



Groundwater travel times and surface water quality

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Surface water quality measurements in The Netherlands are scattered in time and space. Therefore, water quality status and its variations and trends are difficult to determine. In order to reach the water quality goals according to the European Water Framework Directive, we need to improve our understanding of the dynamics of surface water quality and the processes that affect it.

Surface water solute concentrations are often analyzed using travel time distributions of water passing through the saturated and unsaturated soil of the contributing catchment, representing the contact time during which sorption, desorption and degradation takes place. However, travel time distributions are strongly influenced by processes like tube drain flow, overland flow and the dynamics of draining ditches and streams and therefore show strong daily and seasonal variations.

The study we will present is situated in the 6.6 square km Hupsel brook catchment in The Netherlands, which is a predominantly agricultural, gently sloping catchment with mostly sandy soils. Many fields have tube drains discharging into a dense ditch network that feeds into the brook and its subsidiaries. This catchment has been intensively monitored for the past 20 years and therefore a comparison between model results and concentration measurements is possible.

An explorative groundwater model study (Modflow) with a detailed spatial and temporal resolution, combined with a transient particle tracking approach is performed to evaluate the transient behaviour of the surface water network and its effect on travel time distributions. The dynamics in travel time distributions are used to describe surface water chloride and nitrate concentrations to point out the importance of using transient travel time distributions for surface water concentration and load calculations.