

Interactive comment on “Surge dynamics on Bering Glacier, Alaska, in 2008–2011” by E. W. Burgess et al.

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The manuscript by Burgess et al. is a valuable contribution to the available observations of the temporal evolution of surge dynamics. It seems that feature and speckle tracking methods reached a state where they are used by a wider community in glaciology to investigate transient behaviour of glaciers. There are a number of papers published recently on surge investigations by this method which might be useful to consult. Especially for surging glaciers this is a valuable tool, because it is possible to obtain distributed surface velocity fields at a reasonable temporal resolution. This manuscript exploits radar satellite imagery in order to describe the surge events on Bering glacier during a period of about three years. The most striking feature is the double phase surge pattern, even though the second phase is only rudimentary documented by one

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image pair on a small section of the glacier. The strongest benefit of this manuscript is the detailed description of the first full surge cycle which provides a very interesting insight into the development of fast flow. However, it stops more or less on the descriptive level, without going into too much depth of surge mechanics and surge initialisation. Even though the manuscript is worth to be published as a valuable document of surge observations, after some improvements have been done. I mostly agree with M. Peltos R.J. Motykas comments and do not need to repeat them here. In my opinion the description of the glacier system is not detailed enough to provide the reader with the necessary information for understanding the whole system. Therefore the introduction should be extended with a paragraph about the geographical setting, including the climatic conditions in this region. There is no clear information given about the impact of the surge on the glacier front. I assume that there was no surge initiated advance of the glacier. Why did the mass redistribution stop at the front, not pushing the glacier forward into the pro-glacial lake?

Specific comments:

1183, 1: redistribution of mass thickens the glacier terminus already during the surge in dependence of the active surge zone.

1183, 1-5: It is important to note that changes in driving stress are always influenced on a local scale only. Mass redistribution on a large scale does not change the driving stress significantly.

1183, 4: AK is Alaska; readers outside US are not so familiar with state abbreviations

1183, 14: what is meant with ice loss? Imbalance?

1183, 17: could you give some magnitude to the “steady retreat” of Bering glacier?

1183, 26: it might be a good idea to compare these velocities already here to velocities of the quiescent phase. It is mentioned later, but it would be good to get the information about the magnitudes already in this context.

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1183, 29: the surface undulation propagated downstream from where?

1184, 12: do you really mean acceleration rates? What is longitudinal acceleration? Increase of surface speed along the horizontal direction?

1184, 17: In my opinion it would be a clear improvement to present a more detailed description of the glacier, including probably a longitudinal elevation profile. This shows e.g. local plateaus at location where also surge related phenomena are discussed (just downstream of the influx of Jeffries glacier for example there is a break in the slope). Also the flow pattern is not clear from Fig. 1. Only rather late in the manuscript the reader becomes aware that Tana glacier is actually flowing the opposite direction than West Bagely.

1184, 24: there is a noun missing, I guess these are all products.

1185, 7: How many pairs are finally used for the analysis? The description is not really clear about that. Maybe a table with all pairs including dates, baselines, coverage region would help?

1185, 10: Which method is meant using statistical correlation?

1185, 15/16: Is it possible to describe the coverage of the scenes? No single scene probably covers the entire glacier and it would be beneficial to know how the scenes need to be combined for a full coverage.

1186, 3: What is the criterion for detecting erroneous offsets? ASTER GDEM needs a reference and also it needs to be explained why ASTER GDEM is used. What is the quality in this region?

1186, 11: It is understandable to divert the flowline, in order to obtain a better coverage, but you need to give some information about the consequences. How is the velocity field influenced by this? What is the velocity gradient across glacier in this region?

1188, 5: Are there any publications about this reduction in accuracy and which intervals

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are suitable?

1189, 12: I guess it is meant BG instead of BGS? In the introduction Bering glacier is defined as subregion of BGS, but in the chapter 3.3 and later this is mixed up again. Please make it more consistent.

1189, 15: please quantify the higher velocities.

1189, 16: it is not obvious for me that the velocities accelerated in this period.

1189, 18: What kind of visual observations? Field visits?

1189, 19: winter 2011 is winter 2010/11 I guess?

1189, 25: please make it more clear that the TerraSAR-X data are only a snapshot of part of the glacier for one observation span in the second surge phase. The title of the manuscript already raises expectations that the full time span 2008-2011 is covered with observations. But for the last 14 months there is only this one locally restricted data frame.

1189, 28: strain rates are calculated not observed.

1190, 8-10: these numbers are not obviously derivable from the figure 2. For me the timing is not convincing on the basis of the figures.

1190, 13: this should probably read "lower Bering"?

1191, 10: the equilibrium line position needs to be included in the introduction, otherwise nobody has an idea about its location.

1191, 13/14: what is the acquisition time of the ASTER GDEM in this region? How compares the ASTER GDEM with the LIDAR data?

1191, 17: what do you mean with changing geometry provided by the altimetry? Primarily slopes I assume?

1191, 19: driving stresses did not increase everywhere of BIV and upper Bering.

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1191, 20: 1995-2000 is mentioned twice.

1192, 5: what is the dynamic balance line? The interesting stuff seems to happen in the region where you do not have good data coverage (you diverted the flowline here). This might indicate that the surface expression has something to do with the processes involved.

1192, 14: The distance of 123 km is surprising. Before you talk about 120-130 km and on page 1194 it is 125 km?

1193, 2: BIV is probably meant.

1193, 11: here it is the first time mentioned that Tana glacier drains part of the BIV, why not in the introduction?

1193, 26: thickening in the accumulation area caused slight "local" increases in driving stress.

1194, 4: the observations might be similar, but Medvezhiy glacier has a quite different geometry and scale.

1194, 7: there might be also frontal processes which influence this behaviour.

1194, 13/14: This sentence is not clear to me.

1194, 16: here the distance scale is turned around which makes it more difficult. Is it possible to give this location according to the distance scale of figure 1?

1194, 20: suitable bed conditions is only speculation, I guess?

1194, 26-28: This would be a suitable place to present some ideas about basal water pressure and the likelihood of its changes. It is probably also a matter of meteorological conditions and timing within the year.

1195, 5: From many glaciers I know fall is not the season of typically low glacier velocities.

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1195, 8/9: could the step in the altimetry of the glacier have something to do with this termination of the active surge zone?

1195, 20: is Tana glacier not part of the BGS?

Fig. 1: Would be great to see also a velocity map of the "fast phase" in order to see the coverage of the tracking results and the differences compared to quiescent flow. What is the basis for the background.

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