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Free web-based modelling platform for managed aquifer recharge (MAR) applications

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Managed aquifer recharge represents a valuable instrument for sustainable water resources management. The concept implies purposeful infiltration of surface water into underground for later recovery or environmental benefits. Over decades, MAR schemes were successfully installed worldwide for a variety of reasons: to maximize the natural storage capacity of aquifers, physical aquifer management, water quality management, and ecological benefits. The INOWAS-DSS platform provides a collection of free web-based tools for planning, management and optimization of main components of MAR schemes. The tools are grouped into 13 specific applications that cover most relevant challenges encountered at MAR sites, both from quantitative and qualitative perspectives. The applications include among others the optimization of MAR site location, the assessment of saltwater intrusion, the restoration of groundwater levels in overexploited aquifers, the maximization of natural storage capacity of aquifers, the improvement of water quality, the design and operational optimization of MAR schemes, clogging development and risk assessment.

The platform contains a collection of about 35 web-based tools of various degrees of complexity, which are either included in application specific workflows or used as standalone modelling instruments. Among them are simple tools derived from data mining and empirical equations, analytical groundwater related equations, as well as complex numerical flow and transport models (MODFLOW, MT3DMS and SEAWAT). Up to now, the simulation core of the INOWAS-DSS, which is based on the finite differences groundwater flow model MODFLOW, is implemented and runs on the web. A scenario analyser helps to easily set up and evaluate new management options as well as future development such as land use and climate change and compare them to previous scenarios. Additionally simple tools such as analytical equations to assess saltwater intrusion are already running online.

Besides the simulation tools, a web-based data base is under development where geospatial and time series data can be stored, managed, and processed. Furthermore, a web-based information system containing user guides for the various developed tools and applications as well as basic information on MAR and related topics is published and will be regularly expanded as new tools are getting implemented.

The INOWAS-DSS including its simulation tools, data base and information system provides an extensive framework to manage, plan and optimize MAR facilities. As the INOWAS-DSS is an open-source software accessible via the internet using standard web browsers, it offers new ways for data sharing and collaboration among various partners and decision makers.