturing? If this cannot be addressed to advantage than do not.

21-1: Could utilize Shea et al (2015) as well for support they found almost the same value for the Mount Everest region, different climate setting but still a high altitude monsoon influenced area. Wu et al (2011) also determine DDFs for Urumqi Glacier that could be referenced.

21-6: Why the large divergence for Abramov Glacier after 2009 between the constrained and unconstrained model?

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22-15: The TSL observations also represent a direct point balance observations of considerable value.

23-9: Consult and refer to Bazhev (1986 or 1973) who directly measured the internal accumulation in firn on a glacier in the Pamirs and Abramov glacier. Found that almost all meltwater refroze in upper four layers of firn and the amount was in the 0.20 m/a range, this supports the approached used here. Further it is worth mentioning that such a study of internal accumulation should be redone some year as part of the mass balance program. Miller and Pelto (1999) observed a reduction in internal accumulation, on Lemon Creek Glacier, Alaska which if it occurs has impacts on the energy balance.

Figure 12: I do not think this is needed, if included redesign as the visual message is not well communicated by the approach used.

25-12: Worth noting that a SCAF time series such as in Figure 5 is also a critical value for water resource modelling, because of the different DDFs and DDFi values. Bazhev, A.: Infiltration and run-off of meltwater on glaciers. IASH Publ. 95 (Symposium at Cambridge 1969 – Hydrology of Glaciers), 245–250, 1973.

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