

# **DETERMINATION OF THE MINIMAL MEAN RESIDENCE TIME FOR SHALLOW GROUNDWATER AS AN ALTERNATIVE FOR WIDESPREAD USED LUMPED PARAMETER MODELS**

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Lumped parameter models (for example piston-flow model and exponential model) are common tools for dating of shallow groundwater. They are easy to handle and lead to an evaluation of mean groundwater residence time from concentration measurements of specific substances in water samples (for example  $^3\text{H}$ ,  $^{85}\text{Kr}$ , CFC's,  $^3\text{He}$ ). They are necessary because sampling of groundwater in long-screened groundwater observation wells often leads to mixing of water with various ages. Building a model of flow and transport in the aquifer is required for consideration of mixing and determination of the age distribution in the sample. The main disadvantage of the lumped parameter models is that their assumptions about flow and transport in the aquifer are often strong simplifications of what happens in reality. Numerical simulation of flow and transport can give a much more exact picture about flow and transport in the aquifer. However, working with these tools can be very time-consuming. A method which is as easy to handle as lumped parameter models but is free of assumptions about flow patterns in the aquifer is presented in this contribution. Here, the transfer function is discretized and for all possible flow patterns the Minimal Mean Residence Time is calculated. This method can be very useful for example for risk estimation.