Hydrol. Earth Syst. Sci. Discuss., 3, S1911–S1912, 2007
www.hydrol-earth-syst-sci-discuss.net/3/S1911/2007/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Rainfall threshold for hillslope outflow: an emergent property of flow pathway connectivity" *by* P. Lehmann et al.

P. Lehmann et al.

Received and published: 2 February 2007

In this comment we want to discuss the single outflow event that was overestimated with the percolation model. First, we want to emphasize that this was a prediction (based on the events with wet antecedent water content) and it is not a mere fitting. Below, we list some modifications of the model that could be taken into account to describe a wider range of possible behavior:

- The redistribution of free water to unsaturated sites was neglected in the original model. To compute the effect of this redistribution, we implemented a simple redistribution step in down slope direction. In that case, the free water flows to the down slope directed neighbors if the corresponding connections exist. Due to this redistribution, the increase of outflow with rainstorm amount would be less pronounced close to the

percolation threshold. But this effect diminishes for small coordination numbers.

- The subsurface flow was described as a site percolation process with the state of a site (occupied / non-occupied) depending on the rainfall amount. Alternatively, the hillslope could be described as bond-percolation phenomena with the state of the bonds (open/closed) as a function of rainfall amount. Of course, also a combination of bond and side percolation is possible.

- The prediction of runoff for dry initial conditions is based on the assumption that the mean water storage capacity is a linear function of the initial water content measured at 70 cm soil depth and that this value is representative for the whole profile. This assumption is probably too simplified and could be adapted based on some information of the water distribution in the profile under dry conditions. In this paper we made the conscientious choice to keep the description of the hydrological processes as simple as possible, fully acknowledging that most processes can be described in greater detail, more physically based but also generally with greater numbers of uncertain parameters. The rainstorm event that was not correctly reproduced occurred after a drop of the water content at the end of a dry period. The rainstorm started the 26th of April in 1997 at the end of the wet winter period. No intense rainstorm events occurred during the 60 preceding days and the water content measured at 70 cm depth started to decrease. We hypothesize that at the end of April the temperature and the vegetation activity increased causing a more pronounced decrease of water content at the surface. We assume that the water content was lower close to the surface than in 70 cm depth and the water deficit based on the values measured at 70 cm was probably underestimated.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 3, 2923, 2006.

HESSD

3, S1911–S1912, 2007

Interactive Comment