Geophysical Research Abstracts, Vol. 7, 07694, 2005
SRef-ID: 1607-7962/gra/EGU05-A-07694

Assessing the impact of tile drainage on flow generation in a lowland catchment by spatially distributed modelling

B. Tiemeyer (1), R. Moussa (2), B. Lennartz (1), X. Louchart (2) and M. Voltz (2)

(1) Institute of Land Use, Rostock University, Germany (2) Institut National de la Recherche Agronomique (INRA), Laboratoire d'étude des Interactions entre Sol, Agrosystème et Hydrosystème, Montpellier, France

Tile drainage, which is common agricultural practice to improve soil moisture and aeration conditions, shortens the residence time of water in the biologically active unsaturated zone and therefore does not only enhance diffuse pollution of surface water bodies, but also substantially alter the hydrology of lowland catchments. Often, tile drainage is accompanied by flow anomalies causing a further, unexpected acceleration of water flux and solute transport. Here, we present the experimental approach and the spatially distributed modelling concept MHYDAS-DRAIN to account for and to evaluate these phenomena. In 2001, a hierarchical monitoring program was initiated in the pleistocene lowland landscape of north-eastern Germany with measurement stations at tile drain outlets, ditches and a brook. As a starting point for our model development, we chose the spatially distributed model MHYDAS which takes into account the discontinuities and the spatial variability of farmed catchments. The modelling domain consists of a system of interconnected 'hydrological units' derived by the overlay and intersection of geographical information such as land use, field limits, soil properties, tile drainage maps etc. and linked to a ditch network. For the development of MHYDAS-DRAIN it was hypothesized that tile drain discharge is composed of two components accounting for preferential flow and matrix flow. The fast flow component is modelled by a transfer function approach while the slow drainage flow is calculated by the Hooghoudt equation. In ditches and the brook, a baseflow component is also present. All flow routing is realized by a diffusive wave approximation. Model results are encouraging and agree well with measured data. Although model analysis revealed that the fast flow component contributed only with a few percent to the total

tile drainage discharge, this may still be of importance for solute transport. The total tile drainage discharge, however, was found to govern the hydrology of this lowland catchment.