



Water ages of 20 groundwater bodies and its relevance for the implementation of the European Water Framework Directive

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The “Mean Residence Time” (MRT) of groundwater is required to develop reliable hydrogeological concepts of groundwater bodies as a prerequisite for a qualified monitoring and risk assessment. MRTs from monitoring wells help to assess if groundwater bodies are “at risk” or “not at risk” failing to meet good groundwater quantitative and chemical status according to the Water Framework Directive and therefore not being able to use the groundwater as drinking water or industrial water resource. A combination of $^{18}\text{O}/^2\text{H}$, ^3H , $^3\text{H}/^3\text{He}$ and in some cases additional CFC, SF_6 , ^{85}Kr and ^{35}S measurements allow to calculate reliable MRTs in 20 groundwater bodies covering 13% (approx. 10719 km²) of the Austrian territory. Altogether 401 groundwater wells and springs from the existing groundwater monitoring network were analysed for $\delta^{18}\text{O}$ (n=1500), ^3H (n=800) and ^3He (n=327) since 2006. Considering both the fact that monitoring wells may have multiple or long well screens and the inherent uncertainties of groundwater age dating techniques, age estimations were classified into 5 categories of short (< 5 year), medium (5-10, 11 - 25 years) and long (25 - 50, > 50years) mean residence times for each monitoring site. Subsequently, median values of the MRT categories were assigned to each investigated groundwater body. These are valuable information to fix extraction rates, to set measures to improve the land use and groundwater protection and to validate hydrogeological concepts. Generally, MRTs of groundwater bodies increase from shallow Alpine groundwater bodies over deeper Alpine valley-aquifers to longer MRTs in the Pannonian climate range in the east of Austria.