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Hydrology and Earth System Sciences Discussions

Interactive comment on "A flume experiment on the effect of constriction shape on the formation of forced pools" *by* D. M. Thompson and C. R. McCarrick

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We appreciate the constructive comments provided by reviewer Tom Lisle. We are familiar with the excellent research of the referee in this subject area and worked to address the questions raised.

With regard to the question of scaling and morphology length, the modeled pool lengths are approximately 80% of the bankfull width, which are shorter than many natural pools with mixed sediment beds (Thompson and Hoffman, 2001). The combined pool-riffle unit length is also shorter than reported values in the field (Thompson, 2001). However, the length of the morphology was not shorter because of flume run duration. Experiments with longer duration flume runs indicted no significant difference in morphology geometry. The shorter morphology lengths may be due to the use of uniform sediment sizes relative to mixed-sediment-size distributions in natural channels, the use of a single formative discharge versus a naturally variable hydrograph, or differences in turbulent scales in the flume versus the larger natural systems. The flume experiments themselves were not designed to be scaled experiments largely because of the difficulty in scaling sediment sizes and turbulent structures.

Because the constriction produces backwater that becomes progressively more pronounced with increased stage, the flume experiments were run at flow levels less than the critical particle entrainment threshold upstream of the constriction. Flow velocity measurements were not conducted to collect the data necessary to calculate the shear stress using the total kinetic energy method (τTKE). Because of the importance of turbulence in entraining sediment in these settings (MacVicar and Roy, 2007) other methods for estimating shear stress are not accurate enough to be of much value. I added text to the methods section to clarify this issue.

Specific Comments 1946/18 changed as requested 1947/8 changed term to obstruction 1949/23 changed as requested 1951/2 clarified that only water was recirculated 1951/18 we moved the first reference of Figure 2 up to the methods section 1952/19 the sentence has been reworded 1954/18 changed as requested 1958/25 the reviewer raises a very interesting question. I have certainly seen evidence of this type of slipface in field settings. We did not specifically test for this during the flume experiments and it would be difficult to assess at this point in time. However, the similarities in approach gradients suggest this might be the case. Other flume experiments on pool scour in this flume that used the same size bed material showed more variation in approach gradients. 1960/1 I provided the units on figure 4 and 5 to provide a scale. I also tried to scale the lag distance by the depth of maximum scour but found no significant relations.

Refrences

MacVicar, B.J., and Roy, A.G.: Hydrodynamics of a forced riffle pool in a gravel bed river: 1. Mean velocity and turbulence intensity, Water Resour. Res., 43, W12401, doi:10.1029/2006WR005272, 2007.

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Thompson, D.M., Hoffman, K.S.: Equilibrium pool dimensions and sediment-sorting patterns in coarse-grained, New England channels, Geomorphology, 38, 301-316, 2001.

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