

Interactive comment on “Experiments on patterns of alluvial cover and bedrock erosion in a meandering channel” by Roberto Fernández et al.

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Received and published: 12 April 2019

The paper “Experiments on patterns of alluvial cover and bedrock erosion in a meandering channel” by Fernández et al. to explore the potential erosion of bedrock by moving sediment in a sinuous flume. As the sediment was varied, photographs were used to track areas that were (1) permanently covered in sediment and therefore unlikely to erode (2) sediment was continually absent and lacked the tools to erode bedrock, and (3) areas that had transient cover and were therefore subject to erosion. The figures are really fantastic and very clearly show the results. The main issue with the paper is the structure, and I think this issue is easily remedied. The current results section describes the axes and plots of the figures but does not describe the results, as these descriptions are included in the discussion. I found this approach confusing and

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think the figure description from the discussion can be moved to the results, and then the paper will be a significant contribution to our understanding of bedrock erosion in sinuous rivers. A very interesting result that was not discussed much in the paper is that the zone of transient cover moved toward the outer bank when sediment supply and curvature were high enough. This is a cool result and a discussion of this observation would be a valuable asset to the literature. The paper also contains a second experiment where sediment was added to a flat slab to develop a relationship between sediment mass added and cover, and the areal fraction of cover and the thickness relative to the roughness of the bedrock. These results are interesting and should be very useful for future model development, but the motivation for these experiments could be laid out more clearly at the outset, it wasn't clear to me until the results section. In addition, more overtly labeling the figures representing the slab experiments would help. A picture of the slab would also be useful. I am jealous of the experimental design and thought the paper was interesting and certainly merits publishing. A few of the methods and materials need more explanation to properly assess the scaling of the experiments. Specific questions and comments are listed below. Specific questions/comments I had several questions about hydraulics and scaling which would be helpful: 1. What is the settling velocity of the particles (calculated or measured). How does that influence the observations? 2. The Shields stress is relatively high (~ 0.18) does that have an impact on the hop length of the particles, and the locations where impacts are expected? Does the density of the particles affect the hop length? 3. The width depth ratio is relatively narrow (~ 5.5), yet migrating bars are described in the paper. Is there any data on the width depth ratio of bedrock meanders? Are the bars forced bars or free bars (or some other bedform)?, and would the results in a wider channel differ? 4. I would be interested to hear more description of the channel morphology including how deep were the pools and how much did the lateral slope of the bar vary. To some degree, experiments are their own self-contained system, but I couldn't help asking myself how the results would differ if sand or gravel were used rather than walnut shells. Presumably the area of transient cover might be closer to

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the inner bank with heavier sediment? Questions about experimental procedure: 1. Approximately how thick was the pea gravel? 2. Was the bed cleaned out between runs? Is the adjustment between runs reflected in any of the results (i.e., how long did it take to adjust the channel morphology)? 3. My memory of walnut shells is that they are pretty angular. Does that affect the experiments at all?

Other specific comments Page 5. Lines 10-21. I found the intermingling of “bed material”, “alluvium”, “bedrock”, and “bedrock basement” confusing. Bed material could either refer to the bedrock or alluvium. I think sticking to bedrock or alluvium would be helpful. I also got confused by the way the description of the artificial bedrock was built starting with the bottom. It might be helpful to start by describing what each component is used for (walnut shells to give the basic channel shape (pools and bars), pea gravel to provide roughness, and concrete to provide strength), then describe how it was built. How thick was the pea gravel? Page 5. Line 19. Is there anything special about the cement mix? What was the ratio of water to sediment (could be useful to future experiments). Section 2.3. What was the scanning interval of the bed, and was the scanner measuring a grid or cross sections (from later in the paper I gathered it was cross sections but I am not sure) ? Page 7, line 21-23. The slope was measured with point gages from 9 m to 21 m. These spots are just before the apex of one bend and after the apex of another bend. Often the water surface elevation can vary based on position in the bend as water backs up behind the bend apex. Did this occur in these experiments? If so, are these slope measurements representative of the overall slope. Page 10, lines 5-15. Does the thickness of the alluvial cover depend on the shape of the particles? Figure 10. Please define area ratio in the figure legend. Figure 11. Can we quantify the variability of cross sectional alluvial cover relative to reach average cover using standard deviation, or just a range? Figure 13. I found myself curious how symmetrical the results were and wondered why the cover was higher upstream than downstream. How did cover vary as a function of the absolute value of curvature? Presumably the curvature upstream and downstream matters as well as local curvature.

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Interactive comment on Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2019-8>, 2019.

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