Groundwater recharge estimation using the hydrological model J2000 in the Zarqa River catchment, NE-Jordan

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Background

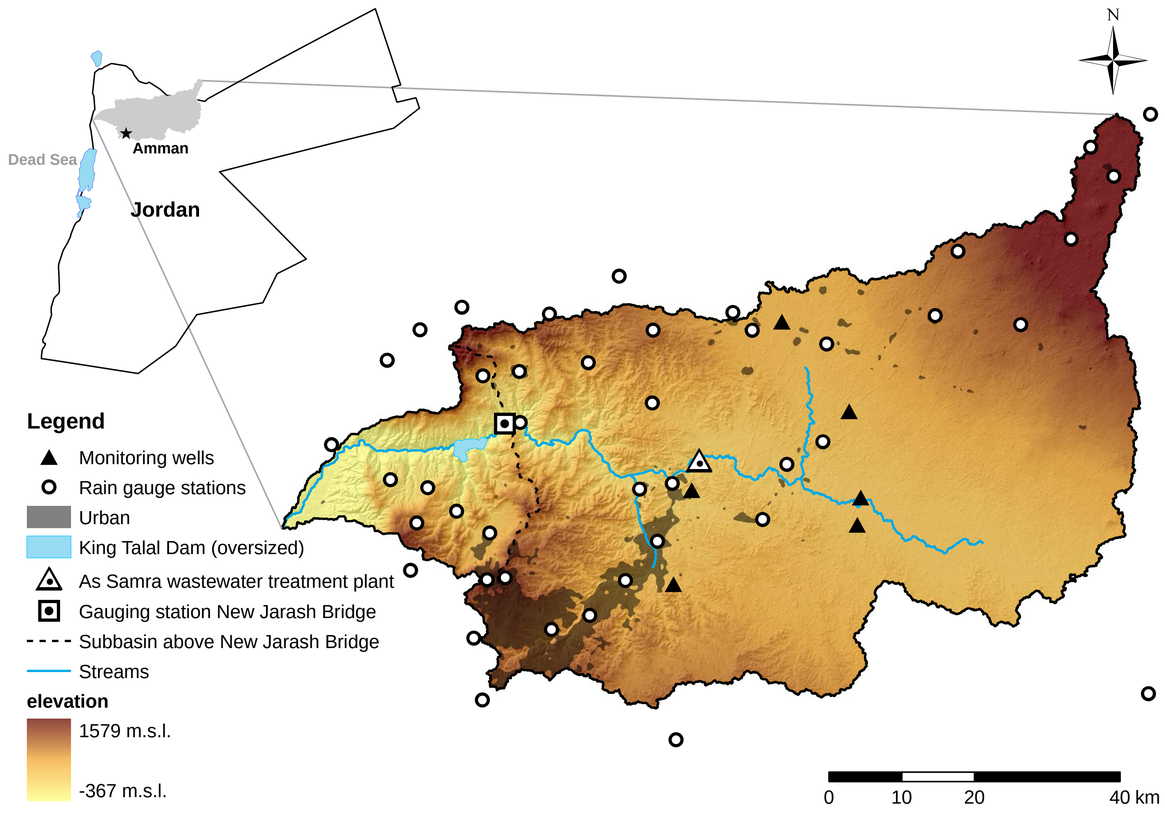
- 65 % of Jordan's total population and 90 % of industry (Al Abbadi 2008) → high water demand
- Limited water resources → overpumping
- Better knowledge of recharge rates and areas → better water management

Research Area

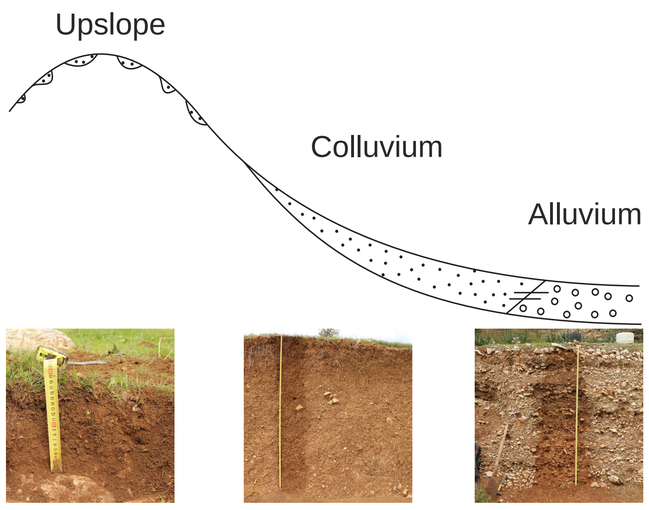
- 100 to 500 mm precipitation per year (rain season in winter)
- Three geographic features: Jordan Rift Valley, Escarpment, Eastern Upland Plateau

Methods

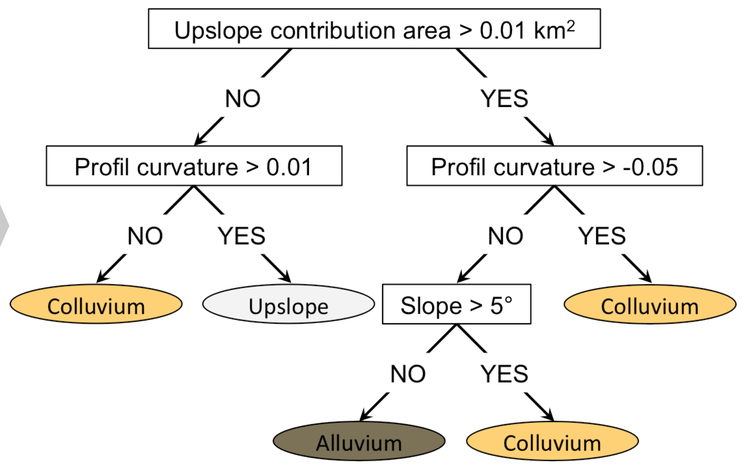
- Modeling recharge rates with J2000 (fully distributed water balance model)
  - Land use: Landsat ETM+ → ATCOR 3 → Maximum-Likelihood classification
  - Parameter: soil sampling, infiltration tests, remote sensing
  - Time variable data derived from WAJ (WAJ 2011) → processing and correction



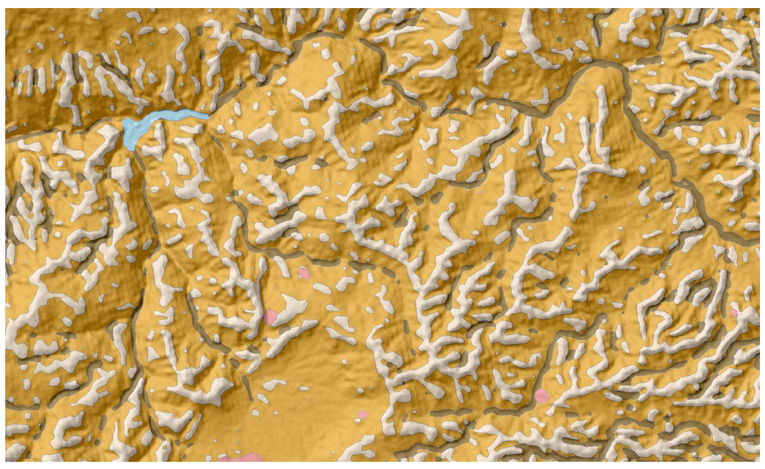
Soil map with topographical approach



Observations during field trip



Procedure for DEM processing

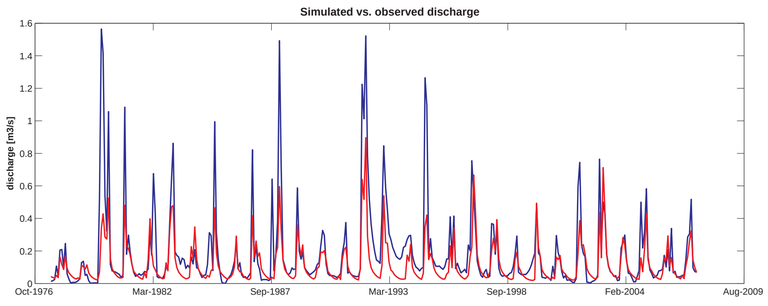


Resulting soil classes related to topography

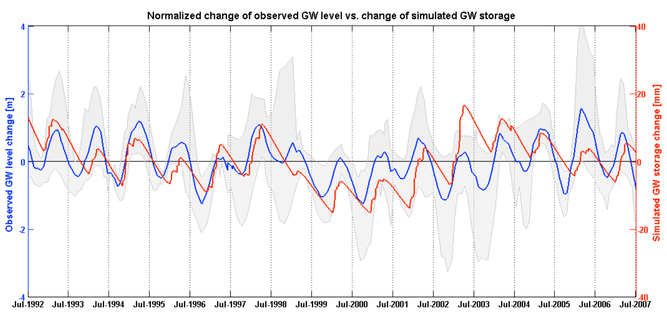
First Results

Calibration

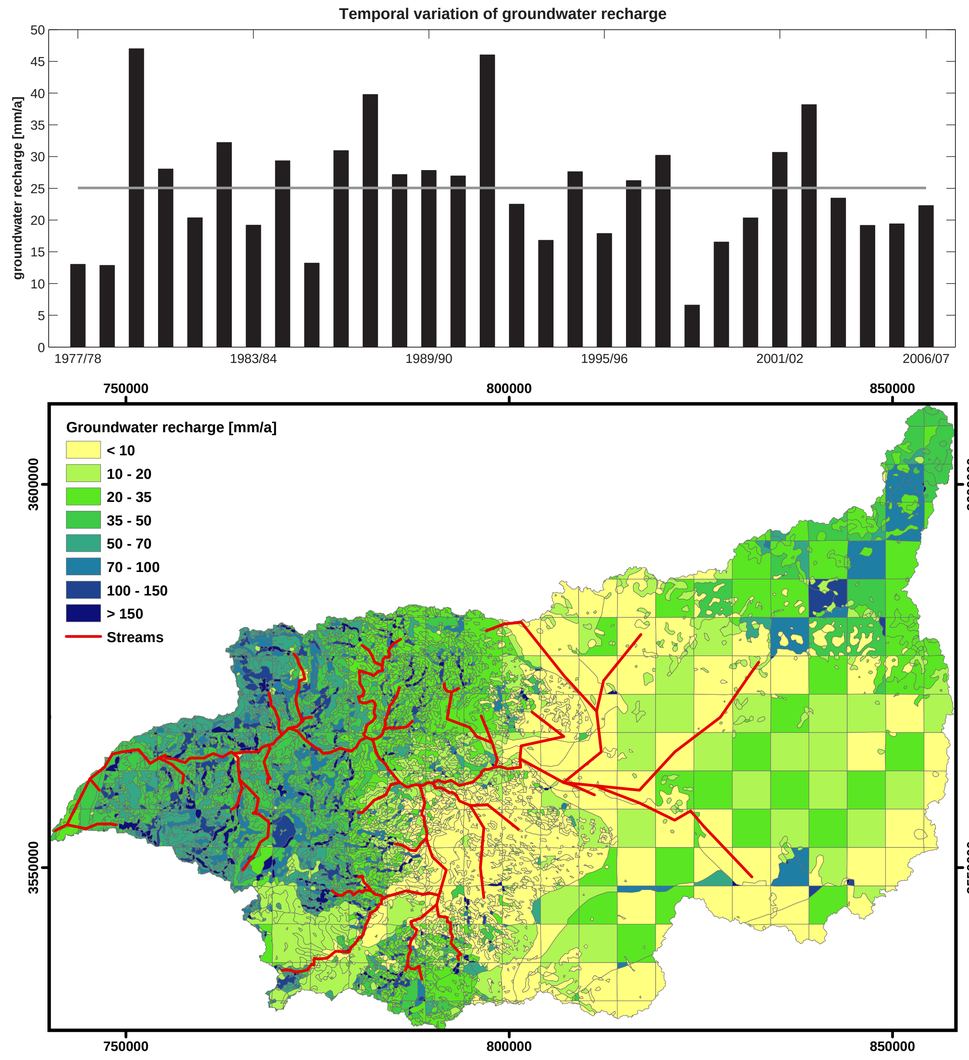
- Matching the first 15 years of simulated runoff above gauging station New Jarash Bridge with the observed discharge → $R^2 = 0.74$



- Additionally the groundwater level change of six monitoring wells are compared with the modeled change in the groundwater storage → $R^2 = 0.54$



Model Results



Validation

- the last 15 years of modeling period are used for validation (split-sample validation) → $R^2 = 0.59$
- Additionally groundwater recharge is evaluated by two independent methods for 12 spring catchments:
  - Chloride Mass Balance
  - Analysis of the stable isotopes ^{18}O and ^{2}H
- Both methods show slightly higher rates than modeled

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References:

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