

Interactive comment on “Improving estimation of glacier volume change: a GLIMS case study of Bering Glacier System, Alaska” by M. J. Beedle et al.

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I commend the authors on an interesting article that identifies the area of the Bering Glacier, the accumulation area ratio (aar), and then calculates the mass balance. The glacier area, aar and mass balance derived all are in line with expectations based on regional mass balance records. The importance of being able to assess such a large glacier using satellite imagery and a balance model is crucial to understanding the impact on sea level rise. The aar values of Bering Glacier are low, which indicates a glacier well out of equilibrium. This point has not been well referenced or emphasized enough. The following comments are targeted at helping the authors better support

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the statements made.

171-14 References indicate that using satellite imagery to define glacier area and mass balance is a very recent development. Whereas several papers 20 years ago utilized satellite imagery in an attempt to determine accumulation area ratio and mass balance.

176-1 Nomenclature for the various hypsometries are not logical nor presented at the same time. The reader is left trying to dig for the true meaning of each acronym. The four hypsometries should be identified at the same time and it would be better to have a more sensible nomenclature if possible.

176-4 What was the threshold for identification of debris cover. There are areas that are or nearly 100% debris covered and others where debris cover is either much thinner or more dispersed, such as the surge medial moraines.

181-21 The balance gradient from Taku and Columbia Glacier have been determined, the former more accurately and repeatedly and are certainly used in PTAA and balance gradient development here. This should be acknowledged and shown in a diagram. This would lend credence to the gradient utilized.

185-14 Problems in identification of the glacier divide. Has any attempt been made to use SAR interferograms, such as Lingle has used in examination of surging of this glacier?

184 The cited aar ranges from 50-80 for equilibrium conditions of non-calving temperate glaciers is a bit broad. Studies of Alaskan glaciers have been made and there are not any non-calving glaciers in equilibrium or advancing with an aar below 55. An aar of 43 and 46 it should be emphasized are notably below that which would maintain equilibrium on any temperate maritime glacier. This is further supporting evidence for the mass balance reported by the authors. The mass balance of the Bering Glacier can be put in perspective further by comparing to the aar of other glaciers in Alaska where either the mass balance is known (Taku, Lemon, Wolverine, Gulkana). It could also be

put into perspective versus the aar of many glaciers where long term terminus behavior indicates the long term overall balance is known such as in numerous publications by (Post, Viens, Pelto, and Mayo). That will put into context the aar, and consequent mass balance of the Bering Glacier. One or both of these means should be pursued.

191 Tangborn reports on PTAA versus South Cascade Glacier, but should reference vs Lemon Creek or Gulkana, the former has been done by Tangborn. This model deserves a regression diagram showing its relative accuracy. Is the ELA which can be identified in many years from Austin Post photographs and satellite imagery used in any way as a tie point for the model or as an independent test.

193-7 Does the statement that the Arendt (2006) mass balance change is about half that of the PTAA model reflect that Arendt (2006) only examined half the glacier in terms of area? If we then apply the average surface change to the whole glacier would not Arendt (2006), been on target. Or have you extrapolated the Arendt (2006) observed changes over the entire glacier?

201-203 Table 3-5 are similarly formatted, which helps with relating them. However, I would prefer to see them either combined in one table or a bar chart showing column 1 and 2 data for example.

209 In either Figure 2 or 6 it would be helpful if the general ELA could be indicated, that is an important as the debris covered area.

Interactive comment on The Cryosphere Discuss., 1, 169, 2007.

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