

Interactive comment on “Hitting rock bottom: morphological responses of bedrock-confined streams to a catastrophic flood” by M. Baggs Sargood et al.

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This is a useful contribution recording the morphological response of upland streams to a catastrophic low-frequency high-magnitude flood. The approach is systematic and the morphological adjustments are well documented. However I felt that some points could have been developed further possibly with more finesse.

Major points:

(1) Some consideration of how upland streams adjust to high-frequency low-magnitude floods would have provided better context to the stripping observed by the rare event, not least as the authors compare, without amplification, the channel morphology to

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morphologies that do reflect frequent events (Montgomery & Buffington; Thompson). Of the few studies of the bed load response and recovery time of such systems, Carling & Hurley (1987) found that over a seven year period with bedload flux events up to 7 years return period, the flux of bedload in an upland UK stream demonstrated constancy of supply with no evident exhaustion effects due to variability in flood event magnitude and frequency thus such event frequencies served to maintain current morphology [Carling & Hurley, 1987, ‘A time-varying stochastic model of the frequency and magnitude of bed load transport events in two small trout streams, pp 897- 920 in: Sediment Transport in Gravel-bed Rivers, (edited by CR Thorne et al), Wiley]. Floods with a lower-frequency than that reported by Baggs Sargood et al must have geomorphological change-effects other than total channel stripping and it would be useful to consider what is known in this respect. For example, upland stream beds deform into step-pools which reset for flows of a given return period. Setting the extreme event into context is especially important as the authors note the importance of stochasticity of bedload flux on page 16 in the Discussion but do not develop this notion adequately.

(2) It was pleasing to see the concept of an ‘alluvial overprint’ noted in the Discussion (p 16). Carling (2009) introduced this concept in passing and did not elaborate fully. The concept does not merely refer to the presence of a coarse debris alluvial mantle in a bedrock channel, as suggested by the authors. Rather it alludes to the partial development of an alluvial channel morphology within the constraints of a bedrock channel. In the case of the Mekong river, which Carling (2009) was describing, the river is trying to form a meandering to anastomosed alluvial morphology within partial sediment cover within the restrictions of a bedrock channel. The idea of ‘alluvial overprint’ is developed a little further with the paper by Meshkova et al (2012) [Nomenclature, Complexity, Semi-alluvial Channels and Sediment-flux-driven Bedrock Erosion, in Gravel-bed Rivers: Processes, Tools, Environments, First Edition. Edited by Michael Church, Pascale M. Biron and Andre’ G. Roy, Wiley]. In Meshkova et al, the important concepts of ‘bedrock’, ‘bedrock-confined’ and ‘bedrock-constrained’ channels are also defined as the response of each of these kinds of systems likely can differ.

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(3) In section 5.1 the authors note that empirical equations for initial motion did not apply well to their case study. However, they implicitly make the link to non-Newtonian flows as a possible explanation for the lack of predictability using clear-water flow equations. Although the presence of non-Newtonian flows is a possible explanation nowhere do the authors present data which might indicate that non-Newtonian flow had occurred in the study streams during the extreme event. It would have been useful to also consider why clear-water equations do not work in high-magnitude events. Such additional controls such as steep slopes, flow blocking, scour beneath boulders, over-passing, and macroturbulence should be accounted in such systems.

Minor points:

Page 2 line 1 Earth should have initial capital letter as in line 2.

Line 5 delete '3' and insert 'three', delete '10' and insert 'ten'. It is a convention to use words for one to ten and numerals for 11 onwards in text unless units are involved. Thus ten samples but 10cm/s.

Line 11 where in the main text is the concept of a desktop reach introduced?

Line 15 Not clear how thalweg variance can decline as bedrock steps are exposed. This statement contradicts the main text.

Line 19 and elsewhere 'This' needs a subject word to follow otherwise it is a clause and not a sentence. If a clause is intended then a semi-colon should come before 'This' instead of a full stop.

Line 24. Upland channels are not usually referred to as bedrock channels. This would preclude any alluvial channel from existing in the uplands.

Page 3 line 13 delete semi-colon and insert colon

Page 4 line 18 'This' again needs a subject word

Line 26 (ditto line 3 page 5) I don't think 'vastly' is the correct word here – seems like

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unnecessary superlative

Line 24 & 26 Page 5 'This' again

Page 6 line 7 delete 'records pre-' and insert 'record pre-disturbance'

Line 8 delete 'unique' as it is not unique

Line 15 missing bracket

Line 25 insert 'average' after 'above-'

Page 7 line 1 insert subject word after 'this'

Page 8 'This' again

Line 21 delete 'is' and insert 'are'

Page 9 line 21 delete 'was' and insert 'were'

Page 10 line 1 delete 'were' and insert 'was'

Line 10 missing full stop

Line 12 insert 'based' after 'flume-'

Line 13 delete 'in' and insert 'to'

Page 11 line 22 'This' again

Page 12 line 8 insert 'flood' after 'pre-'

Line 10 'desktop reaches' have not been defined – see Abstract comment

Line 25 insert 'an' after 'of'

Page 13 line 22 this statement re steps contradicts the Abstract

Page 15 line 22 insert '–LiDAR' after 'pre'

Line 23 delete 'points' and insert 'point'

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Page 16 line 20 insert 'data sources' after 'these' so we have subject words

Page 19 line 10 delete '3' and insert 'three'

Line 18 'This' again

Line 26 'This' again

Page 20 line 1 delete 'to' and insert 'with' It is 'compare with' or 'contrast to'

Line 2 'across the valley bottom' where is this movement shown in the text or in a figure???

Line 10 & 20 delete 'suggests' and insert 'suggest'

Line 22 'This' again

Figure 5 & 6 caption insert '-2011' after 'pre'

Interactive comment on Earth Surf. Dynam. Discuss., 2, 1093, 2014.