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On the influence of advection on the “Guardia dei Lombardi" geothermal field

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Due to local specific-heat-flow maxima of up to 90 mW/m^2 and temperatures of about 100 °C at less than 1.7 km depth, a southern Italian (Province of Avelino) carbonate reservoir is being explored as a medium-enthalpy geothermal resource. Hydrocarbon exploration wells and several seismic profiles within the chosen area (with dimensions of 43 x 28 km) provide the basis for a complex, three-dimensional geological model. The reservoir is faulted, anticlinal in structure, and overlain by dense, partly clay-rich sedimentary layers. A hydraulic and thermal characterisation of the geological units is possible through a combination of laboratory measurements, literature sources, and well log data. Under the assumption of purely conductive heat transport, the specific heat flow at the bottom of the reservoir (at 6 km depth) can be estimated using temperature data from several boreholes in the region to 67 mW/m^2 .

The goal of this study is the investigation of advective flow and the evaluation of its influence on the temperature distribution in the reservoir. First hydrothermal simulation models show a complicated flow structure in the anticlinal reservoir. But an inversion for constant reservoir permeability based on the borehole-temperature observations results in a relatively low value of 0.5 to 1 mD. However, pointwise comparisons between modelled and measured temperatures show large differences. Thus, for an accurate inclusion of regional flow processes and thermal convection, a proper representation of the geometry of the anticlinal Apulian platform and a karstified, highly permeable layer at the interface between the reservoir and its sedimentary cover is necessary. Such a refined model will also lead to a recalibration of the specific basal heat flow.