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

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Thank you for a useful review. The technical comments will be followed up in the final manuscript. The specific comments are answered below:

P860, L19: A reference to Dowdeswell et al. (1999) will be included regarding the velocity structure of Austfonna. The average 2004-2008 velocity of the 13 stakes in Fig. 1d was 5.2 m y^{-1}, so you are right that the ice cap is not truly stagnant. As suggested; 'stagnant' will be replaced by 'slow-moving' throughout the text, and stake velocities will be plotted in Fig. 1d.

P861, L5: The two weather stations are located along the Etonbreen mass balance transect at elevations of 370 m and 540 m. The locations will be plotted in fig. 1d.

P865, L1-L8: The DEM used in this paper is constructed from differential SAR interferometry with ground control points from ICESat. The purpose of the ground control points is to precisely refine the interferometric baseline. We used ICESat data from the winter season in 2004, 2005 and 2006 in order to cover all ICESat ground tracks. The absolute DEM elevations will indeed get closer to the ICESat elevations as a whole, but the local slopes should not be affected since ICESat data are only used to reconstruct the overall geometry of the SAR acquisitions. We will clarify this issue in the final manuscript.

P868, L21: The average density of the winter snow pack measured in snow pits is typically 0.35-0.45 kg m^{-3}, while the density of the firn pack varies more with depth and location due to ice layers of varying frequency and thickness. In terms of net mass balance calculations, we need the density of the uppermost annual firn layer which has been sampled in a few spring season snow/firn pits. We also have firn density measurements from shallow ice cores (Pinglot et al., 2001) and neutron probe profiles (Brandt et al., 2008; Dunse et al., 2009). Based on these data, we chose to use a constant firn density of 0.50 kg m^{-3} to calculate surface net mass balances at stakes in the firn area. If we assume a firn density uncertainty of $\pm$0.10 kg m^{-3}, the corresponding uncertainty of the 2004-2008 area-averaged net mass balance would be $\pm$0.02 m w.e. y^{-1}.

P873, L8: The sentence will be deleted.

P878: References to other glacier regions with similar change patterns will be added.

Fig. 1: Fig. 1d will be moved to 1a, and the other figures will be moved accordingly.

Fig. 4: Ok.

Fig. 7: The total error is the root-sum-squares (RSS) of the individual error components. However, it will be slightly misleading to do this within elevation bins in the plot since there are two random errors and one systematic error that should not be com-

bined. Instead, we first calculate glacier-wide random error components (Eq. 3-5), and then we combine them as RSS in the overall mass balance error (Eq. 6).

References:

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Dowdeswell, J. A., Unwin, B., Nuttall, A. M., and Wingham, D. J.: Velocity structure, flow instability and mass flux on a large Arctic ice cap from satellite radar interferometry, Earth Planet. Sc. Lett., 167, 131-140, 1999.

Dunse, T., Schuler, T. V., Hagen, J. O., Eiken, T., Brandt, O., and Høgda, K. A.: Recent fluctuations in the extent of the firn area of Austfonna, Svalbard, inferred from GPR, Ann. Glaciol., 50, 155-162, 2009.

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