Long term high resolution heavy metal leaching from soils to surface waters in a Dutch catchment

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The impact of seasonal variation and drainage conditions on the leaching of cadmium and zinc was investigated by the application of a distributed pseudo 2D-model to the Keersop catchment in the south of The Netherlands. Soils in the area have been contaminated with heavy metals from zinc smelters during the period 1890 – 1973. Measurements indicated that these metals accumulate in the unsaturated upper part of the soils in the area. Metal concentrations in surface waters that drain the area were also elevated.

A dynamic modelling approach for the soil system was applied to analyse the impact of temporal variations in weather on accumulation and transport of metals in the unsaturated zone, groundwater and in the drained water that leaches towards surface waters. The 1D SWAP model (www.swap.alterral.nl) was extended to enable the simulation of the drained discharge of heavy metals. The modelling approach included daily simulations for the period from 1890 – present. This allowed analysis of the dynamics of groundwater level fluctuations, drained water and metal discharge at the scale of a catchment. Both field and catchment monitoring were used to validate model results.

The non-linear relation between discharge and solute transport of these high adsorbing substances was modelled using a high time resolution in the modelling approach and taking account for the groundwater level fluctuations to explain peak behaviour of the metal concentrations in surface waters.