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A novel technique to estimate infiltration capacity reduction in unsaturated soil media in Managed Aquifer Recharge spreading methods

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Managed aquifer recharge consists in the intentional supply of water to the aquifer, which is used as storage for further use in the future, when the offer of surface water sources decreases during warmer seasons. Within the spreading methods, water is infiltrated through the unsaturated zone via infiltration basins under different wet-dry ratios, using the soil media as a filter for improving the quality of the water before it reaches the groundwater level. Depending on the source of infiltrated water, the surface of the basin floor will suffer from clogging (biological, physical & mechanical) in different rates. Commonly, tracer experiments are performed to check the infiltration capacity state of the basin before the basin overflows.

The aim of this investigation is to give an alternative method to monitor the reduction of the hydraulic conductivity in the unsaturated soil media of the infiltration basin, based on water content data. Water content and electrical conductivity sensors, supplied with a data logger, were installed bellow an experimental field-scale infiltration basin (5m x 4m x 1,5m) at different depths. Data was recorded in 2 minutes interval for five different infiltration scenarios (varying wet and dry regimes) under intensive tracer experiments in every wet cycle.

The overlapping of the wet cycles for each scenario showed a continuous reduction of the overall water content. The Root Mean Square Error values between the water content series of the first infiltration event and the subsequent ones, obtained for different run scenarios, indicate an increasing tendency that is reciprocal to the decrease of the mean linear velocity obtained during tracer experiments. The water-content-resulting-breakthrough curve fits with the one obtained from the tracer experiments, offering a method that can additionally give even more detailed data for the analysis of the infiltration capacity reduction.