Coupling of a Water Evaluation and Planning System Model with a Groundwater Model in Wadi Shueib (Jordan) - Concept and Setup

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Background

- Jordan is one of the water scarcest countries with only 145 m^3/cap/year of renewable freshwater resources
- Most water is demanded by agriculture, especially in the Jordan Valley
- According to Jordan's water strategy (2008-2022) a 503 MCM of water for 2020 is expected
- Since 2004 there has been an increase of population with a rate of 2.2%
- Groundwater levels are decreasing as a product of overexploitation (Fig. 2)

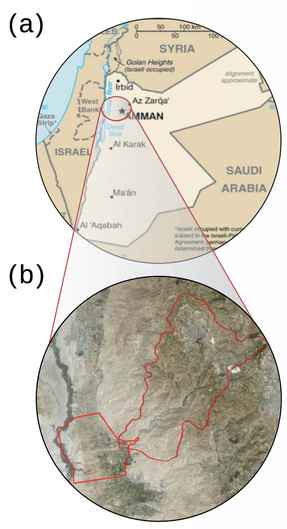


Figure 1. (a) Map of Jordan and (b) Location of the study area: Wadi Shueib and its downstream continuation on the Lower Jordan Valley

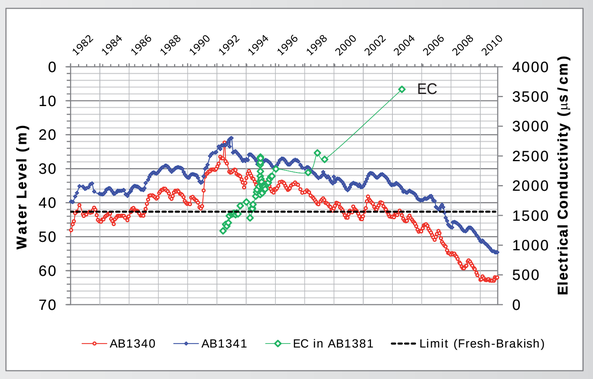
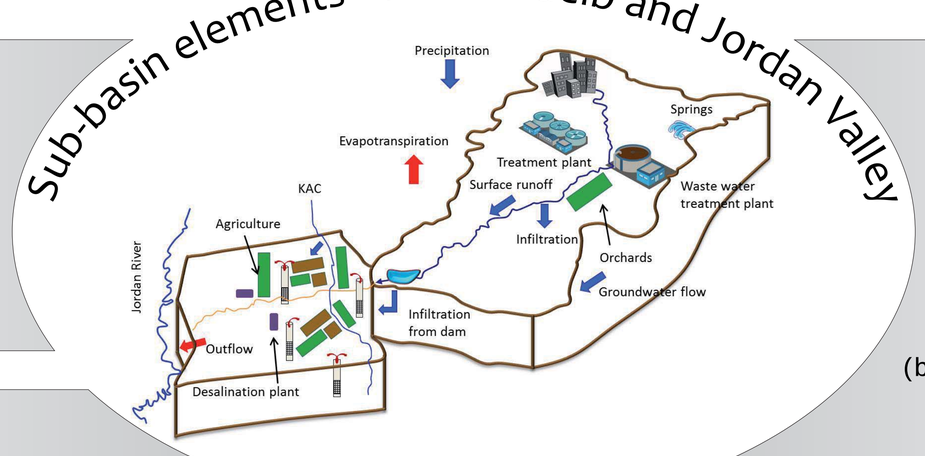


Figure 2. In blue and red are shown the water level values of two monitoring wells in the Jordan Valley. In green electrical conductivity (EC) measurements, which increase with the time and present EC values of brakish water. (MWI open files)

Objective

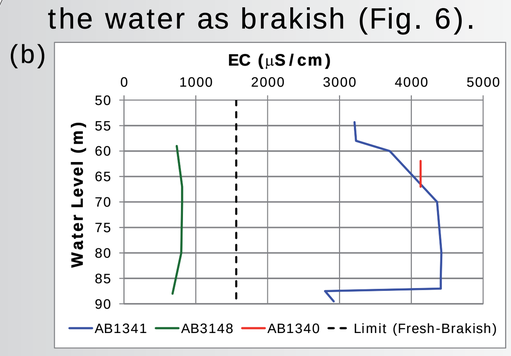
The aim of this work is to support the implementation of the regional IWRM approach by the application of a holistic and integrated water planning case study at the sub-basin scale of Wadi Shueib.



Additional Field Work

Electrical conductivity (EC) profiles have been made in observation wells to show its variation along the depth.

Values found in the Jordan Valley classify the water as brakish (Fig. 6).



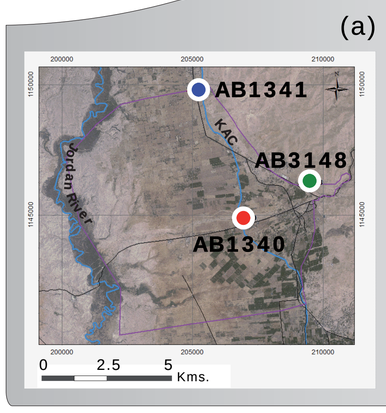


Figure 6. (a) Location of 3 monitoring wells in the study area. (b) EC measurements.The wells located directly in the Jordan Valley (AB1341 & AB1340) have values of brakish water (1562 < EC (µS/cm) < 15625). The decrease of EC after 85 m can be explained by the inflow of groundwater from underlying aquifers

Methodology

- Coupling MODFLOW with WEAP ⇒ aggregated water balance in the Wadi Shueib and downstream at the Jordan Valley (Fig. 4 and 5).
- Analyze water availability, utilization and demand while including the groundwater component.

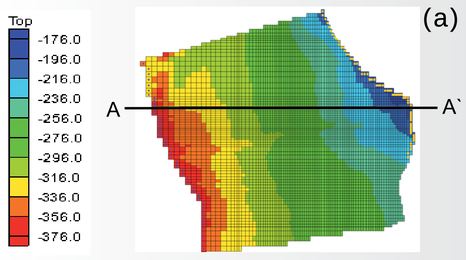


Figure 4. Elevation model in MODFLOW Grid of the Jordan Valley in the area of interest. (a) Plain view and (b) front view of the profile A-A´. The scale is presented in meters below sea level

- Utilization of IWRM indicators ⇒ determine and quantify the possible impact of alternative water allocation options such as the implementation of new technologies like:
  - brackish groundwater desalination
  - decentralized wastewater treatment

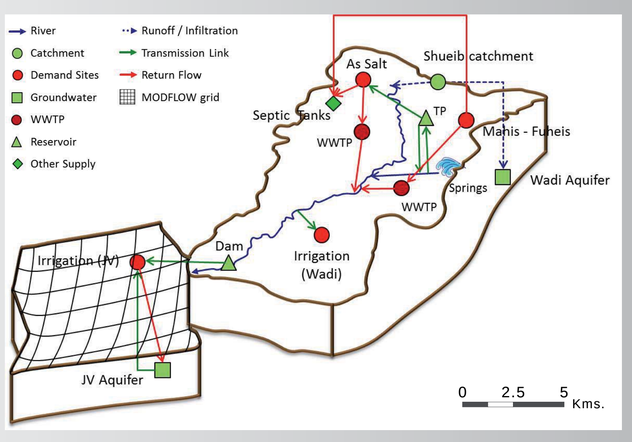


Figure 5. Simplified scheme of the WEAP Model in the complete study area and the grid for groundwater modelling in the Jordan Valley

Conclusions

- This model will be used as a reference for the regional up-scaling study of the IWRM-strategy for the Lower Jordan Valley.
- Values of electrical conductivity show a high salt content in the water of the Lower Jordan Valley as a consequence of overexploitation of groundwater resources and geological formation.
- Generally, results gained from models depend strongly on available input values and therefore, data preprocessing and consistency is necessary to ensure an acceptable accuracy.
- More measurements, especially concerning water quality parameters, will be carried out in the field in order to characterize the sub-basin as complete as possible and to calibrate the model.

References

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