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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Temporal and spatial scale and positional effects on rain erosivity derived from contiguous rain data" *by* F. K. Fischer et al.

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1) As per the authors, the threshold value that determines whether or not a rainfall event is erosive is 12.7 mm or 12.7 mm/hr (see P-3 LN-30). As per the definition of the threshold value on rainfall intensity, the duration of the rainfall intensity is 30 minutes (see P-3 LN-29). Consider a rainfall event that lasted for 30 minutes and contributed 6.4 mm. Would this rainfall event be erosive? As per the definition, the rainfall event contributes 6.8mm. Therefore, the rainfall event is not erosive. However, the intensity of the rainfall event is 12.8mm/hr (=6.4/0.5=6.4*2). Therefore, the rainfall event is erosive. Is this what meant by the definition?

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2) As per the authors, the threshold value that determines whether or not a rainfall event is erosive is 12.7 mm or 12.7 mm/hr (see P-3 LN-30). From the reader's point of view, since this threshold value may not be constant in spatial, this threshold value needs to be assessed against the local (i.e., Germany) climate/soil/landuse conditions. As far as I remember, in the past, an attempt was made by a SWAT research group on a project funded by USDA/EPA to establish a global matrix of this threshold value (i.e., threshold values for the UN nations). The research group was trying to couple its methodology with the available soil/LULC/climate databases. Though I am not sure the current status of the project and what has been materialized, it would be worth to check the threshold value that is applicable in Germany.

3) As per the authors, erosivity is the product of a rainfall event's maximum 30-min intensity and its kinetic energy (See P-3 LN-29; P-2 LN-31). As per the authors, both factors depend on rain intensity and thus, intensity is squared in erosivity (see P-2 LN-32).Consequently, the authors state that a difference in rain intensity of 10% would result in difference in erosivity of 21 %(see P-2 LN-33). How did you end up with 21%? Probably, it would be more appropriate to show an example. Consider a rainfall event that lasted for 30 minutes and contributed 43 mm. For this rainfall event, the rainfall intensity is 86 mm/hr (=43/0.5). As per your equation (1) and equation (2.3), the erosivity is 28.33*(43)*(43/0.5)=104.764 unit. If the rainfall intensity is decreased by 10%, as per your equation (1) and equation (2.3), the erosivity is 28.33*(43*0.9)*(43*0.9/0.5) =84.859 unit. Therefore, the difference is 19% (= (104.764-84.859)/ 104.764*100). Moreover, why would you say that the rainfall intensity is squared in erosivity? Is it based on your equations (2.1-2.3)? Would it be incorrect if we conclude that the equations (2.2-2.3) are independent of rainfall intensity? Don't those equations (i.e., 2.2. and 2.3) lead to a constant value regardless of the magnitude of the rainfall intensity?

4) As per the authors, the erosivity of a rainfall event is defined and controlled by the rainfall intensity (see P-3 LN-28). Even though rainfall intensity is the main factor, there are also other striking factors such as angle of rainfall attack, land use, soil struc-

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ture/texture, and more importantly prior rainfall events, which influence the erosivity. For example, a location that received 8 mm/hr may not be considered eroded as it has not met the threshold (i.e., 12.7 mm/hr).However, at the same location, the next rainfall event with a value of 6mm/hr may detach and erode the soil particles due to fact that the prior rainfall event (i.e., 8 mm/hr) may have already detached and loosened the grains.

5) Consider a location that has received two continuous rainfall events. Assume that the first rainfall event meets your threshold value (i.e., 12.7 mm/hr).In other words, as per your definition, the first rainfall event is considered erosive. Now, assume that the rainfall intensity associated with the second rainfall event is 11mm/hr. Do you think that it is really needed to have 12.7mm/hr to detach the soil that has already been exposed and detached by the first rainfall event that is considered erosive as per your definition? Wouldn't it be needed to have a lesser rainfall intensity to detach the second/exposed/detached soil layer?

6) In equations (2.1-2.3), aren't the upper (76.2 mm/hr) and lower (0.05 mm/hr) threshold values spatial sensitive. Moreover, with the definition presented in the current version of the manuscript, regardless of the energy that is computed using equations (2.1-2.3), a rainfall event is considered non-erosive if the rainfall intensity (i.e., maximum 30-min rainfall intensity) is less than 12.7 mm/hr. Considering this definition, in equation (2.1), what is the reason to set the lower threshold value to 0.05mm. Why would it be required to consider the kinetic energies induced by the rainfall intensities that are less than 12.7 mm/hr? Shouldn't the lower threshold value be 12.7 mm/hr?

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