

Review of - *Brief communication: Rapid $\sim 335 \times 10^6 \text{ m}^3$ bed erosion after detachment of the Sedongpu Glacier (Tibet)*

The authors have analysed a timeseries of digital elevation models to understand the post-detachment geomorphic change – specifically the formation of a deep canyon in the years following the rapid removal of Sedongpu glacier tongue. The paper is well written and the exceptional changes in this catchment will be of interest to the broader community. Some modifications to the paper in order to add a more in-depth exploration of some of the mechanisms driving the pulse of incision and the broader implications of these findings are needed. I believe that these changes can be made while remaining within the constraints of a ‘Brief Communication’.

I have two major comments:

- The reason for the extremely rapid erosion between May-Sep 2021 needs to be explored in more detail. As it stands the manuscript clearly addresses the reasons for the rapid post-glacial erosion, but does not explain why the rates of erosion were \sim an order of magnitude higher during one specific period, particularly a period not immediately following the detachment. This seems like one of the most important findings and one which may have wider implications for our understanding of these extreme erosive events. Why did the deposit experience a sudden change ~ 3 years post-detachment? The limited discussion about precipitation anomalies and other potential drivers needs to be expanded and moved to the methods/results instead of the discussion.

- The balance between results and discussions in this paper is heavily weighted towards results (L35-93). Even the discussions (L94-134) dedicate quite a lot of space to evaluating the specific findings of this study with a fairly limited consideration of the larger scale implications. There is a rich literature considering topics such as the evolution of post-glacial landscapes, the magnitude-frequency distribution of sediment transport events, the relative erosion rates of glacial and fluvial landscapes, and volumes of sediment removed from the Himalaya on different timescales. I would not expect the paper to discuss all possible implications in detail, but the impact of this paper will be substantially reduced if the (very important) findings are not more effectively placed within the context of the broader literature.

Minor comments line by line:

L6 “ $130 \cdot 10^6$ ” – is there an uncertainty associated with this that can be quoted? There are a number of places throughout that volumes are given without uncertainties (e.g. L95, 96, etc), ideally these would all include an uncertainty from the discussed methods in L 60-65.

L7 remove ‘drastic’

L10 Here, as a first-time reader, I am expecting to get some information about why there was extremely rapid erosion in 2021 specifically. I am left with a few questions in mind otherwise. The sentence “The mass was transported [...]” on the other hand doesn’t add very much.

L12 Ending the abstract with a hint about the broader implications of the work would be useful.

L14-34 This introduction is very well written. Concise, yet sets the scene well.

L25 I am not entirely convinced that a detachment can be considered a direct analogy of longer-timescale glacial retreat and landscape exposure as presented here. The rate of change matters – this detachment led to the instantaneous exposure of a very large area of unconsolidated sediment, which may have been more likely to partially stabilize if exposed gradually (e.g., through vegetation growth or other processes). A slight change in wording to get this across would be useful. You do discuss this later on L120 onwards.

L36-45 I am not sure this fits within the subheading ‘2018 glacier detachment’ but is instead more general background information. Move to the intro or its own subheading?

L37 Is the Yarlung Tsangpo a ‘tributary’ to the Brahmaputra, or another name for the main branch of the same river?

L44 Reference for ‘so called elevated bed’

L52 “leaving the bed of the Sedongpu glacier uncovered by ice” is confusing. If I understand correctly then the ice was gone, so the area is no longer the ‘bed of the glacier’! Perhaps an alternate phrasing would be better, such as ‘leaving the sediment previously beneath the Sedongpu glacier entirely exposed’ or similar.

L56-64 Again, this first paragraph is not a great fit for the heading. This appears to be ‘methods’, not sure if it is best in its own heading or with the current heading modified to better represent it?

L75-79 Here is where details are seriously lacking about the extremely rapid erosion in summer 2021. The only real information about it here is “the massive erosion happened gradual, or at least in a series of smaller events”. Please expand and discuss the potential drivers of this here (meteorological data or other) and the mechanisms by which the mass may have been removed (I am guessing some form of landslide/debris flow to evacuate that quantity of material in such a short time).

L81-85 Can you explain briefly why you consider this noteworthy? This is not immediately clear. Do you think that these subsequent avalanches played a role in destabilizing the sediment pile?

L87-88 Is this necessarily remarkable for a river of this scale? Also is there definitely no volume gain at all? It looks like a delta was constructed from the optical imagery in Fig 1.

L90-92 I can understand that an investigation of the routing of this sediment pulse be relegated to a ‘further study’, but this study will be easier to conduct if more baseline discussion about the sediment pulse is in this paper.

L95-96 Can you add the uncertainty to these numbers? Also, what is the distinction between ‘rock’ and ‘sediment’ – surely sediment is just a form of rock. Do you mean to distinguish between bedrock and sediment?

L98-99 ‘several tens to hundreds’, ‘few weeks to months’, ‘up to several metres’ – this sentence has a lot of vague terms. Can you just replace with the actual exact numbers which you have in the results above? They will be more informative.

L102-103 People have mixed views about rhetorical questions, I am OK with them in general. However, I am not sure you really respond to this in any detail in the rest of the paragraph. Perhaps remove it, or keep it in an expanded discussions section about the broader implications (that is needed in any case).

L103-104 “The subglacial material from below this glacier seems especially easy eroded.” As far as I can tell you haven’t really presented the data to support this. We know that is was eroded, but if the erosion was driven by an extreme rainstorm or similar then it may not necessarily be particularly easily erodible?

L106-110 This exploration of possible causes is too brief. It might be useful to have a plot subpanel showing the precipitation data, and possibly exploring reanalysis (MSWEP/ERA5-land/CHIRPS) or satellite-derived (GPM IMERG) precipitation over the area of interest would be useful. These have low spatial resolution (0.05-0.1 degree) and have errors in areas like this, but may be useful for revealing relative patterns.

L117 “Such elevated glacier beds are widespread in most glacierized mountains on Earth” should have a reference.

L126 remove ‘impressively’

L126-132 There are hints of discussion of the results in a broader context, but the broader literature is mostly absent. Please add in some external context to better highlight why these results are particularly relevant.

Data availability – It is a shame that the data cannot be shared more easily, but I understand that this is a limitation of these commercial datasets.

Fig 1 and 2 – the meanings of the black and white dashed lines on the maps are not easy to find. Could you add some info about these to the caption? Also, the white boxed in Fig 1 are not easy to see, perhaps another colour would contrast better with the ice?

Fig 2 – I am not sure how this may best be integrated into the current figure, but the erosion would be more intuitive and easier to compare as a rate (m/yr of erosion for example) than simply an elevation loss. Could this be overlaid onto the existing color legend?

-Max Van Wyk de Vries