Geophysical Research Abstracts
Vol. 14, EGU2012-7765, 2012
EGU General Assembly 2012

Some new results on the mathematical modelling of geothermal exploitation.

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We present some results about the mathematical modelling of geothermal reservoirs exploitation. We first consider the problem of gas/liquid extraction near the bottom well in the context of geothermal energy exploitation. We show a mathematical model we have developed for the isothermal two-phase flow of a mono-component fluid in an undeformable porous media taking into account inertial effects. We use the so-called Forchheimer's equation to model the relation between the fluid velocity and the pressure gradient in the region of co-existence of the two phases.

We formulate the problem in cylindrical geometry assuming steady state and isothermal conditions. We take into account capillary pressure and we study its influence on the whole system, deriving important formulas that allow to predict the main thermodynamical quantities in the region of co-existence of the liquid and gaseous phase and we determine constraints on the physical parameters in order to predict the behaviour of the fluid in the domain of the problem. Finally, we perform some numerical simulations to investigate the dependence on the physical parameters involved in the model.

Within the framework of the model proposed, we also present a numerical algorithm we have developed to estimate the deliverability of a geothermal well, based on a mathematical model considering a monocomponent fluid. The model is able to take into account both the phase change phenomenon near the well and the non-Darcian behaviour of the flow. The implementation of the algorithm turns out in a numerical code (called DNDmultiphase) to be used as additional module in softwares devoted to full-field simulations of a reservoir.