Geophysical Research Abstracts, Vol. 9, 05562, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05562

Stochastical modelling of preferential transport at the field scale: a structural approach

E. Zehe (1), L. Samaniego (2)

(1) Institute of Geoecology, University of Potsdam, Germany, (2) Computational Environmental Systems (CES), UFZ Centre for Environmental Research Leipzig-Halle, Germany

Preferential/rapid flow and transport is known as the key process for the fate of contaminant agro-chemicals for more than 20 years. Nevertheless, predicting environmental impact of pesticide transport at scales larger than the small field scale remains still an unsolved problem. In recent years researchers proposed various approaches ranging from range from simple effective approaches, over double porosity approaches to a approaches based on mathematical morphology mostly with the intention to exactly predict leaching i.e. the temporal evolution of the pesticide concentration in the soil. While this might work at well investigated field plots this strategy has to fail at larger scales. Preferential flow and transport is crucially determined by subsurface structures especially connective preferential pathways such as earthworm burrows that link the soil surface to the subsoil. This crucial information will never be exactly available at larger areas. From a statistical point of view the essence of rapid/preferential flow is a skewed or even bimodal pdf of travel times into the subsoil, where pesticide degradation is slow.

Within the present study we will present a) a stochastical approach for predicting the CDF of tracer transport distances at the field scale and catchment scale and b) demonstrate that this CDF is closely linked to the CDF that characterise the depth distribution of connective macropores that link the soil surface and the subsoil. To this end we employ a physically based process model for flow and transport as virtual landscape and will show that copulas are a suitable means for linking the above mentioned CDF's. For assessing the risk of shallow groundwater contamination with pesticides at the catchment scales the key question to predict which fraction of the pesticide travels into the subsoil within times that are short against the characteristic half live of the

pesticide (before it degrades). We think that this question can be tackled with stochastical methods if, and only if, we succeed in a better understanding and characterisation of spatial structures and there connectivity in the subsurface. In case when earthworm burrows make up the macropore system this may be achieved using a relatively simple connectivity measure and through a cooperation with soil ecologists.