Hydrol. Earth Syst. Sci. Discuss., 7, C3005–C3009, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C3005/2010/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Interrill erosion, runoff and sediment size distribution as affected by slope steepness and antecedent moisture content" *by* M. B. Defersha et al.

Anonymous Referee #4

Received and published: 16 October 2010

MS No.: HESS-2010-119 Interrill erosion, runoff and sediment size distribution as affected by slope steepness and antecedent moisture content Research Paper Dear Editor Dr. Tammo Steenhuis

Now I am able to inform that I revised the paper above. The paper is original and provides good data obtained from experiment lab concerning to splash erosion in Ethiopia. Also, the topic would call the attention of HESS readers. There are, however, some aspects of the study that could be clarified and the general quality of the written text could be improved improve significantly before this manuscript can be accepted for

publication in HESS. I would recommend that the authors perform major revisions to this manuscript.

The paper reports an experiment conducted in laboratory to check the interrelationships of sub-processes related to soil erosion. The study was a four factorial experiment in a complete randomized design with two replications of each combination. The variables under consideration are: slope steepness, antecedent soil moisture, splash, infiltration and runoff. The soils used in the experiments are from Lake Alemaya watershed, Ethiopia. The authors also sought to assess traditional models for predicting soil erosion and tested the hypothesis concerning to slope steepness used on interrill erosion model; also the authors sought to determine the erodibility of the soil (K). There is an overwhelming attempt to explain the result based on physical behavior of the variables under consideration (ex. stream power, shear stress, flow velocity and flow depth). But none hydraulics parameters were measured. In other words, some interpretations (results) cannot be explained by the experimental context. Even so, the authors sought explanations for the experimental variations based on literature review. The experiment is empirical based, so that physical causal explanations are fraught with difficulties since the data/results are restricted to the experimental context. I suggest that the authors try to restrict their explanations based on data obtained in the experiments in order to prevent speculation (see comments bellow). I suggest that the authors before they display the erosion models they could clarify a little more about the interrill erosion (physical mechanism) in order to support further discussion about the results.

Specific comments

Erosion Processes is composed by Detachment, Transport, Deposition so the author should use in some places just soil loss instead of soil erosion.

P1 l.1-2 – Soil erosion is a three-phase process consisting detachment, transport and deposition. Keep the process similar to P 3 l.18-19. P1 l.9 Rainfall intensity at 120 mm/hr change for Rainfall intensity at 120 mm/h. P1 l.11 change Alemaya Black soil to Vertisols, similar to 2.2.2 section P 3 l.5 Theses quotes are old (Hurni, 1985 and Constable, 1985) if possible look for more current literature sources. P 3 l.27 over land flow change by overland flow. P 4 l.1 topography change by slope. P 4 l.18 b, a, and c are fitted constants. These constants are not displayed on the equation 2. P.4 l. 25-26 If "S" equal a second should be "s" (m/S replace by m/s)

Methodology I suggest the Soils as 2.1; and the study area should be included in the description area of the soil sampling since the authors did not have specifically a study area. The topics of methodology are very fragmented; the authors could try to group them in fewer items. P8 Section 2.2.1 provides the characteristics of the rain produced by the simulator (drop size and kinetic energy). P 8 l. 25 change to: even though. P 10 l.15 (2.2.8) How the analysis of variance was performed with just two replications? P 12 l. 22-23 (Imerson and Jungerius, 1977) replace by (Imeson and Jungerius, 1977). P 12 l. 24-25 Authors should choose kg m-2 h-1 or kg/m2/hr, because we can find in the text different manners of expressing this notation. P 13 l.26 data with very high accuracy 6.581% change to 6.58% (see tables: 3; 5 and 9). P 16 l.27 change to: p=0.0001 or only p<0.05 P 18. l.13 Lillard et al. (1941) and Neal (1938) Aren't there also more recent studies? P 19 l. 1 erosivity of over land flow change to detachment of the overland flow

Results and discussion

P7. l.21 The authors assume that: Detachment by surface flow is negligible in interrill soil erosion. . .However, the authors claim on page 19 l.1: Slope steepness has the most direct effect on the erosivity (detachment) of over land flow by determining its stream power (Contradictory). R: Then the authors explain that the increase of sediment yield was due to the detachment caused by overland flow. But it should be negligible.

P.13 l.7 Statement: Soil that is highly susceptible to surface sealing, such as Soil C,

increases strength rapidly with time (Bradford and Huang, 1992), resulting in lower splash after a prolonged periods of rain. R: I do not notice much difference in splash of the soils being analyzed (table 2). Was it performed variance analysis to compare the average?

P.15 l.1-9 Statement: Thus, the probable cause for the lower splash detachment at 9% than at 25% was possibly due to depth of water poundings, as evidenced by the runoff rate measured at the two slopes. . .. R: The authors should have measured the depth of flow. It was not informed the drop size produced by the simulator. Also, nothing is said about the surface roughness.

P.15 l.21-23 Statement: The probable reason for the highest runoff observed on Soil C could be the development of high sealing due to clogging effect of silt particles. . ... R: I do not see on Table 2 such differences in the splash, especially between soil B and C.

P 17 l.1 Surprisingly, for Soil B the mean runoff rate at 45 % slope steepness was much lower than the mean runoff rate at 25% slope steepness. R: Despite such experiment control it could be random variation or experimental error. Therefore, not all explanations are possible. See the splashed material (Soil A, 25% air-dry 5.23 kg m2 h) it seems an outlier.

P.17 l.15 Statement: On average the highest amount of sediment was washed out from Soil C. . . (Table 6) R: This is contradictory, since the author's previously statement indicates that the sealing of the topsoil protected against the effects of splash.

P.18 l.28 The possible reason may be the higher stream power available at 25% slope steepness than at 9%....and others causes R: I partially agree with this statement since the stream power discharge is an important element, not only the slope. So this statement should be valid for 45% slope, as well. P.19 l. 10 The probable reason for this soil may be reduction in raindrop impact due to high flow depth. . . R: I have not seen any depth flow measurement to support this explanation. This effect can occur, however, there is an important change in hydraulic conditions of the flow (i.e increases the transport of particles). (See Bryan 2000, Geomorphology 32, 2000, 385–415)

P. 20 l. 21 . . .for Soil B may be due to the decreased in runoff rate as slope increased (due to less transport capacity of the transporting agent with increase in slope steepness). Previously (P.18 l.28) the authors claim: The possible reason may be the higher stream power available at 25% slope steepness than at 9%. R: Before the slope was the main factor of increasing stream power.

Conclusion Authors should address its findings straightforward responding to the proposed objectives. For example, the best prediction model appears clearly in the abstract, but not at the conclusions. (P2 l. 24 Interrill erosion models that include runoff and rainfall intensity parameters were a better fit for these data than the rainfall intensity based model). Also, should be addressed; how this study can assist in actions against land degradation in Ethiopia (at least briefly).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 6447, 2010.