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Modeling the impact of deep fault zones on the thermal regime in a sedimentary basin

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In order to obtain information regarding the flow regime within the Molasse basin (SW Germany), a thermal 3-D steady state model was set up, with the aim of comparing modeled with measured subsurface temperatures. The conductive high resolution model, reveals areas with significant thermal anomalies due to advective heat-transport. All of the strong anomalies are located near fault zones; which indicates that they are not influences by strata-flow alone. One of the strongest anomalies occurs at the Saulgau fault zone. A genetic connection between this fault zone and the observed thermal anomaly has not been demonstrated until now. Therefore we computed a coupled heat-transport type model for a smaller area, reflecting the main factors. The results of the type model indicate that the observed thermal anomalies are a result of the interaction of the relatively fast groundwater flow in a karstic aquifer (Jurassic) with free-convection within the fault-zone. In contrast to convection in faults without the interplay of regional groundwater flow, no system of multiple cells develops. Instead, there is only one large convection system which is superposed by the regional flow. This combined flow system ends abruptly with a strong up-flow where the fault ends. It is exactly there where the conductive model shows the strongest positive thermal anomalies. This is in line with the field data, which show the major positive thermal anomalies on positions where the prominent WSW - ENE directed faults intersect with other faults which are approx. N - S orientated. It is likely that the faults are interrupted at these locations. However this interpretation is still hypothetical, because due to a significant lack of data it is not possible to preclude other mechanism like salinity and transient processes.