



Implementing a new effective finite difference formulation for borehole heat exchangers into a heat transport code

D. Mottaghy (1) and L. Dijkshoorn (2)

(1) Geophysica Beratungsgesellschaft mbH (d.mottaghy@geophysica.de), (2) Applied Geophysics & Geothermal Energy, RWTH Aachen

We present an effective finite difference formulation for implementing multiple borehole heat exchangers (BHE) in the 3-D coupled heat and flow transport model SHEMAT. The BHE with arbitrary length can be coaxial as well as U-shaped.

The new approach does not require the fine discretisation of the BHE assemblage since it considers heat transport between fluid and the soil through pipes and grout via thermal resistances. Therefore, the simulation time can be significantly reduced.

The coupling with SHEMAT is realised by introducing an effective heat generation. Due to this connection, it is possible to consider heterogenous geological models, as well as the influence of groundwater flow. This is particularly interesting when studying the long term behaviour of a single BHE or a BHE field. The model is validated against the existing BHE modelling codes EED and EWS. A comparison with monitoring data from a deep BHE in Switzerland shows a good agreement. Synthetic examples demonstrate the field of application of this model.