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Hydrology and Earth System Sciences
Discussions

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 #2

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In the manuscript, an analytical solution is proposed to analyze steady state non-isothermal well flow in a slanted aquifer. The analytical solution is then applied to a case study to explain some data. The topic is interesting and is appropriate for a possible publication to HESS. However, due to several weaknesses about the organization of the manuscript, its writing, the English language or about the mathematical developments or the application to the case study, I do not recommend to accept the manuscript. It needs to be reorganized and rewritten to clarify different points before that a possible publication could be considered. Details of my reviews are given be-

low. 1°) The manuscript is messy, difficult to read and to understand. It needs to be reorganized and much better written. For instance, in the introduction the first sentences are written like an abstract, before describing the site and the objectives of the study. But the objectives of the work appear without a clear idea about the context and about the state of the art. It seems more based on some data gathered from a field site than a clear and comprehensive understanding of a scientific question. An introduction clearly written should clearly state the context of the work, the scientific questions addressed and the method proposed to solve them. This is an example from the introduction, but the other parts of the manuscript requires also to be reorganized and clarified (see below). 2°) Furthermore, the English language needs to be thoroughly proof-read and re-written. I recommend finding a native English speaker to assist with this component. 3°) Some references are missing, especially in the field of geothermal flow associated to fault zones. Some very general references about geothermal applications are given in the manuscript, but, for instance, the following references could be more appropriately cited : Malkovsky, V. .I., and F. Magri (2016), Thermal convection of temperature-dependent viscous fluids within three-dimensional faulted geothermal systems: Estimation from linear and numerical analyses, Water Resour. Res.,52, 2855–2867, doi:10.1002/2015WR018001. Zhao, C., B. E. Hobbs, A. Ord, S. Peng, H. B. M€, L. Liu (2004), Theoretical investigation of convective instability in inclined and fluid-saturated three-dimensional fault zones, Tectonophysics.,387(1–4), 47–64, doi:10.1016/j.tecto.2004.06.007 These are only examples. About flow in slanted aquifer, some other references could be also of interest. 4°) The calculations in section 4 and 5 are simple, but the boundaries conditions used should be clarified. The aim of the manuscript is to propose a coupling between head and temperature variations, but it is not clear how varies temperature in figure 4 and 5. Line 262, it is assumed that the temperature is linearly varying along the flow direction. But why this is necessary, how this is justified ? It should be clarified and explained. Some equations should be checked, in particular equation 1b which is incorrect in this form. 5°) It is difficult to understand from section 6 and figure 5 how analytical results from section

5 are applied to the field case. This should be clarified as well as the geometry of the aquifer and the assumptions used for the calculations. 6°) How is calculated the fault permeability ? Permeability values are given (line 392) and largely discussed (section 7.2). It appears as a major result (line 45-46 in the abstract and 475-477 in the conclusion), but it should be explained how permeability is calculated. 7°) Moreover, in such permeable fault zone, with such temperature gradients, one may expect natural free convection to occur. This should be discussed since conditions for flow and pressure distribution in the fault zone (slanted aquifer) should control the response observed in the deep borehole.

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