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Discussion

Reply to comment on ‘Investigating ponding depth and soil detachability for a mechanistic erosion model using a simple experiment’ by Gao, B., et al., 2003.
Journal of Hydrology 277, 116–124

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Abstract

Kinnell [J. Hydrol. XXXX] explained that the conclusions reached by the critical experiments reported by Gao et al. [J. Hydrol. 277 (2003) 116–124] were in agreement with his findings, and those of others. This reply emphasizes the practical significance of the Gao et al. findings to field erosion studies.

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We thank Dr Kinnell for indicating the degree of agreement between the results of his own investigations and those presented in our paper (Gao et al., J. Hydrol. 277, 116–124). In general, the sediment concentration achieved during soil erosion depends on the net results of competing processes, with erosion processes adding to, and deposition subtracting from sediment in the water layer. In this context of competing processes, it is difficult to investigate either of the competing processes with desired accuracy. By using soil material of negligible settling velocity, thus eliminating the processes of deposition and redetachment, Gao et al.

(2003) were able to critically investigate models of the rainfall detachment process. In fact, Dr Kinnell (Kinnell, 2003) notes that semantic difficulties arise in even the simple approach used by Gao et al. (2003) whereby the roles of soil detachability and ponding depth on soil erosion have been lumped into a single parameter, namely, ‘bare soil detachability.’ Indeed, this parameter includes the role of raindrop energy and possibly other factors as well.

This critical investigation showed that the detachability of bare soil can be regarded as approximately constant up to a critical depth of ponding, with the decrease beyond that depth being precipitous. In agreement with previous investigations, this critical depth is of order 2.5–3 times

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raindrop diameter. This finding supports use of a simple step function form of relationship between detachability and water depth, with the consequent advantages given in the conclusions to our paper. This simplification is welcome in practical field application of erosion theory where there are other sources of complexity, such as spatial and temporal variation in water depth.

References

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