MEWAC

Middle East Regional Water Research Cooperation Program

Kick-Off-Meeting, Module A
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Proceedings

EXALT

Coupling thermal desalination and extraction of dewatered salt with hydroponic greenhouse cultivation via heat pumps

PARTNER INFORMATION

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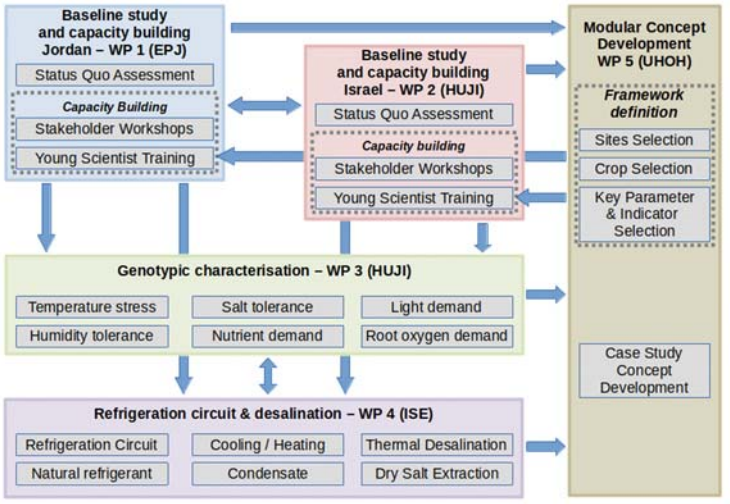
- Fraunhofer Institute for Solar Energy Systems (ISE), Dr.-Ing. Alexander Morgenstern, Dr.-Ing. Joachim Koschikowski, Dr.-Ing. Joachim Went
- EcoPeace Middle East (EPJ), Eng. Abdelrahman Sultan, Eshak S. Al-Guza'a [in collaboration with Jordanian Universities]
- Hebrew University of Jerusalem (HUJI), Prof. Moshe Shenker

PROJECT SUMMARY

The aim and uniqueness of the EXALT project is to couple thermal desalination with hydroponic greenhouse cultivation via heat pumps to enable the use of saline water in arid subtropical areas for crop production without polluting the environment with brine.

In order to define the requirements for the system, baseline studies will be conducted along salinity gradients of available irrigation water on both sides of the Jordan River in the Hashemite Kingdom of Jordan and the State of Israel. The results of these studies will map the evolution of greenhouse cultivation under temporal changes in water availability and salinity. Based on these data, the temperature and salinity tolerance ranges of selected plants under combination of different abiotic stress situations will be investigated. Based on the environmental parameters and the tolerance ranges of the plants, the sensitive and latent cooling demand is determined. The key technical elements of the cooling circuit and the selection of an environmentally friendly refrigerant are made according to the cooling demand.



Technical and educational work packages and tasks of the EXALT project

The heat discharged from the greenhouse will support the desalination process so that the dehydrated salt can be removed from the water circuit. The condensate produced is fed into the irrigation system, resulting in exceptionally high water use efficiency. Detailed designs, developed in a modular fashion for three case study sites in each of the two countries, enable the evaluation and ecological comparison of system performance and serve as a blueprint for demonstration projects.

In regular workshops and training courses, the methodology and the developed designs are presented and discussed with stakeholders and young scientists. This ensures a resilient local reference on the one hand and creates a group of interested parties for implementation on the other.

FURTHER INFORMATION

- BMBF Funding ID 02WME1607A-B
- Project website: http://exalt.uni-hohenheim.de

TransFresh

Transboundary Freshwater Resource Real-time Monitoring and Management
– the Yarmouk River Case Study –

PARTNER INFORMATION

- H3 GmbH Jena, Dr. Christian Siebert, Dr. Tino Rödiger
- Geological Survey of Israel (GSI), Dr. Eyal Shalev
- National Agricultural Research Centre (NARC), Prof. Dr. Elias Salameh

PROJECT SUMMARY

The Lower Yarmouk Gauge observed from the west and the concept of groundwater flow

The Yarmouk River is the primary tributary to the Jordan River and a strategic transboundary freshwater resource of Syria, Jordan, and Israel. In the past decades, the Yarmouk watershed has been extensively exploited by the riparian with the construction of dams including the Al-Wehda and Adassiyeh dams, situated along the Jordan border and intended for agricultural purposes. The operation of the dams is guided by international water agreements between Jordan and Israel and Jordan and Syria and control the flux of the Yarmouk River. Preliminary results indicate unexpected interactions of the river with the major groundwater resources of the entire region. The objectives of this work are hence: (i) to quantify water fluxes and understand flow paths in all groundwater bodies, (ii) their interaction between the groundwater bodies and respectively with the river and (iii) the impact of the anthropogenic control of flow in the Yarmouk River to (iv) suggest operational schemes for flow in the Yarmouk River ensuring long-term safety of the ecological and socioeconomic function of the combined river-groundwater-resource, situated in a difficult transboundary situation. This will be achieved applying for the first time dating and flow analyses tools in combination with a transboundary network of precise online monitoring stations in the river and aquifers along with numerical modelling of the current state and of possible operational scenarios. Optimization of both dams and groundwater pumping operations has the high potential to increase the stability and availability of freshwater in the area for many years.

FURTHER INFORMATION

- BMBF Funding ID 02WME1608
- Project website: https://h3-i.de/projekte/transfresh
- Kontakt: H3 GmbH, Carl-Blomeyer-Str. 65, 07749 Jena; http://www.h3-i.de; info@h3-i.de

GRaCCE

Groundwater Recharge and Climate Change Effects

PARTNER INFORMATION

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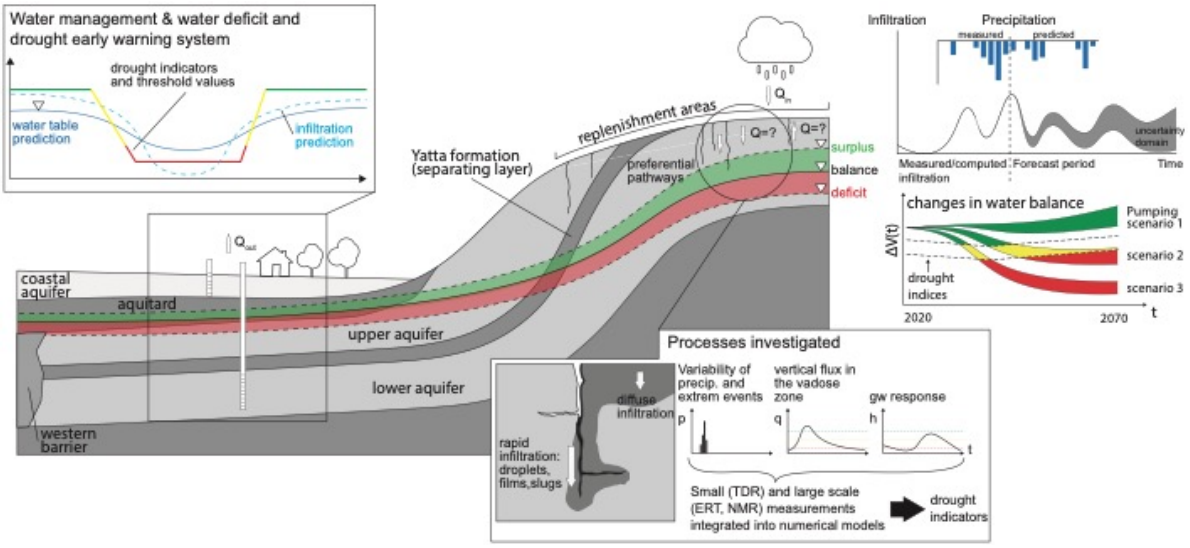
- Hydro-Engineering Consultancy, Dr. Jawad Hassan, Palestine, jhassan@staff.alquds.edu
- VisDat, Germany, Dresden, Dr. Micha Gebel, micha.gebel@visdat.de

PROJECT SUMMARY

The GRaCCE project aims to develop a process-based integrated method for determining groundwater recharge and predicting droughts, thereby supporting water management in semi-arid regions such as Israel, Palestine and Jordan. The study area in the Middle East comprises the territories of Israel, Jordan and the Palestinian Territories of the West Bank. The entire region is subjected to enormous water stress and political tensions, since it's scarce water resources are partly to be managed jointly by Israel, Palestine and Jordan. The target region is also characterized by high hydrological variability and evaporation losses, i.e., strongly fluctuating availability of surface and spring water and consequently an overuse of groundwater resources.

Porous-fractured bedrock aquifers contain important groundwater resources and require specialized assessment and modelling methods to capture highly dynamic infiltration rates. Thick vadose zones (several hundred meters) prevalent in the region may be relevant in water management terms as long-term reservoirs and as a dynamic water resource may help to mitigate supply shortages during long-term droughts. Due to the dual permeability characteristics of the vadose zone in fractured and karst aquifer systems the quantification of water fluxes through the unsaturated zone is difficult. To characterize infiltration and groundwater recharge, various hydrogeologic, geophysical, and hydrogeochemical methods, as well as advanced numerical modelling approaches, are combined to determine available water resources over a management period of approximately 1 month. Information from daily-based climate modelling that replicates the general trends in precipitation and evapotranspiration characteristics is incorporated into the predictive modelling for the period 2020 - 2070. The results of these studies serve as a quantitative basis for predicting water deficits in a control volume of the aquifer based on drought indicators and using data assimilation techniques. Integration into a web-based toolbox that includes a drought early warning system and adapted pumping and storage strategies will enable water users and local governments to improve regional resilience to extreme climate events and minimize water stress.



FURTHER INFORMATION

- BMBF Funding ID 02WME1609A-C; Project website: www.mewac-gracce.de

The responsibility for the content of this publication lies with the authors of the individual contributions.

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Further information on the MEWAC funding measure is available at
https://www.fona.de/en/measures/funding-measures/mewac-multilateral-water-research.php

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