Interactive comment on "Effect of stress history on sediment transport and channel adjustment in graded gravel-bed rivers" *by* Chenge An et al.

Anonymous Referee #2

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Review of 'Effect of stress history on sediment transport and channel adjustment in graded gravel-bed rivers' An. C., Hassan, H., Ferrer-Boix, C and Fu, X. Manuscript Number: esurf-2020-67

This paper presents a series of flume experiments detailing the effect of conditioning flow duration on the sediment flux experienced during a subsequent flood wave. The paper in itself is interesting and would be of interest to the readers of ESurf but at the moment the language is not tight enough and the reader is left to try and fathom out the main take home messaged from each set of data analysis. For example, throughout the results there are phrases like 'increases notably', 'significant degradation' etc but it is not clear whether or not the authors have undertaken statistical analysis to support their results. If they have then the outputs of those statistical analysis need to be

reported. It is also unclear how reproducible the results are – again this needs to be reported. Therefore, this leaves the reader wondering how important the reported trends are, especially given the data is relatively noisy. I would also argue that the majority of the data analysis is relatively basic, which in itself is not a problem, but when coupled with the subjective language used, as discussed above, the main 'story' of the manuscript is lost. That said there are places where I think the analysis could be taken a lot further e.g. analysis of bed surface topography is not really mentioned despite DEMs being collected and mentioned in the methodology. Finally, I have a significant issue with section 4.1 and the back calculation of tau*c using MPP and Wong and Parker since this regression is designed for a small range of known tau*c. Irrespective of this I am not sure of the worth of scaling tau*c from that derived right at the beginning of the experiment – the bed state there is not representative of a true fluvial system, rather is representative of artificial conditions caused by screeding and high sediment transport rates caused by initial scour. So basing analysis off this seems odd and slightly misleading. In this section the authors also say that 'only the slope effect cannot explain the observed range of tau*c' – it is not clear what they mean and given this paper is about steep slope environments this needs careful clarification and expansion.

I really like it when authors include an implications section in their papers and so it is good to see this included in the presented paper however some of the text in this section feels much more like discussion and framing of the authors results within the wider literature of which there was relatively little of in the paper up until that point. So, I think the discussion and implications sections of the paper need re-framing slightly so the discussion section properly frames the results within the wider literature and the implications section talks about the bigger picture and importance of the findings more broadly. If the authors do this I think it will be much clearer to the reader about the new findings which this paper had generated – to make this even easier for the reader there are places where paragraphs could be re-structured such as to lead with the findings from this paper before framing within the previous literature. This will help make it

crystal clear where the additional knowledge is. For these reasons I would suggest a rejection of the paper with a strong encouragement to resubmit once the issues have been addressed. Line by line changes are also suggested below to help the authors revise their manuscript.

Suggested Changes

Line 24 – arguably not just mountain streams

Line 26 – I would consider adding Masteller 2019 JGR paper in here as it seems relevant

Line 28 – what do you mean by average flow regime?

Line 44 – remove etc in the citations

Line 52 – should be Haynes

Line 82 – from reading your methodology I would argue that you don't run experiments which consist of ' extended cycles' – for me that reads as you cycled hydrographs but this is not what you did – instead you ran changed the length of a period of conditioning flow before exposing that bed to the rising limb of the hydrograph

Line 88 – can you be more explicit with what you mean by guided by?

Line 89 – to investigate the study objectives…...

Line 104-106 – so was the flow rate directly scaled?

Line 105 – I don't think that you ran a hydrograph – you ran a rising limb of a hydrograph but not a full hydrograph. The results you would have come up with by running a full hydrograph would have been very different to those which you report here

Line 108- 111 – more justification and reasoning is needed in this section – what are the details of the trail experiments? How exactly were the feed rates chosen?

Line 117 – why was this sediment scaling chosen?

Line 123 – what impact does feeding the bulk sediment rather than feeding a GSD which is representative of the transported sediment have on the surface development?

Line 127 – 129 – how often did you measure the bed surface profile (It is difficult to tell from fig 1) – was this just down the channel centre line?

Line 131- 136 and Line 156 - What impact did draining the flume have on the transport dynamics – did you assess this? How were the DEMs detrended? You need a sentence or more in here justifying why you are using std of elevations as a measure of surface topography

Line 148 – was the shear stress corrected for side walls? If so how?

Line 166 – I would have thought it would have been useful to present the statistical moment analysis of the bed scans so you can properly link the development of the bed surface with some of the sediment dynamics. I think it would also be useful to plot the surface DEM evolution to allow readers to better appreciate and understand how the surface evolves.

Line 168 – I am not sure exactly what you mean by longitudinal DEM – why average it over the cross section? A lot of the previous literature on stress history which has undertaken DEM analysis has shown that the surface develops significant spatial complexity which will be lost by the averaging you have undertaken

Line 180 – what do you mean by further analysis of the DEM? Where is this analysis?

Line 205 – should be noting not noted

Line 205 – what do you mean by keeps relatively flat?

Line 212 – how accurate is the light table?

Line 216 – 217 – again be specific – what do you mean by very large? Gradually dropping? Small and relatively constant?

Line 223 - why is this analysis in the supplemental information? The analysis you have undertaken up to this point in the paper would really seem to benefit from this further analysis

Line 268 and 275 – again be specific and give the statistical outputs if you have undertaken statistical analysis.

Line 279 – I am not sure I agree that the five experiments show similar sediment outputs – there may not be a systematic trend related to condition flow duration but there are certainly differences between them.

Line 303 – 308 – again why is this data in the supplemental information – I would have thought it would have been a really important addition to your paper and provided a lot of useful context from which to hang your discussion

Line 334 – sediment transport rate

Line 337 – what do you mean by basically show an increasing trend – be specific

Line 376 – remove etc from the citations

Line 391 – what implications – can you be specific?

Line 405 – 413 – I am afraid I don't see the relevance of this paragraph to the paper.

Line 415 – more should have been made in the discussion of the comparison between the work presented in the current paper and the results of Haynes and Pender (2007) since this is a very relevant study which would have provided really useful comparators.

Line 419 – again I am not sure I agree with you here – the data presented in this paper has shown that the effects of stress history are effectively cancelled out under higher flows in any subsequent flood. However in line 419 you say 'might be more lasting during subsequent flood' – this seems counter to the rest of the message in the paper.

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