Earth Surf. Dynam. Discuss.,
doi:10.5194/esurf-2016-1-AC3, 2016


Earth Surface Dynamics Discussions

# *Interactive comment on* "Armor breakup and reformation in a degradational laboratory experiment: detailed measurements of spatial and temporal changes of the bed surface texture" *by* C. Orru et al.

**C. Orru et al.**

C.Orru@tudelft.nl

Received and published: 2 March 2016

The authors thank Referee #3 for his/her helpful and constructive review.

We apologize for the fact that we have provided insufficient information on the image analysis technique. A manuscript presenting the new measurement technique for measuring the bed surface texture in detail is currently under review with Water Resources Research. We did not want to repeat the information but realized insufficiently that the current manuscript is therefore not sufficiently stand-alone. We propose that we revise the current manuscript such that it does become stand-alone and we will pro-



vide the referees with access to the submitted WRR manuscript. We thank Referee #3 for his/her detailed suggestions on improvement of the structure of the manuscript and his/her requests for further explanation, which will help improve the clarity of the manuscript.

With normal flow conditions we indicate a state in which the slope of the water surface is equal to the slope of the channel bed. If the boundary conditions of a reach (i.e., upstream water discharge and sediment supply rate, as well as the downstream water surface elevation) are constant for a sufficiently long time, the reach will approach normal flow conditions (provided that particle abrasion and tributaries do not play a role). Yet, conditions of partial transport, in which the coarse fractions of the sediment are immobile, and the associated armor can prevent this adaptation of the bed and its approach to normal flow conditions. Armor breakup then enables adjustment of the bed slope such that the bed slope is closer to the water surface slope and the final bed configuration is closer to normal flow. The sediment contributing to the migration of the front of the gravel reach appeared to provide much more information regarding the local increase of the sediment transport capacity due to armor breakup than the sediment caught in the sand trap. However it is a good idea if in Figure 11 we not only report the sediment transport capacity at the gravel reach front but also the sediment transport capacity at the downstream end of the flume.

The bed step has formed as a result of the adjustment of the bed to the limited sediment supply. As no sediment is fed at the upstream end of the flume, the bed approaches a final state that is characterized by zero sediment transport. This situation of zero transport results from either (a) the washing out of fines from the bed surface or (b) if fines are present at the bed surface they must be characterized by a Shields stress that is smaller than the critical one. For the sand reach, a state of zero sediment transport is governed by a much smaller flow velocity (and so larger flow depth) than for the upstream gravel reach, which results in the observed bed step.