3D geological modelling and geothermal assessment of the Limagne basin (France)

3D Geological modelling

The geological layers are discretized using hexahedra and prisms (3D elements). Faults are discretized using squares and triangles (2D elements). A Finite Element mesh is built using the Winfra mesh generator and the Orion extension. Both tools are developed at Geowatt AG. The resulting mesh is an unstructured mesh composed of more than 100,000 elements. A diffusive thermal model is applied and the temperature of the aquifers is extrapolated to 5 km depth from Hurtig et al. (1991).

3D diffusive thermal modelling

Geothermal potential estimation

Computations show that aquifer S1_Reservoir seems to be the best potential target for a geothermal exploitation, due to high temperatures and to a thickness up to 1000 m. This conclusion could be questioned by the fact that the hydraulic conductivity of this aquifer seems quite low (0.02 mD x 10^-6 m/s at 80°C; cf. Dagaller, 2004). This parameter was only indirectly taken in account in the computation of the utilizable energy. On the other side, it is possible for the potential of aquifers S2_Reservoir and S3_Reservoir to be higher than predicted, thanks to a good hydraulic conductivity (this is clearly the case for S3_Reservoir). The temperature model could be enhanced by better temperature data and a detailed analysis of hydrogeological behavior of the system in order to take in account advection processes in the numerical model.

References

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- Signorelli S. et al. (2006), Geochemical Ressourcenatlas.

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