Solid Earth Discuss.,
https://doi.org/10.5194/se-2019-156-RC1, 2020

Solid Earth Discussions

Interactive comment on "Potential influence of overpressurized gas on the induced seismicity in the St. Gallen deep geothermal project (Switzerland)" *by* Dominik Zbinden et al.

Anonymous Referee #1

Received and published: 19 January 2020

Zbinden et al. present a modelling study of the induced seismicity triggered during stimulation of the St Gallen EGS project, Switzerland. The study applies methods and models developed by the authors in previous work. Therefore, the novelty here is in the specific application (St Gallen) and its idiosyncrasies (involvement of gas). The primary finding is to confirm a hypothesised conceptual model using a numerical model that approximates multi-component (water and gas) fluid flow and seismicity triggering (a stochastic "seed" model). The model has difficulty capturing all complexities associated with the stimulation, e.g., borehole processes, breaching of the fault seal, but these are acknowledged and discussed by the authors. Overall, I think is a well-executed study, technically sound and fairly presented. I have listed below a few technical and editorial

comments that the authors may wish to consider, although none are major items.

Abstract: final sentence - "important implications" - could be specific about which implications of the study you think are important. L32: "rock-fluid interaction" suggests geochemistry in many circles, when I think you are referring to fluid destabilisation. L39: "recently, a M 5.5..." awkward phrasing L42: would be appropriate to cite McGarr 2014 here L49: "gas kick" introduced without being defined - an early definition would aid readability L61: very pedantic but "secondly" is not a word IMO. However, if you're going to use the 'ly' then be consistent (e.g., firstly in prev sentence) L271: distribution for coefficient of friction is quoted but not for other parameters in seed model L311: I don't think this is explicitly mentioned - is the gas modelled in TOUGH2 methane or air? L478: With arbitrarily seeded stochastic simulations, your ability to "reproduce the extension (extent) of the observed seismicity" can be challenged as simply a random feature of the realisation. Have you run multiple realisations and confirmed that the observed extent falls within the modelled distribution? L489: pedantic maybe, but "nicely" is perhaps a value judgment best left to the reader

Finally, one thing I missed in the discussion was some comment on model uniqueness. A lot of choices have to be made about parameter values in your model. Even if these are the best, most defensible values, they could still be wrong. Which parameter values do you feel are least well constrained? If the model was rerun (incl. recalibrated) using different plausible values, would you arrive at similar conclusions (either qualitative or quantitative)?

Interactive comment on Solid Earth Discuss., https://doi.org/10.5194/se-2019-156, 2019.