Geophysical Research Abstracts,
Vol. 10, EGU2008-A-04173, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-04173
EGU General Assembly 2008

Spatial heterogeneity and overland flow: do we always gain from distributed modelling?

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Recent studies have demonstrated that connectivity between areas infiltrating and producing runoff plays a major role to explain the scale effects when moving from plots to catchments. However, for catchments of comparable sizes, the influence of the location and patchiness of areas with contrasting hydrological behaviour is subject to thresholds in rainfall regime or land use. These thresholds are difficult to identify with field measurements in natural conditions, particularly when it involves large areas like catchments of several km^2 as we have little control on the nature of the different objects we are studying, especially regarding changes in land use. The objective of this study is therefore to carry out simulations with a prediction runoff model to test the influence of land use, field size and rainfall characteristics on the runoff response. On a simulated catchment we produced different maps with varying field size resolution (the total area was divided in 10, 20, 40, 80, 160 or 1280 fields), and varying land use (the percentage of infiltrating fields representing 10, 20, 40 or 60 % of the catchment area). 8 maps with random location of the different fields were generated for each combination and three storms of 16, 20 or 40 mm in two hours with 10 mm 48h antecedent rainfall were simulated. The results showed a strong decrease of the runoff response with the decrease in field size and more expectedly with the increase of percentage of infiltrating area. In both cases, the relative decrease was more pronounced for the 16 mm than for the 40 mm storm. The variation in the response between the 8 maps with random location of the fields allowed us to determine conditions for which the spatial distribution has an effect on the runoff response. These results give indi-

cations on the domain of validity of catchment scale modelling of overland flow with spatially averaged parameters.