

Interactive comment on “Geometric changes and mass balance of the Austfonna ice cap, Svalbard” by G. Moholdt et al.

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Moholdt et. al. (2009) provide a thorough description of the methods and results from surface elevation and ice thickness profiling campaigns and Austfonna. The work is well described and provides an excellent benchmark for future comparison. One issue that demands further attention for the interpretation of the 2002-2008 thickness change results to be more robust and complete, is annual surface mass balance change. In the absence of significant glacier flow the surface balance should be the key to the observed surface elevation changes. Limited attention is given to the impact of either a more positive balance trend from 2004-2008 or a more positive general balance 2002-2008 leading to the increased thickness changes in the accumulation zone. Annual ELA data is needed since this should closely approximate the thinning-thickening tran-

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sition elevation. This issue can be addressed easily with the data in hand and I look forward to reading the results with this added level of scrutiny incorporated.

Comments in order of appearance not significance;

858-17: dormant should be replaced with stagnant

859: Much of the material in this paper focuses on the changes with elevation of the surface elevation or mass balance. It would be useful to the reader to have a map that shows the ice cap with readable and identified 100 m contours.

861-16: For comparison to Pinglot et. al., (2001) mean summit accumulation which is referenced, what did the 2004-2008 mass balance show at the summit area?

861-20: Does the GPR indicate that point measurements provide a good measure of the surface balance? Simply a reference or one sentence would do.

861-22: Several mass balance assessment methods utilized from 2004-2008 are noted, followed by the observation that accumulation rates vary markedly from year to year and not the pattern. This makes complete sense; however, the magnitude of these variations are not discussed here or later on page 864.

864: Since a stagnant flow situation should result in thinning below the ELA and thickening above, how closely is the transition elevation from thinning to thickening in Figure 3 approximating the ELA? The ELA should be reported somewhere for each year. Walemarbreen's ELAo reported to WGMS is about 270, the ELA for 2002-2005 reported to WGMS was 390 m, 430 m, 400 m and 429 m. This would imply the transition on this glacier should be close to 400 m for that period, if this is not the case why not.

873-7 and Fig 1c: The change rate as noted for 1c is less than 1a or 1b. However, the main difference I observe is that the transition from negative to positive thickness change has shifted toward the summit of the ice cap significantly for the 1983-2007 period compared to the 2002-2008 period various periods Fig. 1a and 1b. This shift is not examined in the text. Is it simply not robust? What this shift potentially implies is a

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more positive balance and a shift downward in the ELA for the latter period.

Fig. 3d This reinforces the previous two comments. The elevation where the fitted lines cross into positive thickness changes are 150 to 200 m higher for the 1983-2007 period than for the shorter periods of 2002-2008. Is this related to a more positive balance for the period, or simply the trend within the period from the very negative balance of 2004 to the positive balance of 2008. This is point that needs more attention. In the absence of significant flow the annual surface balance changes should be determine the observed elevation changes. Does the negative-positive intersection elevation for any of the periods match the ELA observations for the mean ELA for the period?

Figure 5: Are the point observations the mean of the 2004-2008 observations at each point?

Interactive comment on The Cryosphere Discuss., 3, 857, 2009.

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