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# A new look on anomalous thermal gradient values obtained in South Portugal

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A NEW LOOK ON THE ANOMALOUS THERMAL GRADIENT VALUES OBTAINED IN SOUTH PORTUGAL
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It is well known that soil temperatures can be altered by water circulation. In this paper, we study numerically this effect by simulating some aquifers occurring in South Portugal. At this location, the thermal gradient values obtained in boreholes with depths less than 200 m, range between 22 and 30 ºC km-1. However, there, it is easy to find places where temperatures are around 30 ºC, at depths of 100 m. The obtained thermal gradient values show an increase one day after raining and a decrease during the dry season. Additionally, the curve of temperature as function of depth showed no hot water inlet in the hole.
The region studied shows a smooth topography due to intensive erosion, but it was affected by alpine and hercinian orogenies. As a result, a high topography in depth, with folds and wrinkles is present. The space between adjacent folds is now filled by small sedimentary basins. Aquifers existing in this region can reach considerable depths and return to depths near the surface, but hot springs in the area are scarce. Water temperature rises in depth, and when the speed is high enough high temperatures near the surface, due to water circulation, can be found. The ability of the fluid to flow through the system depends on topography relief, rock permeability and basal heat flow.
In this study, the steady-state fluid flow and heat transfer by conduction and advection are modeled. Fractures in the medium are simulated by an equivalent porous medium saturated with liquid. Thermal conductivity values for the water and the rocks can vary in space .Porosities used have high values in the region of the aquifer, low values in the lower region of the model and intermediate values in the upper regions.
The results obtained show that temperature anomaly values depend on water ascending velocity, permeability values and depth of the aquifer. Comparing the results of our model with the measured values we can obtain information about aquifer depth and temperature.