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Interactive comment on "Steady State Non-isothermal Well Flow in a Slanted Aquifer: Mathematical formulation and Field Application to a Deep Fault in the Xinzhou Geothermal Field in Guangdong, China" *by* Guoping Lu and Bill X. Hu

Anonymous Referee #1

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In this paper an analytical solution is developed for well flow in a non-isothermal slanted aquifer. The temperature distribution is considered to be given. Thus Darcy's law and continuity equations are solved. The analytical solution is applied to the Fault in the Xinzhou Geothermal Field in Guangdong (China). The topic is interesting and fits well with the journal. My concern is with the organization and focus of the paper. I have also a technical concern regarding the developed solution. The paper is not well written. It misses structure and organization. Hence, I strongly suggest to do a thorough re-organization and possible re-writing of parts of the manuscript. Technically, I have a

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Discussion paper

problem with the way in which Darcy's law is presented. I am not sure that the viscosity should be within the gradient operator. I am not familiar with this form and I am not sure that this is correct. This may help in getting the analytical solution (especially, for the non-isothermal radial flow in a horizontal confined aquifer) as viscosity will be in the right hand side but I think this is not correct. I suggest major revisions. My comments are below: - Please justify why the viscosity is included in the gradient operator. This is essential because form me this is not correct. - Comparison against numerical solution (using an existing model) will confirm the accuracy of the developed solution - Please revise the introduction and state clearly the objective of the paper (which is for me analytical solution for non-isothermal flow). The introduction is too long. - Figures 4a and 4b not cited in the text. - Please revise: "Consequently it is a critical concept in practice that a dome-shaped water head surface would be present in its equilibrium-state water potential, as a proper observation needed to understand geothermal flow fields. " - In section 2.1 please include a vertical cross section representation of the site. - Please split Figure 1 in 2 figures - Tables 2 and 3 are cited in the text before table 1. - There is no need for table 1 which is standard in thermodynamics. - At line 192: "also listed is the density values" should be "also listed are the density values" - I did not understand why properties of saturated water are presented (+ properties at P=5.1MPa). At line 195, it is mentioned that density is function of P and T. The discussion here is ambiguous. I think variation of density and viscosity in terms of pressure and temperature is standard in thermodynamics and there are several existing models to do that (as n Tough2 simulator used in this paper). Authors can simply mention that they used Tough2 simulator and there is no need for further discussion. (Section 3 can be removed). - Please remove "The negative sign in front of the left side stands for the flow pointing to the opposite of the gradient" as it is standard. - Line 244 is not clear - Line 281 "Non isothermal radial flow in a horizontal confined aquifer 281 Assuming in a horizontal confined aquifer, in the non-isothermal scenario, fluid density 282 and viscosity are variables of temperature (Figure 4c)" Please revise this sentence and explain how the temperature is variable. - Grammatical and editing check (figure

numbering and citation, equations). - Results are not well discussed and illustrated.

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