Response to Reviewer #2, Dave Rounce:

Dear Dave,

Thank you for your careful and positive review. Thank you also for the comments and questions, which will improve the manuscript's clarity. We will certainly reconsider the figure size (and especially the font size within the figures) to improve their readability for the revised manuscript. We respond to your specific comments individually below, with your comments appearing in blue italics and our response in normal text.

Kind regards,

Evan and Co-authors

Figure 1 – There is a lot of information in this figure, but I found key aspects of the figure a bit difficult to read. For example, this figure introduces readers to the general area, so the names of the glaciers should be clear (they are very small and hard to read). After looking at the figure for a while, the inset figure clearly shows the maximum area, but the legend does not state this nor is this mentioned in the caption. I would simply make note of this in the caption, so the reviewer knows they are looking at how the maximum lake extent fills and drains. If possible make the text larger.

Thank you for the suggestions. We will certainly increase the font size in this figure (and others) for key aspects, and will include a reference in the caption to the display of maximum lake area in the inset figures.

P3 L23-28 – Does this mean you avoided all areas that had a supraglacial pond or ice cliff in the previous year? Please add a sentence here detailing how you identified areas where surface lowering was not attributable to cliffs and ponds, since it is not very clear.

Regarding this section, we agree that this text was slightly ambiguous, and should be clarified. The current text reads 'not solely attributable to ice cliffs and supraglacial ponds' and later mentions 'clearly associated with the lake drainage.' By this we do not mean that cliffs and ponds were entirely excluded or played no role, but that we could not explain the zone of surface lowering only by the presence of cliffs and ponds. Our rationale appears below, but we will carefully modify the text to succinctly describe that we have avoided pond water-level lowering and areas that had a thin, arcuate form, but focused specifically on broad areas of enhanced elevation change with initial changes visible in the Planet imagery.

The delineation process for zones of enhanced change focused on identifying zones of considerable elevation change with three key characteristics:

1) We first ensured that zones of elevation change were not attributable to pond water level change. This is straightforward to avoid as such zones would have been ponds in the March Pleiades image.
2) We aimed to identify zones inexplicable by ice cliff backwasting. Backwasting rates for Khumbu Glacier are 1-6 cm d^{-1} (Watson et al, 2017), depending on season and local characteristics. Over the period between our two Pleiades DEMs (266 days between 23

March and 14 December 2017), this would total 2.7-16.0 m of cliff retreat. This linear change could be adjusted by the cliff's advection down-glacier (e.g. Brun et al, 2018), but Khumbu is nearly stagnant below the Changri inlet, so we neglect this.
As cliffs tend to have arcuate or linear forms several 10s of meters in length, but backwaste up to ~10 m during the melt season, the features leave a characteristic thin arc of enhanced mass loss in our dH data, which is due to the high spatial resolution of the DEM and the relatively short interval between acquisitions. We ignored these forms (clearly visible in Figure 2) entirely, but focused on broad (i.e. >40 m across), continuous areas of elevation change.

3) The third necessary characteristic is that minimal change was evident in the Planet imagery prior to the lake drainage.

Although this process was subjective, we were as conservative as possible. For example, field evidence suggested that many of the changes in the area shown in Figure 5e (location shown in 5a) were probably due to the passage of the flood, but the pattern of dH in this area appears similar to ice cliff backwasting, so we did not include it in our analysis. Without a doubt, it is not possible to entirely separate the effects of cliff and flood: the passage of water directly leads to exposure of steep, bare ice (i.e. a cliff).

P4 L9 – "by a cloud" or "by clouds"?

True, "by clouds." We will adjust this in the revised manuscript.

P5 L16 vs. L17 & L32 – I think it is better to be explicit when referring to the zones like L16 "Zone A in Figure 2"; however, on L17 and 32, the zones are just stated. I suggest being consistent throughout the text in how you refer to them. Either always refer to them as Zone _ in Figure 2, or change L16.

Thank you for the suggestion. We had decided to refer the reader to the pertinent table and figure at the first instance only, but we agree that it is probably easier for the reader if we refer them at each instance.

P7 L9 – This appears to reference Figure 4c, not 3c.

Thank you! We will adjust this in the revised manuscript.

P7 L24 – This appears to reference Rounce et al. (2017) not Rounce et al. (2016).

You are correct, our apologies! This will be corrected in the revised manuscript.

P7 L26-28 – I found this sentence unclear and difficult to read. What do you mean by "of this area in similar conditions"? Also, "examining available historic satellite image archives we have not found" does not make sense – perhaps split this into two sentences: "The area of bank erosion is greatly magnified during 2016-17. This magnitude of geomorphic change appears to be uncommon, since we were unable to find similar areas of bank erosion in any of the historic satellite image archives"?

Thank you for the suggestion, which we will implement in the revised manuscript.

P7 L29 – It appears that at least a portion of the second peak is simply due to the diurnal signal caused by the melting of the glacier. On July 14th, the flow increased by approximately 3 m3 s -1 , compared to this second peak where it increases around 3.5 – 4 m3 s -1 ; hence, it doesn't seem unreasonable that *this is simply the extra discharge coming from the glacier melt. It's timing is consistent as well. This seems much more likely than a possible blockage, since one would expect that the flood would generate very efficient channels, which would make something getting blocked unlikely.*

We certainly agree that some of the second peak is simply due to the diurnal signal, and have estimated that portion based on the diurnal discharge patterns preceding and following the event (the black line in Figure 7). The second peak corresponds to an increase of 6.5 $m^3 s^{-1}$ (see P6 L14-18; note that Figure 7 has a logarithmic scale), which is greater than the diurnal variation preceding the event.

The blockage hypothesis corresponds to the landslide in the Changri gorge, which definitely occurred on the 16^{th}. This deposit of mass would have choked the entrance to the sub-marginal drainage path, preventing access to the englacial and subglacial channels altogether, but the debris blockage would be unlikely to prevent drainage for long, and would thus be a potential candidate for one of the peaks later on the 16^{th}.

A third possible explanation, that of multiple flowpaths, has arisen from internal discussions since the manuscript submission, and we will also adapt the manuscript to briefly include it in the discussion. We think it likely that the flood's passage through Khumbu Glacier would have temporarily overpressured the subglacial system. In this case, water would try to exploit weaknesses in the ice to drain to the surface. We see evidence for surface routing of at least part of the flood from the zones of enhanced elevation change (e.g. Figure 5) and from increased turbidity of the chain of terminal ponds on the 16^{th} and 17^{th} of July. However, this does not mean that the entire flood would have been routed to the surface; instead, only the water which could not be accommodated by subglacial and englacial conduits would find its way to the surface. As the surface flowpath is inefficient (Irvine-Fynn et al, 2017), this would lead to at least two distinct traces at the Pheriche station.

We will be sure to represent all three potential hypotheses in the revised manuscript.

P8 L25 – The use of "low" here is a bit awkward. Consider "melt-inhibiting thick debris near the terminus on such glaciers" or something similar.

Agreed, thank you.

P9 L2 – "region" not "regional"

Agreed, thank you.

References

Brun, F., Wagnon, P., Berthier, E., Shea, J. M., Immerzeel, W. W., Kraaijenbrink, P. D. A., Vincent, C., Reverchon, C., Shresta, D., and Arnaud, Y. (in review, 2018). Can ice-cliffs explain the debris-cover anomaly? New insights from Changri Nup Glacier, Nepal, Central Himalaya, *The Cryosphere Discuss.,* https://doi.org/10.5194/tc-2018-38.

Watson, C. S., Quincey, D. J., Smith, M. W., Carrivick, J. L., Rowan, A. V., & James, M. R. (2017). Quantifying ice cliff evolution with multi-temporal point clouds on the debris-covered Khumbu Glacier, Nepal. *Journal of Glaciology*, *63*(241), 823–837. https://doi.org/10.1017/jog.2017.47