

Interactive comment on “Uniform grain-size distribution in the active layer of a shallow, gravel-bed, braided river (the Urumqi River, China) and implications for paleo-hydrology” by L. Guerit et al.

Anonymous Referee #2

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This paper presents a field study in which the authors sample the surface and sub-surface sediment in an active braided gravel-bed river in a variety of ways, and compare the resulting grain size distributions. The overall intent of the work is to assess whether grain-size distributions collected from vertical exposures are representative of the overall grain-size distribution of the river bed, as this has important implications when interpreting data from outcrops in paleohydrology studies.

Overall this is a clear paper that presents useful data that should be of interest to the readers of Earth Surface Dynamics. There are, however, a few areas in which the

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manuscript may be improved.

Much of the analysis relies on comparison of grain size distributions – either individual volumetric samples compared against each other, horizontally or vertically aggregated volumetric samples compared with each other, volumetric samples compared to Wolman-style point counts, surface transects compared to trench samples, and so on. . . – but the presentation limits the comparison to the D50 and D90, with some estimate of the uncertainty in each parameter, and visual comparison of cumulative grain-size distributions. Some sort of more rigorous statistical testing would greatly improve the main thrust of the paper. Some possible options could be the Mann-Whitney test to compare medians, or the Kolmogorov-Smirnov test to compare entire distributions.

Along these same lines, the grain size distributions are shown in Figure 6 with an arithmetic horizontal (grain size) axis. In some circumstances this may be okay, but in general with a wide range of grain sizes, as is the case here, it is preferable to use a logarithmic horizontal axis as it does not overly compress the finer range of grain sizes. Replotting the distributions with a logarithmic axis will also probably better represent how the D50 differs from one distribution to the next.

In addition to the D50 and D90, it would be instructive to see how the variability (perhaps quantified by the geometric standard deviation) of the grain size distributions varies as a function of the individual volumetric samples, and as samples are aggregated. I suspect the standard deviation of the individual samples is smaller than the aggregated samples, supporting the idea that individual morphologic features within the active layer are better sorted patches of sediment than the distribution of the active layer as a whole.

The results from the transects (the surface samples) are not really presented in the Results section of the paper. Currently they are mentioned only in passing in Section 4.3 and shown in Figure 6d. It would help to provide more information on these samples in the Results, and perhaps to add a table or amend a current table to include the

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relevant grain size statistics from this dataset. Looking at Figures 5 and 6, it is not clear to me that the D50 of the surface transects and the D50 of the trench sediment are the same.

The Discussion section 5.2 on vertical sampling could be expanded to provide some more context to relate the present work to the stratigraphic record. An important outcome of the sampling strategy employed in the present study is that only the active layer (defined as $\sim 10 \times D_{90}$ thick) was sampled, and the authors conclude that if the sample size is large enough the grain size distribution does not vary in space throughout the active layer. In the rock record, deposits from different time periods are likely to have different active layer thicknesses, and these may be further changed after emplacement by erosion events, which may reduce the thickness of or even completely destroy an active layer. Some further discussion about how the findings in this paper may apply to paleo studies would be welcome.

Some other comments, by line number:

P. 4, line 27, and elsewhere: the word “weight” appears in several places in the manuscript, when it should be a different form of the word (i.e., here, it should be “We then weigh the grains. . .”

P. 7, line 3: “excesses” should be “exceeds”. Also, what is the “typical size of the morpho-sedimentary elements of the bed”? Those data were not presented, and no mention of how to estimate them is given.

Figure 3: This figure could use a legend. And the vertical axis has no units? My interpretation of the plot is that the vertical axis is the deviation from the mean bed elevation at each cross section, which should still have units of (probably) meters.

Figure 5: How is “inherent variability” determined here? Fit by eye, or some statistical method?

Figure 8: Caption should say “Photographs”, not “Photographies”

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