Geophysical Research Abstracts, Vol. 9, 03236, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03236

Spatial variability of soil properties and shallow groundwater solute concentrations in a degraded peatland

B. Tiemeyer (1), J. Frings (1), P. Kahle (1) and B. Lennartz (1)

(1) Institute for Land Use, Faculty for Agricultural and Environmental Sciences, Rostock University, Germany (baerbel.tiemeyer@uni-rostock.de)

Most of the once ecologically valuable and widespread peatlands in Western Europe as well as in Mecklenburg-Vorpommern (North-Eastern Germany) have been drained in the course of the intensification of agriculture. Peat degradation and mineralisation frequently caused high nitrate losses, while re-wetting might lead to elevated phosphorus concentrations in the pore water. High concentrations of nitrate-nitrogen and other solutes in a ditch draining a catchment (85 ha) dominated by a degraded peatland under intensive grassland use gave reason to investigate the relationship between the spatial variability of the shallow groundwater quality on the one hand and soil properties, topography and hydrological dynamics on the other hand. Therefore, in addition to the ditch, three transects of dip wells were sampled and soil samples were taken along the transects in a high spatial resolution

Soil organic carbon and total nitrogen contents varied significantly from 0.80 to 41 % and 0.08 to 2.87 %, respectively. A trend surface analysis (TSA) of the soil properties showed a strong trend depending on the ground elevation and the distance to the adjacent drainage ditch, reflecting both a transition from mineral to organic soils and differences in peat formation and degradation connected to the topography and, consequently, to the depth to the groundwater table. Semivariogram analysis was performed using the normally distributed residuals of the TSA and showed in all cases a strong spatial dependence and short (5 to 26 m) ranges. Therefore, soil sampling in peatlands needs to be conducted at short distance sampling intervals.

The patterns of groundwater solute concentrations were complex and spatially and temporally very variable between as well as within the transects, thus proving that

a few groundwater samples are insufficient for a representative characterisation of the peatland status and for an evaluation of possible environmental impacts or re-wetting prospects. Concentrations ranged from 0 to 65.4 mg/l nitrate-nitrogen and 0 to 1.95 mg/l total phosphorus, while ditch water concentrations of “only” 0 to 15.9 mg/l nitrate-nitrogen and 0.05 to 0.44 mg/l total phosphorus, respectively, were measured. Factor analysis of groundwater concentrations, topographical data, hydrological conditions and soil properties led to the identification of five factors explaining 76 % of the observed variance of the data: (i) topography and soil chemical properties, (ii) cations and sulphate, (iii) day of the hydrological year and temperature, (iv) drainage effects, groundwater level and nitrate-nitrogen and (v) precipitation and chloride.