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Impact of climate variations on Managed Aquifer Recharge infiltration basins.

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Managed Aquifer Recharge (MAR) is a technique that is gaining more attention as a sustainable alternative for areas where water scarcity is increasing. Main concept relies on facilitating the vertical infiltration of a source of fresh water (river water, rainwater, reclaimed water, etc). The groundwater acts as storage of water for further use in the future, for example in times of water scarcity. In some MAR types the soil itself can be used even as a filter for the removal of specific organic and inorganic compounds.

In order to promote the benefits of MAR in different zones of the globe with variable climate conditions, including the effects of climate change, a numerical model (HYDRUS 2D/3D) is being set up. Coupled with the model a field-scale rapid infiltration unit (4m x 5m x 1.5m) was constructed with the capacity to log different MAR key parameters in the soil (tension, water content, temperature and electrical conductivity) in space and time. These data will feed the model for its calibration using specific hydrogeological characteristics of the packing material and hydraulic characteristics of the infiltrated fluid. The unit is located in the city of Pirna (German), 200 m north from the Elbe River where the groundwater level varies seasonally between 6 and 9 m below the ground surface.

Together with the field scale rapid infiltration unit, a set of multi-parametric sensors (measuring in time: water stage, electrical conductivity, dissolved oxygen and temperature) in six monitoring wells, located on the basin surroundings, were installed. The purpose of these sensors is to estimate, via tracer experiments, the time that the infiltrated water needed to reach the groundwater and the flow speed in which it travelled once it reached the saturated zone.

Once calibrated, the model will be able to estimate the flow behaviour under variable climate conditions (temperature, precipitation and evaporation), representative for different climatic zones in the globe. The simulation results of the different climate models reported by the IPCC will also be considered for critical zones where fresh water availability will decrease considerably.

In the field, the first results confirmed the arrival, after 14 days of travel time, of the infiltrated river water front to the monitoring wells located next to the infiltration unit. Further tracer experiments have to be performed in order to catch a stronger breakthrough curve in more than one observation point. Interesting open questions arise from the data stored in the trench sensors. How the change of the travel velocity depends on different external parameters like time of operation, cyclic wetting and drying regime and temperature, will be analysed together with the results of the ongoing experiments.