



## **Comparison of different estimation techniques to quantify groundwater recharge in Pirna, Germany**

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Water scarcity in combination with groundwater exploitation is a major concern worldwide because of climate change, population growth and rising water demand. To be able to sustainably manage and protect groundwater resources, it is necessary to quantify the amount of water which leaks through the unsaturated zone and recharges the aquifer naturally. However, quantifying the spatial and temporal distribution of recharge is difficult because of soil heterogeneity and the influence of vegetation. For that reason and because field measurements of recharge are difficult to obtain, models are valuable tools to quantify recharge. Numerical models need a lot of parameters which are hard to measure and hence can only be estimated. Therefore analytical models or empirical equations which use less and / or easier obtainable parameters could estimate groundwater recharge as well as numerical models because of the underlying uncertainty in parameter estimation. Recharge estimation methods which use different model approaches and have varying complexity were compared at Pirna test field site, Germany to select suitable methods which will later be integrated into a web-based Decision Support System (DSS) developed for the sustainable management of groundwater. The complexity of the used methods covers numerical models, analytical models as well as empirical equations. Different model approaches were used to estimate groundwater recharge including amongst others a groundwater flow model, an unsaturated zone model and a watershed model. The resulting groundwater recharge estimates received from the numerical and analytical models and from empirical equations were compared to evaluate whether the methods are suitable to estimate groundwater recharge considering the complexity, data requirements and time-consumption of each method.