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# Tritium concentration in the Fischa-Dagnitz Spring reinterpreted with improved lumped parameter and hydrogeological models of the Southern Vienna Basin

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The Fischa-Dagnitz Spring (400 L/s) in the middle of the Southern Vienna Basin porous aquifer has a very long tritium record (n=116, 1963-2014). The Mean Transit Time (MTT) has been estimated using simple models and the Vienna-Gloggnitz input data to be 9yrs (Davis et al, 1967) and later 8-10yrs (Rank and Papesch, 2003).
Later, Stolp et al. (2010) calculated an MTT of 8yrs based on 3H/3He-results (and 11yrs using a hybrid exponential-dispersion model). They regarded the tritium series age as being in agreement with their gas-tracer results. However, Kralik et al. (2012) found MTTs of 5-10yrs with 3H/3He, 85Kr, and SF6-data. Also, Wyhlidal et al. (2013) reported an MTT between 13.5-16.5yrs from the 3H time series using the dispersion model.
The complete tritium time series has now been reinvestigated using multiparameter estimation methods. The tritium age uncertainties due to measurement errors and model parameter choices were investigated using Monte Carlo sampling in a generalised likelihood uncertainty estimation (GLUE) framework (Gallart et al., 2016) for a variety of lumped parameter models. The models were the exponential piston flow (EPM), dispersion (DM) and gamma (GM) models. These single models assume homogeneous groundwater systems or catchments. We also looked at double versions of these models, which allow for heterogeneity in hydrological systems (e.g. two source components in springs or two distinctive geological parts in a catchment).
The new analyses of the Fischa-Dagnitz tritium time series show MTTs of 15-20yrs. The double models show the presence of two water components. There is on average 20% of young water 3-4yrs old and 80% of older water 20yrs old.
The potential recharge area for the spring is 600 km2 of Alpine karst with a yearly precipitation of 1100mm, and an adjacent 300 km2 of porous aquifer in the Vienna Basin itself with precipitation of 600 mm/a. The $\delta$18O value in the Fischa-Dagnitz Spring (-10.5‰ shows a 25:75 mixture of basin (-9.1‰ and Alpine karst (-10.9‰ precipitations. Considering this result, the 75-80% of old water calculated from the tritium time series would come from the Alpine karst over 10-40 km. This contribution comes partly through infiltration of river water and partly from Alpine karst. 20-25% would then infiltrate by heavy rain-events into the unconfined porous aquifer over 0-20 km.

Davis, G.H., Payne, B.R., Dincer, T., Florkowski, T., Gattinger, T., (1967): Isotope Hydrology 1967. IAEA, Vienna, 451-473.
Gallart F. Roig-Planasdemunt M. Stewart M.K. Llorens P. Morgenstern U. Stichler W. Pfister P. Latron J. (2016): Hydrological Processes 30: 4741-4760.
Kralik, M.; Humer, F.; Brielmann, H.; Sültenfuß, J.; Purtschert, R.; Gerber, C. (2012): ISOMETH – Final report: 27 p., (DaFNE), BMLFUW Vienna. https://www.bmlfuw.gv.at/
Rank, D., and W. Papesch (2003): Abstract Volume of the First Conference on Applied Environmental Geology in Central and Eastern Europe: BE-228: 206–207, Environment Agency, Vienna.
Stolp B., Solomon D. K., Vitvar T., Rank D., Aggarwal P. K., and Han L. F. (2010): Water Resour. Res. 46, 13.doi:10.1029/2009WR008006.
Wyhlidal, S., Rank, D., Schuster, K., Jung, M. (2013): Geophysical Research Abstracts, Vol. 15, EGU2013-1500.