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Geothermal springs associated with buoyant-driven fluid flow in the faults of the Seferihisar-Balçova system, Western Anatolia, Turkey - results from 3D simulations.

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The shallow and fractured aquifers of the Seferihisar-Balçova Geothermal system (SBG), Western Anatolia, Turkey, are characterized by anomalously high temperature gradients of 3.5 – 5 °C/10 m. In the SBG hot springs vent at the fault intersections with temperature ranging between 30 and 78 °C. Previous two dimensional simulations of coupled groundwater flow and heat transport along a North-South transect showed that the interaction between forced convection from the Seferihisar Highs and free convection in the faults (i.e. mixed convection) is likely the major transport mechanism responsible for the observed temperature anomalies.
Because 2D models are computationally less demanding and easier to handle, there has been a limited effort in tackling numerical models of coupled transport processes in 3D basins. Nevertheless recent findings prove that the third dimension is essential to correctly describe the flow fields, particularly in fractured areas.
In this presentation, the SBG serves as example to illustrate 3D convective patterns of density driven thermal plumes. The results indicate that several convective structures can form and that the patterns are definitely not constrained to a 2D plane. In the case of planar high permeability regions such as faults, 2D and 3D patterns vary significantly, the latter being allowed to develop parallel to the fault planes. This is an important finding which so far has been stated explicitly in very few studies. At present, 3D modeling is the direction to be taken to gain insights into coupled transport processes which control geothermal fluid migration and active thermalism of most faulted basins in the world.