Geothermal modelling using MT3DHEAT

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Due to the mathematical similarities between heat and mass transport, the code
MT3DMS, originally developed for solute transport modeling, is applied to simulate
heat transport. For this, the governing equations for solute transport were transformed
for both conduction and convection, and in- and output routines of MT3DMS are re-
interpreted. The procedural steps of this "MT3DHEAT" application are described in
detail. For verification and validation of the implementation, representative field cases
are used. In particular, closed and open geothermal systems such as ground source
heat pumps (GSHP) and aquifer storage are simulated. MT3DHEAT is verified with
both analytical heat transport functions as well as commercially available numerical
heat transport models such as FEFLOW and SHEMAT. In addition, sensitivity studies
are performed to examine the role of different conceptualizations and parameter set-
tings. Special attention is drawn to the role of transient flow conditions, heat source
definition, and to key parameters such as thermal conductivity and dispersion.