Geophysical Research Abstracts
Vol. 18, EGU2016-9211, 2016
EGU General Assembly 2016

Sensitivity analysis of hydraulic and thermal parameters inducing anomalous heat flow in the Lower Yarmouk Gorge

Nora Goretzki (1,2), Nimrod Inbar (3), Michael Kühn (1), Peter Möller (1), Eliyahu Rosenthal (3), Michael Schneider (2), Christian Siebert (4), Fabien Magri (5,2)

(1) GFZ German Research Centre for Geosciences, Section 3.4 - Fluid Systems Modelling, Potsdam, Germany (mkuehn@gfz-potsdam.de), (2) Freie Universität Berlin, Hydrogeology, Berlin, Germany, (3) Tel Aviv University, The Department of Geophysics and Planetary Sciences, Tel Aviv, Israel, (4) Helmholtz Centre for Environmental Research – UFZ, Halle, Germany, (5) Helmholtz Centre for Environmental Research – UFZ, Leipzig,Germany

The Lower Yarmouk Gorge, at the border between Israel and Jordan, is characterized by an anomalous temperature gradient of 46 °C/km. Numerical simulations of thermally-driven flow show that ascending thermal waters are the result of mixed convection, i.e. the interaction between the regional flow from the surrounding heights and buoyant flow within permeable faults [1]. Those models were calibrated against available temperature logs by running several forward problems (FP), with a classic “trial and error” method.
In the present study, inverse problems (IP) are applied to find alternative parameter distributions that also lead to the observed thermal anomalies. The investigated physical parameters are hydraulic conductivity and thermal conductivity. To solve the IP, the PEST® code [2] is applied via the graphical interface FEPEST® in FEFLOW® [3].
The results show that both hydraulic and thermal conductivity are consistent with the values determined with the trial and error calibrations, which precede this study. However, the IP indicates that the hydraulic conductivity of the Senonian Paleocene aquitard can be 8.54*10-3 m/d, which is three times lower than the originally estimated value in [1]. Moreover, the IP suggests that the hydraulic conductivity in the faults can increase locally up to 0.17 m/d. These highly permeable areas can be interpreted as local damage zones at the faults/units intersections. They can act as lateral pathways in the deep aquifers that allow deep outflow of thermal water.
This presentation provides an example about the application of FP and IP to infer a wide range of parameter values that reproduce observed environmental issues.

[1] Magri F, Inbar N, Siebert C, Rosenthal E, Guttman J, Möller P (2015) Transient simulations of large-scale hydrogeological processes causing temperature and salinity anomalies in the Tiberias Basin. Journal of Hydrology, 520, 342-355

[2] Doherty J (2010) PEST: Model-Independent Parameter Estimation. user manual 5th Edition. Watermark, Brisbane, Australia

[3] Diersch H.-J.G. (2014) FEFLOW Finite Element Modeling of Flow, Mass and Heat Transport in Porous and Fractured Media. Springer- Verlag Berlin Heidelberg, 996p