IC4WATER RDI FUNDED PROJECTS BOOKLET

Project: SMART FRAMEWORK FOR REAL TIME MONITORING AND CONTROL OF SUBSURFACE PROCESSES IN MANAGED AQUIFER RECHARGE APPLICATIONS

Acronym: SMART-Control

Outcomes and expected impact:

The main outcome of SMART-Control will be the development of an innovative web-based open source platform including modelling, monitoring and risk assessment tools to improve the management and operation of MAR facilities and reduce the associated risks.

The web-based platform will include various tools for monitoring, modelling and risk assessment of MAR facilities. The first tool (T1) aims at initial risk assessment with the evaluation of risks and remediation measures which will be published in guidelines. The second tool (T2) will be developed as a guided instrument to evaluate subsurface removal processes of pathogens. The tool will incorporate real-time monitoring data in combination with automated optimization and control algorithms and will be integrated on the web-based platform. In addition, real-time monitoring data will be utilized for up-to-date optimisation and management simulations based on the numerical modelling scheme of the MAR system (T3). With the help of the prediction and advanced management tool (T4), upcoming changes regarding climate change and urban development can be incorporated into the modelling framework. The developed tools span various complexities (literature guidelines to numerical modelling and prediction) to cover the demand at a wide range of facilities and will be tested at six MAR plants.

A guideline on the transfer of the SMART-Control approach including a cost-benefit analysis (CBA) and a technological transfer concept will be published allowing system operators to quantify the site-specific benefits of the implementation of an advanced monitoring and control concept. Besides the publication of guidelines, the results of SMART-Control will be presented at international conferences and will be published in at least two open access articles. In addition, training material will be developed including web-based documentation pages and online user-guides for the various features of the web-based platform. Workshops in the participating countries and webinars will be established to increase the user circle of the web-based platform and facilitate its application.

Increased monitoring frequency of microbial, operational and chemical parameters using online tools increases the safety of water production and the data density for process performance validation and provides cost-effectively relevant information for MAR operations. SMART-Control will prove that despite MAR is a nature-based solution, risks associated with the implementation and operation can be managed and controlled and demonstrates that it is a safe and reliable technique for integrated water resources management. The web-based platform offers a new scientific approach to analyse the relevant processes in real-time which enables the up-to-date diagnostic for operators, regulators and water managers.

The SMART-Control project addresses key elements of the JPI Water RDI agenda by facilitating international cooperation among four European and one non-European partner, fostering the implementation of related international & EU policies and promoting

transdisciplinary research among researchers and end-users to enhance the efficient and sustainable use of water resources under the impact of climate change. The main added-value of the project is on bridging the gap in "water supply-demand" paradigm through technological innovation, rising social awareness, improvement of ecosystem services, demonstrating economic viability and integration of policies. The measures proposed contribute to SDGs 6, 11 and 13 by promoting and ensuring safe water supply and sustainable management, and by making cities more resilient and sustainable in the combat with climate change and its impact.

The project builds on previous as well as on-going European, national and bilateral projects. The web-based monitoring and modelling platform developed within the BMBF-funded Junior Research Group INOWAS (#01LN1311A) will be extended and will incorporate and further enhance tools implemented within the projects AquaNES (#689450), SubSol (#642228), DEMEAU (#308339) and DEMOWARE (#619040). The international consortium, consisting of nine full partners from Germany, France, Brazil and Cyprus and several associated partners composed of stakeholders and end-users, promotes the international cooperation which allows the achievement of project results that would otherwise not be possible. The participation of stakeholders and end-users is ensured during the whole project lifetime through the participation in project meetings and training activities to maximise the dissemination of project results.

SMART-Control supports young researchers and entrepreneurs by producing open source and free software to promote digital education and jobs, avoiding the creation of barriers or inequalities often caused by high license fees. The project aims to create a trans-disciplinary environment for researchers by bringing together water scientists, water managers, economists and software developers. Additionally, an Advisory Board consisting of two experts with high international reputation on MAR assessment will ensure the quality control of project activities.

List of deliverables expected:	
1	Publication of guide on assessment and management of MAR-associated risks
2	Web-based real-time observation platform running
3	Initial risk assessment tool implemented
4	Web-based real-time monitoring and control capabilities implemented (T2)
5	Real-time monitoring and observation platform implemented and tested at pilot-scheme Pirna
6	Upload of webinars on project website
7	Online user-guide published
8	Project website online
9	Published guide on technology transfer

Expected research results to communicate and disseminate (in very general terms)	**Target groups for communication and dissemination activities:**
1. web-based open source platform including modelling, monitoring and risk	Scientists, water utilities, decision makers, stakeholders

assessment tools	
2. demonstration of real-time monitoring and control approach at various case studies	Water utilities, stakeholders
3. Guideline on assessment and management of MAR-associated risks	Replicators e.g. water utilities, water managers, scientists, stakeholders
4. Technology transfer guideline	Replicators e.g. water utilities, water managers, scientists, stakeholders
Experiments / Case studies (if any): location, type of experiments: • Pirna, Germany: RMCS system setup, testing and calibration; influence of recharge on water dynamics • Berlin-Spandau, Germany: combination of real-time monitoring of subsurface residence times with high-resolution microbial dynamics • Aquarenova, France: prevent saltwater intrusion and monitor saltwater wedge at the Gapeau riverbank • Ezousas, Cyprus: setup continuous monitoring system: locate saltwater interface, monitor water quality (nitrate) • João Pessoa, Brazil : setup continuous monitoring system: reduce surface runoff during flooding • Recife, Brazil: setup continuous monitoring system: mitigate saltwater intrusion, extreme climatic events	
Water Policy context / project contribution to policies (National, European, International – UN SDGs): UN SDG 6 (integrated and sustainable water resources management to combat water scarcity, improvement of water quality by safe water reuse and strengthens the international cooperation and capacity building efforts)	