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Interactive comment on "Decadal changes from a multi-temporal glacier inventory of Svalbard" *by* C. Nuth et al.

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Nuth et al (2013) completed and review the most extensive inventory of Svalbard glaciers to date. The figures in this paper are exceptionally informative. The paper and inventory will be an important addition to our current and future ability to analyze and understand glacier change in Svalbard. The authors need to more carefully address the response time issue. The main weakness of the inventory is the lack of a fixed time period for which the glaciers are analyzed. This is presently an unavoidable issue for this inventory that includes the important characteristics in Figure 5, and is not focused primarily on area and length change.

Specific Comments:

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2497-5: Why is 10% a threshold at which the centerline length change is no longer used?

2501-4: The changes in central Spitsbergen are the largest in Figure 6b as noted, based on Figure 5 this is a region of dominantly smaller glaciers, which is worth noting.

2502-14: or 2507-21: Would not increased area/width length changes during Epoch 1 help lead to greater centerline length change in Epoch 2?

2505-21: This inventory does not meet this definition as it is not one point in time, consider rewording.

2505-28: Johannesson et al (1989) compared two means of calculating Tm: Tm=f L /u(t) (1) Tm=h/-b(t) (2) Tm in these equations is dependent on four variables: L the glacier length, u(t) velocity of the glacier at the terminus, h the thickness of the glacier, and b(t) the net annual balance at the terminus. The former equation, which was proposed by Nye (1960), typically produces longer full response times of 100 to 1000 years, the latter full response times of 10 to 100 years (Johannesson et al, 1989). The variable f is a shape factor that is the ratio between the changes in thickness at the terminus to the changes in the thickness at the glacier head (Schwitter and Raymond, 1993). Pelto and Hedlund (2001) observed that equation 1 overestimated Tm and because of the wide spatial variability of u(t), it is not expected to yield a consistently accurate result on small land terminating alpine glaciers such as in the North Cascades. The second equation however is designed for glaciers where ablation is the dominant loss process. For calving glacier ablation is often not the dominant loss process. Further for calving glaciers as we have witnessed, calving often enhances the response to climate. For non-calving glaciers flow typically declines near the terminus, whereas for calving glaciers the velocity typically increases. The result is for calving glaciers a faster response to climate change using equation (1) than for equation (2). If you mention response time, the second approach must be mentioned and would likely be a more valuable approach for calving glaciers.

2506-6: This statement of still responding to previous climate changes is particularly true for Epoch 1 as it is much longer time span. In Epoch 2 much of the change should reflect climate changes during Epoch 1 and Epoch 2.

2506-19: Figure 8 illustrates what appears a clear regional signal of greater retreat in Epoch 2 in southern Spitsbergen and less in northeast Spitsbergen.

2508-21: Is it worth citing Kohler et al (2007) who noted the recent increased thinning on the upper section of Spitsbergen glaciers, that represents a volume change, but less of an area change?

Figure 8 better identify inset map location in the caption.

Johannesson, T., Raymond, C. and Waddington, E.: Time-scale for adjustment of glacier to changes in mass balance. J. Glaciol., 35(121), 355-369, 1989. Kohler, J., James, T. D., Murray, T., Nuth, C., Brandt, O., Barrand, N. E., Aas, H. F., and Luckman,A.: Acceleration in thinning rate on western Svalbard glaciers, Geophys. Res. Lett., 34, L18502, doi:10.1029/2007GL030681, 2007. 2491 Pelto, M.S. and Hedlund, C.: The terminus behavior and response time of North Cascade glaciers. J. Glaciol., 47, 497-506, 2001. Schwitter, M.P., and Raymond, C.: Changes in the longitudinal profile of glaciers during advance and retreat. J. Glaciol, 39(133), 582-590, 1993.

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