

Interactive comment on “Frontal destabilisation of Stonebreen, Edgeøya, Svalbard” by Tazio Strozzi et al.

Anonymous Referee #1

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Strozzi et al. presents their study about the dynamic changes of Stonebreen located in the southeast of the Svalbard archipelago. Using remote sensing (mostly SAR), they have reconstructed the surface ice velocity since 1994. The glacier shows a strong acceleration from 1994 to 2016 superimposed with very strong seasonal variations (<0.5 km/yr in winter to >2 km/yr at the end of summer). The authors discuss the different causes for the glacier destabilization. They conclude that surface melt-water and/or warm ocean water could be the cause of such changes.

I do not see any issues with the processing and analysis of the different remote sensing data sets (surface ice velocity changes). The results shown here are solid and should be published.

On the other hand, the discussion about the potential causes for the glacier accel-

C1

eration is not well supported due to the lack of other external data (bathymetry, ice thickness, ocean water temperature). The authors are seeing strong seasonal variations of the ice speed and mention the frontal ablation as a cause for the observed changes. To better prove this interaction, I think it would be interesting to show the seasonal position of the terminus corresponding to Figure 9 and Figure 10 and see if they are linked to seasonal speed changes. Although the authors rule out ice thickness changes as the cause of the recent speed fluctuations, I still believe that the combination of higher input of melt-water and ice thickness reduction could have triggered this surge-type behavior.

The glacier shows similar behavior that other “surge-type” glacier such as Pío XI in Patagonia (see Fig. 2c in Mouginot and Rignot 2015), which presents similar features such as shallow bed below sea level at the terminus, large thickness changes, strong seasonal and annual variations, and large melt water production. I believe a comparison with other glaciers in the region or elsewhere would be interesting. In other words, is the behavior of Stonebreen glacier unique, and if yes, in what sense?

Below are the minor comments on the document:

Page 1

L10 don't -> do not

Page 2

L1,2 : unclear. If at steady state, calving fluxes are always the same order of magnitude than surface mass balance. The authors probably meant that mass fluctuation in Svalbard is similarly controlled by both dynamic and SMB changes.

Page 5

The authors mention ERS data with 3-day repeat cycle are not suitable for speckle tracking. I wonder if the authors looked at longer repeats (6 to 36 days). I know in Greenland such pairs are sometimes available, is it the case over Svalbard ?

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Page 6

The authors did not mention ionosphere noise in your ALOS error estimation. It is probably very small (not visible in Fig. 5a) or is it a source of error here ?

Page 7

I think a reference would be needed for the computation of speed changes from increase in slope.

Page 11

L21: "Total contribution to sea level..." sentence is not clear as described here. If the authors look at the calving flux, they have to compare to the surface mass balance. they could assume that surface mass balance was equal to zero (no discharge and glacier in balance), but if they do so, they should state it. In conclusion, more details on contribution to sea level needed here.

Page 12 or 13

I think the derived data sets should be made available to the scientific community. A sentence in the conclusion or acknowledgments where to find them would be great.

Table 2 could be added as supplemental material. I see that Landsat-8 pairs are not a factor of 16 days (nominal repeat cycle), which means that the authors used different path/row to compute ice speed. It is a potential large source of error due to topographic effects (even with the orthorectification from USGS). I would recommend using only identical orbits as done for SAR sensors.

Figures should be vector graphic rather than raster.

Fig. 1

If Stonebreen glacier is the glacier shown in Fig.1c-d, I think the label Stonebreen in Fig.1b should be placed differently. Perhaps an arrow pointing to glacier would do.

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Fig. 2

The background is not contrasted enough, which makes the map difficult to read

Fig. 5-8

These figures could be combined in one figure.

Fig. 10

Although obvious, blue and red dots should be explained in caption. Corresponding terminus position would be a must.

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