



Smart framework for real-time monitoring and control of subsurface processes in managed aquifer recharge applications: project outlook

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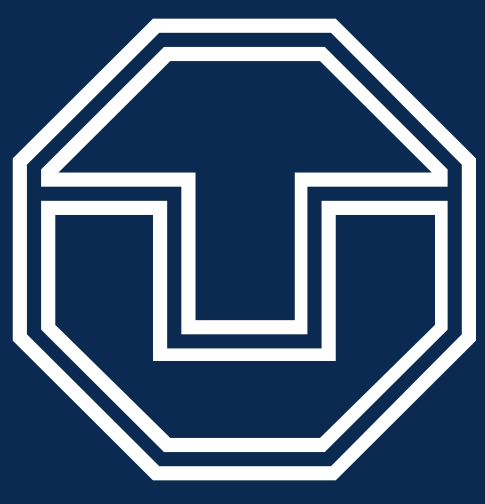
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Smart framework for real-time monitoring and control of subsurface processes in managed aquifer recharge applications: project outlook

The main objective of the WaterJPI funded project SMART-Control is to reduce the risks in the application of sustainable groundwater management techniques by the development of an innovative **web-based, real-time monitoring and control system (RCMS)** in combination with **risk assessment and management tools**.

The system consists of an **in-situ real-time monitoring system** and a **web-based platform** for control, modelling and prediction. Objectives will be measured against quantifiable performance indicators according to risk management issues in water reuse applications related to public health, environmental risks, clogging management, recovery efficiency and residence time.

Case studies applying different MAR technologies in various hydrogeological, climatic and socio-economic environments were selected to reach a wide range of objectives:

- increase water availability in urban areas,
- prevent saltwater intrusion in coastal aquifers
- mitigate extreme climatic events.

Reducing the risks associated with MAR facilities makes them manageable and controllable, increases the capacity and social acceptance of water reuse technologies and demonstrates their viability as climate change adaptation measures.

METHODOLOGY

The core of the project consists of the web-based INOWAS platform (right column), where various tools for MAR assessment are compiled. During SMART-Control, additional features will be added to assess, monitor and control the occurring parameters and processes at MAR facilities (Figure 1).

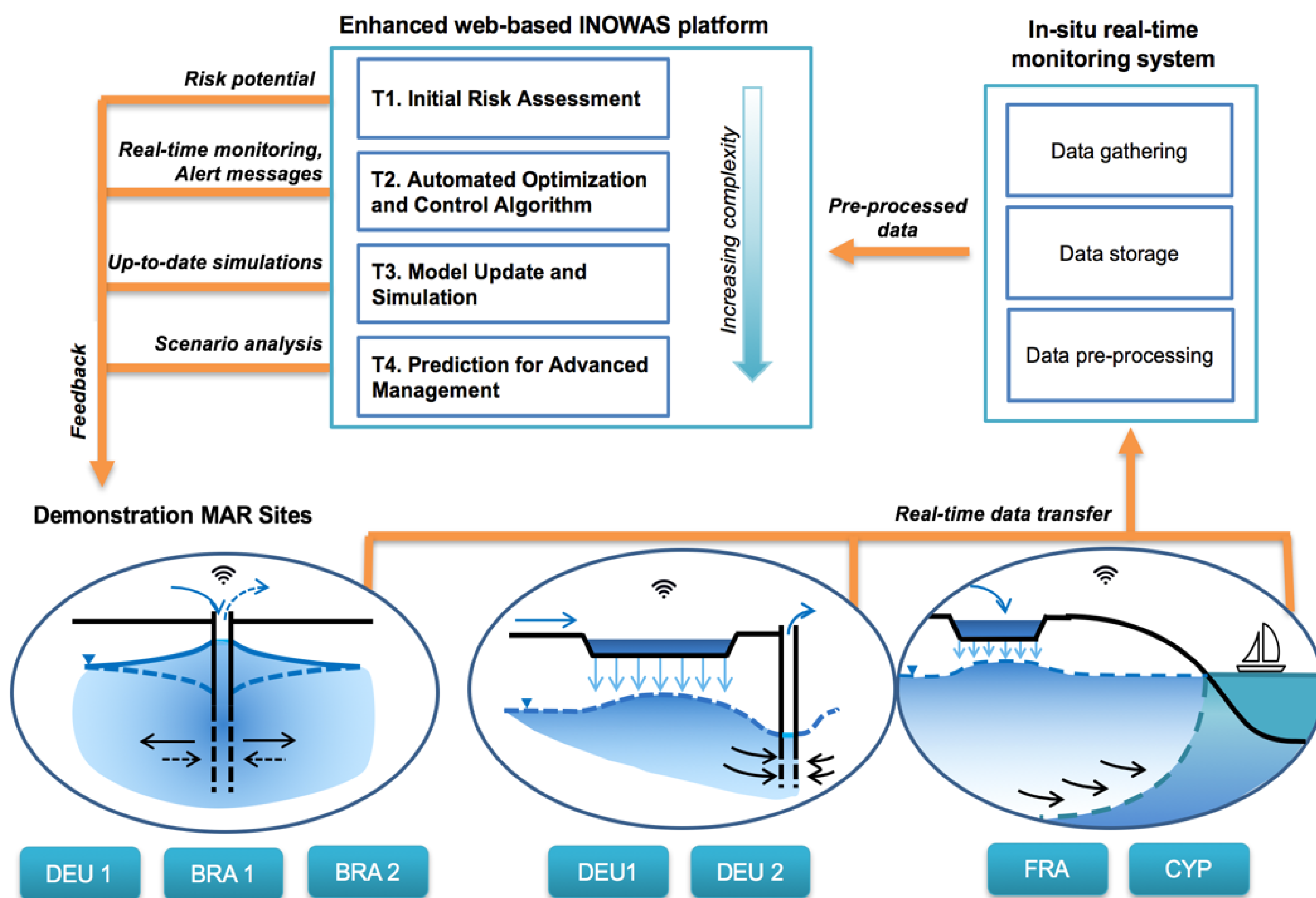


Figure 1. RCMS concept within SMART-Control including the various components of the approach (online sensors, real-time monitoring system, web-based platform) and the MAR demonstration sites.

The SMART-Control approach will be first implemented and tested at the pilot MAR facility in Pirna, Germany. The concept will then be deployed and adapted to five additional pilot and full-scale MAR schemes encompassing various environmental, socio-economic and technological characteristics to demonstrate the wide applicability (Table 1).

Table 1. Overview of case study sites including specific objectives of the SMART-Control approach.

Case Study	MAR type	SMART-Control objective
Pirna, Germany (DEU1)	ASR well, infiltration pond	RMCS system setup, testing and calibration; influence of recharge on water dynamics at pilot site
Berlin, Germany (DEU2)	Infiltration ponds	combination of real-time monitoring of subsurface residence times with high-resolution microbial dynamics
Aquarenova, France (FRA)	Infiltration ponds	prevent saltwater intrusion and monitor saltwater wedge at the Gapeau riverbank
Ezousas, Cyprus (CYP)	Infiltration ponds	setup continuous monitoring system: locate saltwater interface, monitor water quality (nitrate)
João Pessoa, Brazil (BRA1)	ASR well	setup continuous monitoring system: reduce surface runoff during flooding
Recife, Brazil (BRA2)	ASR well	setup continuous monitoring system: mitigate saltwater intrusion, extreme climatic events

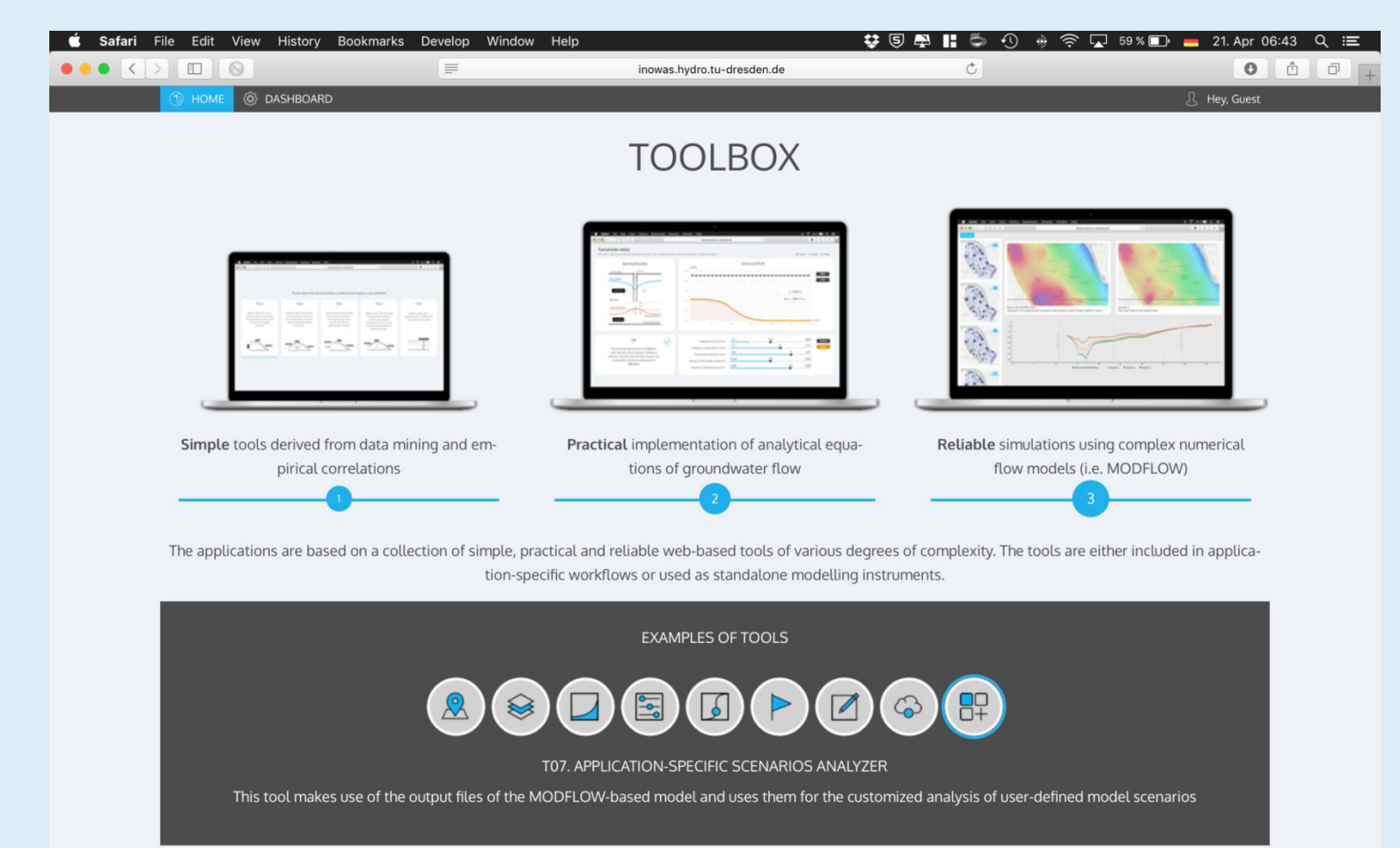
A guideline on the transfer of the SMART-Control approach including a cost-benefit analysis (CBA) and a technological transfer concept will be developed to allow system operators to quantify the site-specific benefits of the implementation of an advanced monitoring and control concept.

WEB-BASED INOWAS PLATFORM

www.inowas.com

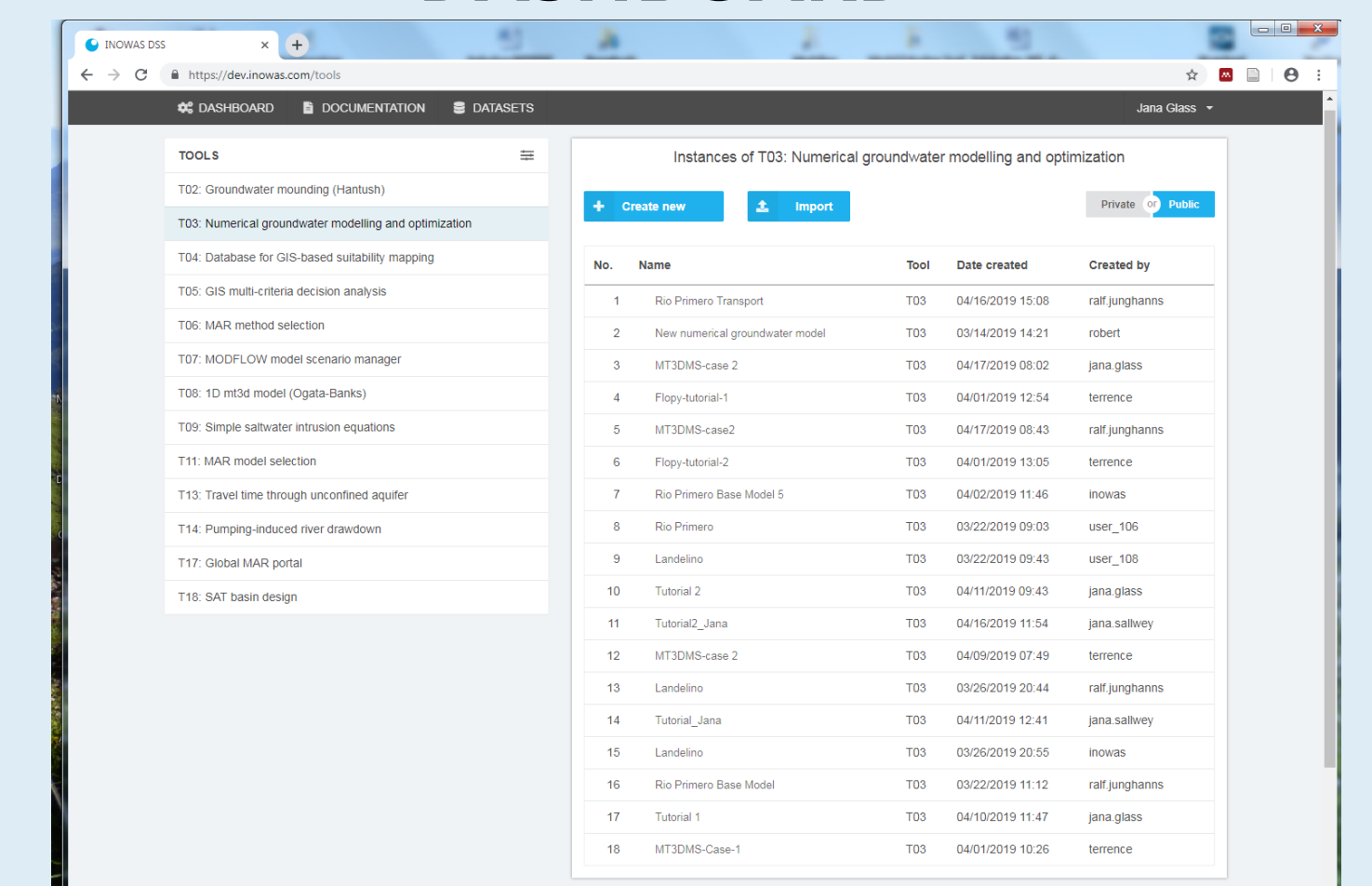
- ✓ Web-based
- ✓ Open source
- ✓ Cloud modeling
- ✓ Online documentation
- ✓ Parallel / scalable
- ✓ Worldwide accessibility
- ✓ Easy user collaboration

TOOLS



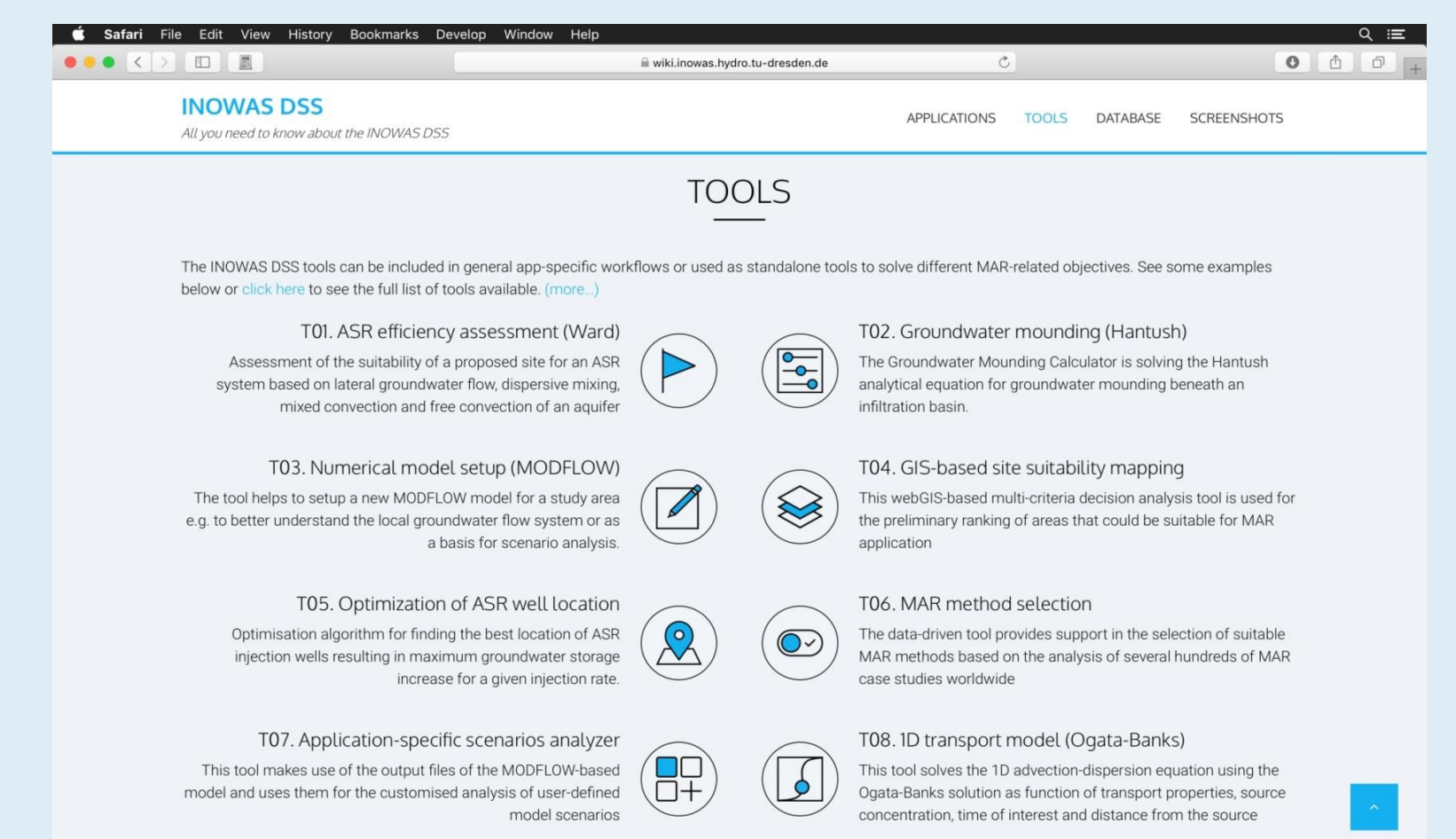
The online tools cover various complexities: empirical (e.g. Global MAR Portal), analytical (Saltwater intrusion assessment), and numerical (MODFLOW, MT3DMS, SEAWAT).

DASHBOARD



Project dashboard for integrated system configuration and management of user-specific applications, tools and datasets

DOCUMENTATION



Full web-based platform documentation with detailed description of each tool, including scientific background, examples and screenshots