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Interactive comment on "A model study of Abrahamsenbreen, a surging glacier in northern Spitsbergen" *by* J. Oerlemans and W. J. J. van Pelt

Anonymous Referee #2

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The main goal of the study is to quantify the climate sensitivity of Abrahamsenbreen. and to predict its future response to climatic variations.

Next to nothing is know about he glacier forming the subject of this study. Glacier bed is not known. Mass balance it not known either. Surface velocities are not known. Past length variations are not known.

The glacier is a surge-type glacier. The duration and frequency of surges is however not known. It is not even known in which phase of a surge cycle the glacier currently is. Flow velocities are also not known, but average estimates of velocities in some areas are calculated from locations of looped moraines (1969, 1990, 2001). For the two time intervals, two very different velocity values are obtained. These numbers are then translated into surge and non-surge displacements. However, since the timing

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and the duration of surges in apparently unknown, it is unclear how this can be done. In the model calculations is it assumed that a surge lasts for 2.5 years and a surge cycle 125 years. These numbers are varied in sensitivity tests.

The manuscript uses lots of descriptive words like, small, significant, dramatic, rather similar, and so on. Sometimes is possible to understand, or at least to guess, why the authors consider something to be small, large, etc., for example, when they are discussion results shown in figures. But in many cases the meaning is unclear.

The main question that I struggled with as I read the paper was if they authors are actually modelling Abrahamsenbreen. Giving the fact that just about all glacier parameters (thickness, velocity, mass balance distribution) are not known it is difficult to see how this is a study specific to that glacier. I also find it hard to see how one can have confidence in the model results giving the fact that the model is not tested against any data.

The authors seem to argue that since little data is available for so many glaciers, it is worthwhile to use simple models to gain as much insight as possible. I agree with this in principle. Using simple models that capture the essential physics can be highly valuable. But there must be a limit to this approach. If next to nothing is known about a glacier, then one can question if a model study can really tell us much about that particular glacier in a quantitative way.

It might also be argued that it is somewhat questionable to send out the message to the wider community that one does not need to know thickness, velocity, or mass balance, to predict the future of glaciers. What one can do is to gain insight into the general response of glaciers, but a quantitative predictions can hardly be made without actually knowing something about the geometry, ice flow, and the mass balance.

The study has some value as a general discussion about glaciers in Svalbard and as an illustration of how sensitive these glaciers can expected be to changes in surface mass-balance. If the authors would be interested in rewriting and refocusing the paper

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along those lines, then a publication might be warranted. However, as that would imply almost complete rewrite of the paper, I see that option as a submission of a new manuscript rather than modification and resubmission of the current one.

Interactive comment on The Cryosphere Discuss., 8, 5687, 2014.