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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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The manuscript describes an interesting case study for the effect of large floods on bedrock channels. However, there are a number of points that need to be clarified and elaborated on.

Introduction: There is some important recent literature that could be included to set up the paper. For suggestions (not exhaustive) see the detailed comments.

Methods: The information on methods is sparse in places. I would welcome more information for example on the lidar processing and the grain size measurements (see minor comments and below). The meteorological and geomorphic information is in-

complete in places (see detailed comments).

Grain size distributions: the calculations of initiation of motion rely on various percentiles of the grain size distribution. I wonder how accurate the measurements are. It is well known that the sample size needs to adjusted to the largest clast on the bed (see e.g., Church et al., 1987, River bed gravels: sampling and analysis, in Sediment transport in gravel-bed rivers). With boulders of at least 1.7m in diameter (page 1104, line 26) or larger (4.8m, page 1105, line 1), I have doubts that point counts including a hundred pebbles give accurate estimates of the D90. The photographs in Figure 3 also suggest a very coarse bed. I also wonder how the authors dealt with fines and what the smallest grains were that they considered (with regard to establishing D16).

Conceptual model: The treatment of the conceptual model depicted in Figure 7 is a bit thin at the moment. The model needs to be described in more detail in the text, explaining the different stages. In particular, it would be interesting to discuss when the bulk of the bedrock erosion is actually happening, during the extreme events or during subsequent small floods that are able to attack the exposed bedrock. Further, the model should be contrasted with other models in the literature, such as ones proposed in the papers by Yanites et al. and Turowski et al. (which are cited elsewhere in the current manuscript), the model results discussed by Lague, JGR, 2010, Reduction of long-term bedrock incision efficiency by short-term alluvial cover intermittency, or the conceptual framework by Hovius and Stark, 2006, Landslide-driven erosion and topographic evolution of active mountain belts, in: Landslides from Massive Rock Slope Failure, NATO Science Series (their fig. 5). The effects of small versus large events could also be better treated.

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1096.21 Bedrock channels… I suggest to add 'typically' to this sentence, as not all small streams have highly variable flow regimes (e.g., in small glaciated catchments), or resistant boundary conditions (e.g., highly fragmented or weak bedrock).

1096.25 some work of Baker could be cited here (e.g., Baker and Kale, The role of extreme floods in shaping bedrock channels, in: Rivers over Rock, 1998).

1097.6 There is some important recent literature that could be informative here from a modelling point of view. See for instance Lague et al., JGR 2005, Discharge, discharge variability and the bedrock channel profile, Lague, JGR 2010, Reduction of long-term bedrock incision efficiency by short-term alluvial cover intermittency, Molnar et al. JGR 2006, Relationships among probability distributions of stream discharges in floods, climate, bed load transport, and river incision, Snyder et al., JGR 2003, Importance of a stochastic distribution of floods and erosion thresholds in the bedrock river incision problem.

1100.12 What was the total rainfall of this second event?

1102.5 For a recent review of flow velocity in mountain streams using a large field data compilation, see Rickenmann and Recking, WRR 2011, Evaluation of flow resistance in gravel-bed rivers through a large field data set.

1103.10 Should be Eq. 6?

1103.13 What was the point density in the LiDAR measurements? What was the spatial resolution of the DEM? How was the gridding performed?

1103.16 The method used to construct the error surface needs to be described in more detail.

1103.22 How did this normalization procedure affect error estimates?

1104.12 It is unclear to me how much of the erosion is actual bedrock erosion and how much is the mobilization of sediment. A clear statement to clarify this would be helpful.

1106.17 The term 'bedrock-confined' has been precisely defined by Meshkova et al., 2012, Nomenclature, complexity, semi-alluvial channels and sediment-flux-driven bedrock erosion, in: Gravel bed rivers – processes, tool, environments. I doubt that

this precise use of the term has been taken up in the community, and it would benefit from a definition here.

1106.26 In my opinion this is too much interpretation for the results section.

1107.13 abut?

1108.4 the word 'modern' seems misplaced here.

1108.13 'Alluvial overprint' refers to the behavior of a stream as an alluvial streams for instance by meandering, anastomosing, building step-pool units etc. in the sediment mantle overlying the bedrock. The presence of a sediment mantle itself is not the alluvial overprint. The alluvial overprint is not the cover, but occurs in it. See Meshkova et al., 2012, Nomenclature, complexity, semi-alluvial channels and sediment-flux-driven bedrock erosion, in: Gravel bed rivers – processes, tool, environments, and Turowski et al., ESPL 2013, Large floods, alluvial overprint, and bedrock erosion.

1108.13 Please distinguish precisely between the cover effect, the alluvial overprint, and the overprint effect. Seidl and Dietrich were not concerned with the cover effect, and the citation is inappropriate here. For other work on the cover effect see for example Turowski et al., JGR 2007, Cover effect in bedrock abrasion: A new derivation and its implications for the modeling of bedrock channel morphology.

1108.24 The year of the reference should be 2013.

1108.24 The interesting question here is for me: was bedrock exposed, allowing bedrock erosion, DURING the flood? The mantle of alluvium in 85% of the reach could be due to deposition in the waning part of the hydrograph. Using the threshold-based model by Turowski et al. 2013 referred to earlier in the paragraph, such behavior would be expected.

1109.19 Large boulders are often mobilized due to scouring at their downstream side, rather than due to hydraulic lift and drag. The equation for the threshold of motion do not account for this process.

1111.7 The conceptual model needs to be better explained in the text. The implications of the model for our thinking about bedrock channels need to be discussed.

1111.10 The 3 phases should be explained. The argument needs to be elaborated.

1111.16 See also Turowski et al., ESPL 2008, Distribution of erosion across bedrock channels. The literature on the debate over incised meanders could also be informative (e.g., Shepherd, Science 1972, Incised River Meanders: Evolution in Simulated Bedrock).

1112.8 anecdotal

Table 2: In addition to D50, the authors used D16, D84 (both eq. 6) and D90 (eq. 1) for their calculations, but not D94. Dmax is frequently referred to in the text (also table 3), but is not given either. I suggest to include the values actually used in the paper into the table. Fig. 6b: I find the figure way too small to read both on the screen and in the printout. I suggest to separate this plot from the erosion map and treat it as a separate figure. Please also include error bars in the figure.

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