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Interactive comment on "Surge dynamics and lake outbursts of Kyagar Glacier, Karakoram" *by* V. Round et al.

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This manuscript presents an interesting combination of remote sensing and in situ observations concerning the interaction between glacier surge and glacial lake outbursts. Kyagar glacier is known to be the source of glacier lake outburst floods, but only recently it was recognized that it belongs to the family of surge type glaciers. In the upper Shaksgam Valley, glaciers reach far down the tributary valleys. These glaciers pose a potential danger by blocking the main valley and retain the river discharge in glacial dammed lakes. This combination of a surging glacier and the possibility to create a large and potentially unstable water reservoir makes Kyagar Glacier a very interesting study subject.

The authors demonstrate very well how modern remote sensing information can be

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used to characterize the temporal evolution of glacier changes, not only by describing the area changes but also by inferring the dynamic situation and the mass transport. They also connect the surge termination with the characteristics of the outburst flood, which adds valuable information to the paper. In general, this paper is well structured and provides a good insight into the evolution of the surge. Even though the described surge dynamics do not reveal a new situation, this manuscript contributes very valuable information about another surging glacier in this region. There are only a few minor points I want to raise in order to hopefully improve the paper.

Specific remarks: P. 2, l. 1-3: I do not agree that the nature of glacier surging in High Mountain Asia is unknown. The mechanisms are described for different glaciers across the Karakoram and the Pamir. The recent collapse of the glaciers in Southern Tibet, just reveals that there is more to investigate about accelerating glaciers besides the known surge phenomena. P. 3, l. 4-11: This is a truly interesting relation between GLOF and surge timing. If you state that GLOFs are generally linked to the active surge phases, it might be worthwhile to mention Hoinkes (1969) who describes one of the very few other situations where the GLOF occurrence is clearly linked to surge activity: H.C. Hoinkes, 1969, Canadian Journal of Earth Sciences, 6(4), 853-861, doi:10.1139/e69-086 P. 3 l.32: It is preferably to use “North Gasherbrum Glacier” in order to distinguish from “South Gasherbrum Glacier” which flows into the Baltoro Glacier system. P.3: There should be a not in the Introduction, that the glaciers of the upper Shaksgam valley seem to be prone for surging, because apart from Kyagar and North Gasherbrum Glacier also Urdok Glacier clearly shows signs of former surge activity (e.g. Kotlyakov, 1997; Copland et al., 2011). P. 5, l.9: Is the monitoring station 600 m upstream, or 500 m as noted in the caption of Fig. 3? P. 6, l.23: What is the reason for progressively updating the master scene for the TanDEM-X data? P.7: Are you sure that the lake is only formed during surge phases? P. 9, 28/29: as the SAR system is a side-looking system, the baseline is perpendicular to the flight direction. Perpendicular to the line of sight might be misleading. P. 10, 7-11. These two sentences are somehow describing the same thing. Maybe consolidate to one sentence. P. 10/11, l.

31-35and Fig. 5: A comparison of a sequence of dry to wet images during the onset of snow melt gives an indication of penetration depth. A sequence of wet to dry conditions will not give the same results, because it is not possible to judge the snow height by remote sensing data independently. Why should a 2 m height difference between August and December indicate a 2 m penetration depth? Given that surface melt is terminated in August (no surface height change by melt and compaction afterwards), new snow on top of this surface will result in a higher surface elevation in subsequent TanDEM-X DEMs. The height difference in this case depends on the amount of snow and the snow humidity. Given that the entire snow column above the August level is dry in December, a 2 m elevation difference only indicates that there must be at least more than 2 m of snow. Unless there is a dynamic effect during this period. If the penetration depth is actually 2 m, the snow depth needs to be 4 m in order to produce a 2 m elevation change in the DEMs, which is rather unlikely for the end of December. P. 16, Fig. 10: It might be a good idea to include the longitudinal profile again in the figure and indicate the distance along the flow line. This helps to relate the velocity profiles to the elevation changes. P. 19, l. 15/16: Is there a reason for such large ELA changes over a short distance? P. 22, l. 20-24: How does this relate to the fact that the summer of 2013 probably has seen the most intensive melt amounts, according to the PDD calculations? After such an ablation season, I would expect the drainage system to be very effective. P. 23, l.4: A survey of existing photographs of Kyagar glacier back to the 1920s reveals that the surface of the glacier constantly is extremely rough and broken. This indicates that drainage of surface melt water into the glacier is rather effective. P. 23, l 24ff: this is also seen at other glaciers in the Karakoram. E.g. at North Gasherbrum Glacier also only the flat part below the ice fall is affected by the surge. P. 24, l.14: as you already have calculated the PDD sums, this relates to a realistic degree day factor of about 9 mm/° day. P. 24, l. 20ff: There is an interesting discussion about discharge amount and discharge seasonality in Ng et al., 2007. Climatic control on the peak discharge of glacier outburst floods, GRL, doi: 10.1029/2007GL031426

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