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Inverse problem to constrain the controlling parameters of large-scale heat transport processes: The Tiberias Basin example

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Salty and thermal springs exist along the lakeshore of the Sea of Galilee, which covers most of the Tiberias Basin (TB) in the northern Jordan- Dead Sea Transform, Israel/Jordan. As it is the only freshwater reservoir of the entire area, it is important to study the salinisation processes that pollute the lake. Simulations of thermohaline flow along a 35 km NW-SE profile show that meteoric and relic brines are flushed by the regional flow from the surrounding heights and thermally induced groundwater flow within the faults (Magri et al., 2015). Several model runs with trial and error were necessary to calibrate the hydraulic conductivity of both faults and major aquifers in order to fit temperature logs and spring salinity. It turned out that the hydraulic conductivity of the faults ranges between 30 and 140 m/yr whereas the hydraulic conductivity of the Upper Cenomanian aquifer is as high as 200 m/yr. However, large-scale transport processes are also dependent on other physical parameters such as thermal conductivity, porosity and fluid thermal expansion coefficient, which are hardly known.

Here, inverse problems (IP) are solved along the NW-SE profile to better constrain the physical parameters (a) hydraulic conductivity, (b) thermal conductivity and (c) thermal expansion coefficient. The PEST code (Doherty, 2010) is applied via the graphical interface FePEST in FEFLOW (Diersch, 2014).

The results show that both thermal and hydraulic conductivity are consistent with the values determined with the trial and error calibrations. Besides being an automatic approach that speeds up the calibration process, the IP allows to cover a wide range of parameter values, providing additional solutions not found with the trial and error method.

Our study shows that geothermal systems like TB are more comprehensively understood when inverse models are applied to constrain coupled fluid flow processes over large spatial scales.

References

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.

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

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(0), 342-355.