

Interactive comment on “Velocity structure, front position changes and calving of the tidewater glacier Kronebreen, Svalbard” by M. Sund et al.

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This manuscript aims to test calving criteria using data from Kronebreen, a tidewater glacier in northwest Svalbard. They present their detailed dataset from field study and some of the methods they used. They discuss different factors and their influence on calving and glacier geometry and make a conclusion that the water-depth at the glacier front is the controlling factor for glacier retreat (water-depth model) and that the crevasse-depth model cannot explain the calving events. However they fail to provide convincing arguments for their conclusion.

I would recommend the authors to rewrite the manuscript in a different form and resubmit it again. I think although their approach is potentially very valuable but the presentation of their ideas and results are uncoordinated and the arguments for their conclusion

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are not scientifically convincing. I suggest that they provide more data (longer period), which can allow them to draw a convincing argument for their conclusions. I strongly encourage them to rewrite their manuscript in a well-structured way and investigate different calving models with better data as I really like to see results from such an approach on different type of calving glaciers.

I believe that the manuscript is not written in an appropriate and balanced way. The overall presentation is not well structured, which makes it very difficult for a reader to follow their explanation. Their results and discussions are confusing. Language is not fluent, there unnecessarily too long sentences. I had to read some parts of it three or four times to understand their point. Presentation and order of figures are very poor. Figure captions are not clear and some times doesn't agree with the text.

The authors try to discuss many different aspects and controlling factors but they fail to explain any of them in a proper way. Their main concern is to investigate which calving criterion (water depth model or crevasse-depth model) can explain the observed calving on Kronebreen. They conclude that crevasse depth model is not valid. Their conclusion is not valid for below reasons:

1. Comparing calving events with velocity data is not valid for testing this calving criterion; they should plot the stretching rate along the flow line and its changes in time. Then compare it with calving rate.
2. They don't present the calving criterion truly. Equation 1 in the result section, section 4.2, $d=2/g (\epsilon_{xy}/A)^{1/n}$ they don't consider the water pressure in this equation. Are the crevasses in Kronebreen water free? By including that a crevasse depth (or calving) can be linked to surface melt rate as well.
3. They should note that the calving criterion suggested by Benn et al. is considered as a first order approximation of the position of the glacier terminus, relating the calving to stretching rate and surface melt. This criterion is not meant to explain individual calving event. To check such a criterion they should use much longer data set. The

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period they look at velocities and calving is too short to make any valid conclusion. I am aware of more data available for calving and velocities in the same year (I have seen a presentation by A. Chapuis, showing extensive data set for calving rate and velocities for longer periods).

4. Their conclusion is based on long-term data to validate the water depth calving criterion and based on a short period in summer 2008 to test crevasse depth calving criterion. To make a valid comparison they need to present more data (esp. bed topography from J. Koler and more available velocity and calving rate data from Chapuis et al.) and compare both criteria for the same data set.

They also discuss the changes in surface elevation and talk about the history of the glacier surge and glacier terminus position, which are interesting but in this paper doesn't add any credit to their results. Perhaps it could be interesting to show these data in a different paper, more focusing on behaviour of the glacier in the last century and discuss Kongvegen surge and its influence on the Kronebreen ice flow and geometry.

Interactive comment on The Cryosphere Discuss., 5, 41, 2011.

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