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Solid Earth Discussions

Interactive comment on "Flexible parallel implicit modelling of coupled Thermal-Hydraulic-Mechanical processes in fractured rocks" *by* Mauro Cacace and Antoine B. Jacquey

J. Taron (Referee)

jmtaron@usgs.gov

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I must apologize for the delay in this review. I thoroughly enjoyed reading the article. Presentation is clear and well-written. In the final analysis, your story is worthwhile and deserving of publication. I have some revisions.

minor:

1) Change THOUGH to TOUGH on page 2, line 20.

2) Strain decomposition is introduced before defined. Suggest moving paragraph at page 8, line 5 before equation 12.

3) Page 9, line 5. You state that the biot/bulk expansion term is of second order. Please explain or provide reference.

4) Your presentation of the energy balance is somewhat topical relative to the other formulations in the paper. You should either begin from internal energy, or cite the origin of equation 23 and note the assumptions required to attain it. Also, the dissipation term added ad-hoc to equation 25 should instead be present and justified in 23.

5) Figure 7: Colors are fine, but different symbols or inlayed arrows should be added. Figure 8: Should probably specify that you ignore contours beyond 170.

6) Please specify boundary conditions in Section 4.5 or in figure 8. Also, in the simulation with true fluid properties, you must have equilibrated the system with those properties, otherwise you would see some non-linear porosity-change depth variation globally. I presume you computed and restarted, but please state this.

7) Also section 4.5. How are the wells treated? As lower-dimensional "fractures"?.

general:

1) It is unclear to me which portions of your work are extensions to MOOSE, and which are already present. This is important and needs to be stated clearly.

2) In most reservoirs I have worked with, permeability change is dominated by the behavior of fractures, not by porous mechanics (i.e. Kozeny-Carman), which are minimally important. Perhaps this reservoir is not highly fractured, or perhaps you only interesting in displaying porous behavior for the sake of illustration. In either case, you need to clarify the intent of your assumptions and their shortcomings.

3) My last and largest comment is in agreement with the previous review. Essentially, you have provided details of capabilities that are then never utilized in the final analysis.

I understand this temptation, but it detracts from the story you are trying to tell. The only useage of plasticity in the paper is to demonstrate an oedometer problem. Either add greater complexity to your final problem (I understand there is a fair amount required), or remove plasticity from the discussion. Alternatively, you might choose a validation more along the lines of a Mandel-Cryer type problem (preferably at interesting temperature and pressure and with properties computed internally), which is a fundamental aspect of your final elastic simulation and rounds out the other validations.

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