Deep geothermal reservoirs evolution from a modeling perpective

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Deep geothermal reservoirs evolution: from a modeling perspective

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We propose to review different aspects of conventional deep geothermal reservoirs evolution and management based on examples ranging from direct use of geothermal heat to geothermal electricity production. We will try to focus on French experiences. Technological developments or changing circumstances can lead to cyclical re-assessment of reservoir potential and economics play an important role in any geothermal reservoir definition. Nonetheless, we will mainly address "physical" aspects of deep reservoirs evolution.

We will start from a brief discussion about the natural state of deep geothermal reservoirs based on the different time scales of natural and exploitation related evolutions. As the reinjection strategy is one of the key aspects of managing reservoir evolutions, some of the main reinjection related issues will be summarized. Some specific aspects will also be considered. For example, in high energy fields, it is mandatory to estimate precisely the reservoir state depending on whether one wants to promote or prevent evolutions such as a steam cap development. Reservoir spatial and temporal uncertainties should also be integrated into any attempt to predict reservoir evolution.

Then we will try to review the pros and cons of different reservoir model type and their applicability. Simple quantitative models, such as lumped parameters models, can be precious tools in the early phases of field development. They may also give insight into the long-term behavior of the geothermal field and are quite useful in appraising exploitation sustainability. As soon as they capture the driving phenomenon, conceptual models are quite efficient in predicting production temperature decline or reservoir pressure or any other reservoir evolutions. When field development is mature and more monitoring data is available reservoir modelling can be more tightly constrained. In this case, qualitative and quantitative aspects should progressively merge in a unified model of the exploited area.

Finally we will conclude our talk with a tentative attempt at identifying some of the current trends in deep geothermal reservoir modeling and the kind of tools available to reproduce and predict reservoir evolutions.