Geophysical Research Abstracts, Vol. 8, 05474, 2006
SRef-ID: 1607-7962/gra/EGU06-A-05474


# Determining the rainfall controls on preferential pesticide transport: A statistical analysis of a lysimeter leaching experiment

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The transport of pesticides through the vadose zone has been shown to be controlled by the timing and nature of rainfall since application. We conducted multivariate analysis of tracer and pesticide effluent data of a three year lysimeter experiment in order to identify rainfall controls of tracer and pesticide transport. The experiment consisted of 12 0.5-1mˆ2 , 1.2m deep uncropped and unirrigated lysimeters at two nearby sites in Julich, Germany. Bromide and the herbicides ethidimuron (ETD) (1,3-Dimethyl-3-(5-ethylsulfonyl-1,3,4-thiadiazol-2-yl)-urea), and methabenzthiazuron (MBT) (1-Benzothiazol-2-yl-1,3-dimethylurea) were applied in November 1997 with periodic collection and analysis of leachate. Rainfall data was collected at 10 minute intervals for the duration of the experiment. Pesticide effluent was highly episodic in contrast to bromide that displayed a more classical breakthrough curve. The multivariate analysis consisted of principal component and regression tree analysis of (1) climate properties averaged over the sampling interval; (2) mean and extreme rainfall at 10 minute, hourly and daily temporal resolutions; (3) mean and extreme storm statistics such as duration, average intensity, and time between storms; and (4) the average drainage and leachate response of the lysimeters. The results of the multivariate analysis suggested drainage and bromide transport rates were greatest when the frequency of rainfall events and the averaged rainfall were higher. In contrast higher resolution rainfall (10 - 60 minute), storm based and extreme statistics tended to characterise better faster herbicide transport. The results of the analysis suggest characterisation of the statistical structure of high resolution rainfall may provide a measure of the risk of event based transport of agrichemicals due to preferential flow. Furthermore, hourly rainfall may be insufficient to accurately model pesticide mobilisation from surface soils.