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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Effective rainfall: a significant parameter to improve understanding of deep-seated rainfall triggering landslide – a simple computation temperature based method applied to Séchilienne unstable slope (French Alps)" *by* A. Vallet et al.

A. Vallet et al.

aurelien.vallet@univ-fcomte.fr

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We would like to thank Referee #3 for his/her very useful comments on the paper.

A point-by-point answer to the comments is as follows: "The authors consider that ETo is equal to Etc for the whole study. I am not sure if I can agree with this from a conceptual point of view. We all know that ETo is not equal to ETc, so the results

will be seriously affected by this over- simplification. If the authors do not wish to have complex ETc calculations, then they should just use general average values of kc. They can use values of 0.7-0.9 for the Kc values, based on the local vegetation and growth cycles, and thus improve their results."

–> Thanks to your remark, we reviewed the literature and we agree that ETc should be used instead of ET0, especially because it presents a good ratio accuracy/complexity. Indeed, crop coefficient estimation does not require extended study and does not add complexity to the effective rainfall computation. We show below some extracts on the revised manuscript concerning Kc estimation.

Method: Crop coefficient (Kc) was defined according to vegetation cover deduced from aerial pictures of which main vegetation species were described thanks to field observations. Because the Kc coefficient is dependent of the crop growing development stages, it varies from a minimum during wintertime to a maximum during summer time. For each vegetation type, a minimum and maximum Kc were estimated with literature and assigned respectively to the 4 February (middle of winter) and 6 August (middle of summer) of each year. A daily linear interpolation was performed between these two dates in order to have a continuous Kc estimation for each day of the year (Verstraeten et al., 2005).

Results: Forest is mainly composed of beech (Fagus sylvatica) and conifer (Picea excelsa) trees which can be associated occasionally with ash (Fraxinus) and sweet chestnut (Castanea sativa) trees. Proportion of beech and conifer was assumed identical for Séchilienne forest (each 50% of forest subarea) and other species were neglected for Kc estimation. Kc minimum and maximum was set to 0.71 and to 0.97 for conifer, and to 0.78 and 0.9 for beech tree (Verstraeten et al., 2005). Most of the pastures are anthropogenic and constituted of grass of which Kc minimum and maximum was set to 0.85 and 1 respectively (Allen et al., 1998). Contribution of each subarea was estimated allowing the determination of watershed Kc (0.77 and 0.95 for minimum and maximum respectively).

“IN Figure 1 I do not understand how they have limited the watershed. It covers the highland, which is rather strange.”

–> The watershed has been limited taking into account (i) the results of a tracer test which demonstrates that the summits of the massif contribute to the recharge area; (ii) the results of a Delta18O survey, which enable to include 3km-far high areas within the recharge area of the unstable slope.

“In Figure 4, it is hard to distinguish the points on the left of the figures.”

–> Figure will be colorized in revised manuscript.

“This paragraph seems rather confusing. You should try to separate the components (Et, infiltration, soil,. Etc.) and not jump from one to another. 8951. Line 27. If not, evapotranspiration process can be restrained to null and the AWS is not reached, which leads to the absence of infiltration. I understand what you are trying to say, but here it seems that lack of evapotranspiration will lead to lack of infiltration. If it does not rain there will be no infiltration. This has nothing to do with evapotranspiration.”

–> The entire paragraph has been changed and soil-water balance components were more details. Problematic sentence was modified to “However, field conditions do not always fulfill these requirements, particularly during low water periods, when water supplies are inadequate to support vegetation. It is only when the amount of precipitation (rainfall and snow melt) (P) can satisfy ET0 process and fills AWS that the remaining water can infiltrate into the aquifer (i.e. effective rainfall (ER)). If not, evapotranspiration process can be restrained (up to null) and the AWS is not reached, inducing therefore absence of infiltration.”

“Equations. Why do you have to make the equations complicated? Please just use simple notations, instead of long notations.”

–> Notations used for our manuscript are the same as literature cited in the references list. We are not sure to understand the simple notations you mention.

“This coefficient was applied for the two first rain event day as temperature and Rs get equilibrated beyond extended period of rainfall. I am not sure if I understand this.”

“This coefficient was applied for the two first rain event day as temperature and Rs get equilibrated beyond extended period of rainfall. As well if ÉT on the day before rain event (ÉTj-1) was less than ÉTj-2 by more than 2 C, the coefficient was also applied assuming cloudy cover was already significant. For the other days, was set to 1. Why are you doing this? What is the scientific base for the 2°C?”

–> Our method is inspired by the work of Bristow and Campbell (1984) and adapted to our site where the cloud cover adjustment factor alpha was calibrated versus real measurement on the reference weather stations (0.79 instead of 0.75 default value from Bristow and Campbell). We will nuance in the revised manuscript the fact that 2°c and 2 days lag were chosen arbitrary based on the Bristow and Campbell’s work and only the cloud cover adjustment factor alpha was calibrated according to site conditions. This approach was based on the principle that if it was not relevant, calibrated alpha would have yield to 1 (no effect).

Extract from Bristow and Campbell (1984): “For reduced radiation loads under rainy conditions, the Pullman data generally yielded larger DeltaT values than expected. This necessitated adjusting measured DeltaT on rainy days by setting DeltaT (J) equal to 0.75 times the measured DeltaT (J). If DeltaT on the day before rain occurred, i.e. DeltaT(J-1), was less than DeltaT(J-2) by more than 2°C it was also reduced by 25%. In this situation it was assumed that cloudy conditions began on day (J-1) resulting in a large drop in incoming radiation. Extended rain periods should enable equilibration between incoming radiation and DeltaT. They should not require the 0.75 correction beyond the first few days of any rain spell.”

“AWS capacity is dependent on the vegetation surface type, as root zone extension and permanent wilting point are variable from one plant to another. Not in this case. You are not calculating crop water needs, but the effect of pore pressure. The way this

is study is conducted the root depth is indifferent."

–> We agree and revised manuscript clarifies this point.

"Effective rainfall was 15 then estimated with an AWS of 135 mm. Why?"

–> We understand that this sentence is difficult to understand, due to the inappropriate paper structure. Revised manuscript structure has been deeply changed and this sentence was removed.

References:

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 8945, 2013.