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Rapid vertical transport: evidence from an isotopic and chemical lysimeter-profile in a porous aquifer, Wagna, Leibnitzer Feld, Austria.

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Isotopic behaviour, hydrochemical exchange and variation of transport velocities in the unsaturated zone and at the transition unsaturated and saturated zone are still unknown in many groundwater bodies. This vertical transport time through the unsaturated zone has to be added by estimating the Mean Residence Time (MRT) of groundwater by gas tracers as e.g. 3He, 85Kr, CFCs, SF6 etc.

At the lysimeter station Wagna (Leibnitzer Feld, Styria, Austria) a dense depth-profile (n=24 suction cups) over the transition unsaturated and saturated zone was sampled 6 month after an unusual wet summer. On all samples oxygen and hydrogen isotopes as well as major ions were analysed. Tritium was measured at the top and the bottom of the saturated zone. The heavier isotopes and the smaller ion-concentration in the water of the unsaturated zone approach the surface of the saturated zone with a gradient. This gradient continues in a steep form over the depth of the saturated zone. The tritium content on top of the saturated zone is significantly higher than at the bottom of the zone (11 and 9.7 TU), indicating summer water with a higher tritium content of 11 – 12 TU. The unusual high summer precipitation (150%) seem to have arrived quicker (4.4-6.6 m/a) than normal (2.5 m/a) at the saturated zone in the depth of 3.3 m. All the major ions are less concentrated in the unsaturated zone with the exception of nitrate supporting the idea of diluted ion-concentrations in strong summer precipitations, but enhanced nitrate leaching.

Isotope data and tracer gas measurements of 14 monitoring wells in the groundwater body surrounding the lysimeter allow calculating the timing and the importance of summer precipitation for the groundwater recharge in unconfined aquifers in humid climates.