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Earth Surface Dynamics Discussions

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

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In the paper, the authors describe experiments to investigate the effects of conditioning flows on sediment transport. They argue that conditioning flows can indeed reduce transport rates, as has been suggested before, but only for a limited time. Memory is lost as sediment supply rates and discharge increase. The paper presents some interesting data, and the topic is timely and is generally suitable for publication in ESurf. There are, however, a few short-comings that should be addressed.

First, the interpretation of the data frequently rests on subjective judgements or undisclosed criteria and arguments. For example, the authors identify trends or 'significant' differences without explaining their criteria or providing suitable statistical tests. Fur-



ther, errors and uncertainties are not reported or discussed. Given the often large fluctuations, the trends, effects and differences claimed by the reviewers are mostly hard to spot, or they cannot be judged against the uncertainties in the measurements. This makes it hard for the reader to fully understand and believe the conclusions. I ask the authors to provide uncertainty estimates for the key parameters, and to re-assess their interpretation in light of these uncertainties, best with suitable statistical tests.

Second, the reader is not guided through the entire argument and often, the punchlines are not explicitly delivered. For example, in the discussion section 4.1, the authors finish their back-calculation of the threshold of motion with the statement "...indicating that only the slope effect cannot explain the observed range of tau_c* (line 354). The obvious question to ask is: if it is not slope, what is it? I think the authors are trying to address this question in the following paragraph (starting on line 360), but this paragraph contains merely some further statements about the data. As a reader, I am unsure what features of the data I should particularly aware of, how they are interpreted and how this leads to the conclusion of the authors. There are similar problems in other parts of the manuscript. For example, the authors claim that they observe reduced transport rates after the conditioning phase (e.g.,. line 376: "Our flume experiments also show a reduced sediment transport rate in response to the implementation of conditioning flow."), which presumably rests on data shown in Fig. 6c and Fig. 7. These data show large scatter and behavior contrary to the expectation. They and their interpretation are not picked up in the discussion other than as a stepping point to the implications. Statistical tests of presumed similarities and differences are missing, as are error bars. To address these issues, I ask the authors to develop a clear logic with explicitly stated punchlines. In the best case, they can formulate an expectation (e.g., condition leads to an increase in the threshold of motion), a null hypothesis (e.g., threshold is constant), and a suitable statistical test to discriminate them. Then, they can walk the reader through the various observations until the conclusion is reached.

44 to me it makes sense to differentiate the terminology somewhat. The terminology

chosen in the cited papers seems to be motivated by the available data and the chosen approach. For example, Mao looked at the effect of flood events, while Masteller et al. focused more on continuous discharge data. Further, a change in flow does not directly translate into a change in stress, there are non-linearities and feedbacks involved (e.g., non-steady flow, re-organization of the bed). It does make sense to use a stress approach (and therefore terminology) for experiments, but stress information is much less reliable for field measurements.

69 Maybe the effect of sand supply on gravel transport should be mentioned somewhere in this paragraph; see for example Curran and Wilcock, JHE 2005 (DOI: 10.1061/(ASCE)0733-9429(2005)131:11(961)

75 also Lenzi, (Step-pool evolution in the Rio Cordon, Northeastern Italy. Earth Surface Processes and Landforms 26: 991–1008, 2001), and Turowski et al., 2009 (DOI: 10.1002/esp.1855).

89 To investigate the study objectives. . .

107 . . .not fed. . .

107-108 The approach and reasoning here needs some more detail. What were the simulations? What kind of trial experiments? How was the final feed rate chosen?

136-141 Unclear, lacks detail.

137 How were images merged? How did you deal with image distortion due to merging or lense distortion effects?

137 perform

139 I don't understand how particle sizes were measured.

140 How were changes quantified?

144 Please add some information on accuracy and precision of this method.



156 What does "slowly" mean in this context? Please also explain how an effect of the rising discharge after measurements was avoided.

168 why the average over the cross section, instead of, for example, the thalweg? Maybe this should be described and justified in the method section.

177 How were trends assessed here?

180 How exactly was this assessed? What features did you look for to identify a bedform?

191 Here, the authors implicitly identify the standard deviation of the bed with the bed roughness. Bed roughness is a technical term in fluvial hydraulics, and although there is evidence that the standard deviation scales with roughness, the terms are not directly equivalent, as they are used here.

193 what does "almost constant" mean in this context? Can you make this statement quantitative?

198 please add in symbols to mark the time of the actual measurements.

198 is it possible to add error bars to these plots?

204 What does "relatively stable" mean in this context? How was stability assessed?

205 What does "relatively constant" mean in this context? How was constancy assessed?

206 Interpretation, to discussion.

209 Please mark the time of the measurements on the plots and add error bars.

228 Fig. 6c shows presumably not a derivative, but a ratio of discrete changes. Please change the notation accordingly (for example, by using delta symbols). Please add error bars.

229 During each of the hydrograph steps, there seems to be decline of transport rates

over time. This may be due to a transient adjustment of the bed to the changed hydraulic conditions. It does not seem to me here that an equilibrium is achieved. Can the different stages then be meaningfully compared? How would a transient adjustment affect the interpretations?

237 . . .of the sediment transport rate. . .

238 How did you assess whether it agrees? What does agreement mean in this context?

246 Please explain how you detected trends and give corresponding statistics. The interpretation is a little difficult, since there are no error bars for the data.

260 How did you arrive at this assessment? REF7 is around 50% larger than REF3! It would make sense to add error bars to the measurements and a statistical test to actually show that there is no difference.

265 please add uncertainties.

270 with a longer conditioning phase leading. . .

274 How did you arrive at this interpretation? Maybe this is just an effect of the scale of the plot? It would be good to add error bars to the data here and some suitable statistical test.

290-298 how did you establish significance and what does 'more significant' mean in this context / how was this assessed?

300 Please give some indications of the uncertainties of these measurements.

303-308 this needs more detail if it is relevant for the central message of the paper. If not, consider deleting it.

304 The use of the term 'equal mobility' has become ambiguous. Originally, it meant that the grain size distribution of the transport material matches the grain size distribu-



tion of the material found on the bed. However, it is now often used to mean an equal threshold of motion for all grain sizes. It is unclear from the context here which meaning is intended.

334 transport rate

365 please add error estimates to these calculations.

388 predictions

397 This would imply that the stronger trends should be seen in d90 rather than d50, right? How does this expectation compare to the data?

405 either 'e.g.' or 'etc.', not both

416 . . .the conditioning flow was. . .

416 In the present paper. . .

427 consisted

430 consisted

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