Limiting nitrogen and veterinary pharmaceutical input into groundwater: combining hydrogeophysics and soil science

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The EU Interreg project TOPSOIL investigates opportunities to improve surface and groundwater quality as well as water management strategies under the consideration of climate adaptation challenges. Within the framework of the project, we investigate the transport behavior of percolation water in the unsaturated zone, the migration of nitrogen and veterinary pharmaceuticals in soils, and - together with different stakeholders (e.g. farmers, water supply companies) - develop common strategies to minimize the migration of these substances into the groundwater. In our study we focus on distinguishing preferential and diffuse flow using soil scientific and geophysical methods.

During the first investigation campaign, we combined soil sampling with radiometry and electrical conductivity overview measurements on the typical sandy soil of the studied area south of Oldenburg, Germany. We used the CMD explorer for the electromagnetic mapping (horizontal and vertical dipoles, intercoil spacing of 1.48/2.82/4.49 m, investigations depths of appr. 0 - 6 m) and the radiometry detector comprised five sodium-iodide crystals each with a volume of 4 litres. The spectral data are evaluated for potassium (1.37 – 1.57 MeV), uranium (Bi-214) (1.66 – 1.86MeV) and thorium (T-208) (2.41 – 2.81MeV) and total counts (0.41-2.81MeV). A total of 292 soil samples were taken from 46 ram coring profiles (depth range: 0 to 3 m) and analyzed for soil chemical parameters and water content.

The first evaluation showed a good correlation between conductivity and radiometry measurements. While the uranium and thorium values are generally low, the potassium values possibly reflect higher clay contents as do the higher conductivity values. The geophysical overview measurements were used to select the locations for soil sampling and we specifically targeted presumably clay-rich as well as clay-poor areas for sampling.