Geophysical Research Abstracts
Vol. 20, EGU2018-2040, 2018
EGU General Assembly 2018

GIS-based estimation of shallow groundwater nitrate concentrations on the large-scale

Lukas Knoll, Lutz Breuer, and Martin Bach

Justus Liebig University Giessen, Institute of Landscape Ecology and Resources Management , Landscape, Water and Biogeochemical Cycles , Germany (lukas.knoll@umwelt.uni-giessen.de)

Estimation of nitrogen inputs into surface waters has turned out to be a key research area in the last years, particularly in the context of the implementation of the EU Water Framework Directive. Predominantly nitrate loads from agricultural land use contribute to the high concentrations in the groundwater bodies. A better representation of nitrogen (N) flow paths, retention times and denitrification processes in groundwater transport models is needed to develop effective management plans. However, data required for meaningful large-scale applications of groundwater transport models regularly is still limited.
Recently, the federal state of Hesse (Germany) provided measurements from about 2.500 monitoring sites (springs, wells and monitoring wells) for nitrate concentrations in groundwater bodies. In addition, a wide range of spatial data on land use, N-surplus on agricultural land, groundwater recharge, hydrogeological conditions and potential denitrification rates in soils is available. Based on this data, we developed a multiple linear regression (MLR) approach for statewide predictions of spatial nitrate concentration in shallow groundwater.

We generated a MLR model from different explanatory variables such as percentage of arable land use, percolation rates, groundwater recharge, residence times, the protective function of the groundwater cover, N-surplus and the potential denitrification rates in soils to predict nitrate as the dependent variable. Our MLR model shows that shallow groundwater nitrate concentrations of the state of Hesse can be explained with an adj. r^2 from 0.4 to 0.5 for different hydrogeological regions. The use of statewide, commonly available spatial data as independent variables makes the model applicable to other comparable regions or even on a national scale of Germany. We show preliminary results and discuss how to apply our GIS-based statistical approach to estimate groundwater nitrate concentrations in regions where less field observations are available.