

Master thesis/Study project – WaterD2D project

The Water Security in Jordan: From Data to Decision (WaterD2D) is a BMBF funded project in which a consortium of higher education institutions promotes evidence-based knowledge as an effective tool for decision making towards a water-secure Jordan.

Based on the outcomes of the science-policy dialogue workshops and stakeholder meetings, the Mujib Basin was selected as the project pilot area. The Basin lies in the central part of Jordan, with a watershed area of 6727 km², where two main wadies cross the Basin, Wadi Al-Wala and Wadi Al-Mujib, emerging into a single course (called the Mujib River). The Basin hosts many industrial and mining activities like the phosphate and potash industry. The annual precipitation in the Mujib basin ranges from 70mm in the south of the Basin to 350 mm in the north. Over the last 30 years, it has significantly dropped and suffered from extreme events. The total annual discharge of the river is estimated at 84 MCM/y. The Mujib dam and Wala dam with reservoir capacities of 30 MCM to store the flood and the base flow and about 8 MCM to be used for artificial recharge for downstream aquifers and irrigated agriculture are constructed. Groundwater is used for domestic purposes in Karak and Madaba cities and other areas (Amman) and irrigation.

However, land degradation and flash flood are amongst the primary concerns. The Basin needs a comprehensive IWRM plan considering the climate change effects. The management plan should conclude new climate change adaptation measures and water allocation and conservation strategies. Currently, the WaterD2D project is seeking highly motivated, skilled, and committed master students to undertake their thesis work/study project on topics related to the WaterD2D project. In particular, the following areas of research are a priority:

Wellfield management for the Wala wellfield:

Pilot project 2 focuses on developing a wellfield management toolbox for the Wala wellfield; the results will be delivered to the stakeholders through a science-policy dialogue workshop and specific meetings. The conducted work will continue the wellfield management tool developed for Wadi Al-Arab wellfield (Al Qadi et al., 2019). This tool can be applied to the Wala wellfield and other MENA countries. The usability of the tool and its market potential needs to be investigated. In addition, the tool needs to be further developed and implemented in a GIS environment based on the Q-GIS plug-in developed in the FREEWAT EU project.

The suitable student must be able to demonstrate the following skills:

- Good technical experience and knowledge in groundwater management and hydrology.
- Good knowledge in python, preferable knowledge in matplotlib, NumPy, pandas, and PyQT5.
- Independent, conscientious and responsible way of working

SWAT modeling and data collection for the Wala dam reservoir:

Pilot Project 3 is focused on conducting sediment transport and water quality modeling in the Wala dam reservoir. This reservoir plays a critical role in the Basin, and modeling its

hydrological and water quality status is essential for the Ministry of Water and Irrigation and Environment. Preliminary studies conducted during the preparatory phase by the project team using the RBIS tool concluded that data availability is currently insufficient to assess these practical issues. More demand-driven research is needed to fill the knowledge gap and improve the management of the system. This pilot project aims to create a SWAT model for the area, collect missing information, and demonstrate the benefit of improving capacity and data sharing to solve complex management problems in the water sector.

The suitable student must be able to demonstrate the following skills:

- Good knowledge of SWAT and ArcGIS.
- Good technical experience and knowledge in groundwater management, hydrology, and soil sciences.
- Possibility to stay in one of the research areas for a couple of weeks
- Independent, conscientious and responsible way of working

Flood risk modeling in the Wala catchment:

There is a severe climate-induced flood risk in the Wala catchment, which is expected to increase frequency and intensity. Flooding will impact communities at risk, tourism infrastructure, and practices used (i.e., agriculture). The goal is to help decision-makers take action to reduce the exposure of vulnerable communities, visitors, and infrastructure in the region to climate-driven natural flash flood hazards. Three main maps for flood generation, flood accumulation, and flood vulnerability will be created in ArcGIS based on factors affecting flood risk using the weighted linear combination (WLC) method. **Pilot Project 4** is focused on conducting these flood risk mapping exercises. This pilot project is designed and implemented in collaboration with the Jordan Meteorological Department (JMD).

The suitable student must be able to demonstrate the following skills:

- Experience in spatial analysis, hydrology, and hydrological modeling (2D, 3D).
- Knowledge of water balance model LARSIM, or experience with GIS software.
- Independent, conscientious and responsible way of working

Systematic approaches and governance frameworks to increase trust between stakeholders:

The lack of trust has been identified as a significant barrier to research-based innovation in the country and demand-driven research development. Therefore, there is an evident need to identify systematic approaches and frameworks to develop demand-oriented master's theses topics that meet the demand of multiple stakeholders in the country (e.g., ministry of water and irrigation, universities). Per this aim, **Pilot Projects 5 and 8** were designed to deliver recommendations for improving trust between different stakeholders.

The suitable student must be able to demonstrate the following skills:

- Experience in multi-stakeholder management and governance frameworks.

- Interest in social sciences to build a detailed questionnaire.
- Basic knowledge in statistical analysis.
- Independent, conscientious and responsible way of working.

Start:

As soon as possible

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