Solid Earth Discussions

Solid Earth Discuss., referee comment RC1
https://doi.org/10.5194/se-2021-100-RC1, 2021
© Author(s) 2021. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on se-2021-100

Jonathan Turner (Referee)

Referee comment on "De-risking the energy transition by quantifying the uncertainties in fault stability" by David Healy and Stephen Paul Hicks, Solid Earth Discuss., https://doi.org/10.5194/se-2021-100-RC1, 2021

This paper addresses a topic of general societal interest; it is well written, carefully explained, thoughtful. The paper highlights the importance of several fault zone processes which are previously known about but this study provides fresh perspective e.g. the role of uncoupled fluid pressure, coupled fluid pressure (poroelasticity), the frictional properties of fault rocks (gouge, cataclasites), the importance of optimally constraining in situ stress measurements, etc. Infact I think poroelasticity deserves wider discussion here and elsewhere because it may be the key to understanding the unpredictability of induced seismicity.

I have few substantive comments and recommend that this paper be published.

1. It may be a bit too long with a little too much space devoted to explaining the method (or perhaps consider cutting one of the two synthetic case studies).

2. Rangely oil field, Colorado is another good example to cite of a case study which showed a critical threshold in fluid pressure, above which seismicity was induced and below which it was absent (sorry, I don't have the reference but I think it was in the 1970s).

3. The Townend & Zoback dataset is intriguing but in my experience very difficult to apply to development projects. What I mean is that is it hard to demonstrate that critically stressed faults are conductive/transmissive/higher perm, at least in as coearly as the T & Z dataset shows they should be.

4. I got confused by the difference between slip tendency and friction coefficient - in

words, friction coefficient is the ratio of shear force to tractional force at the moment of failure. So I then thought it's no surprise that your modal slip tendency in the first case study is 0.56 because that's the inverse tan of ~30degree which is an 'average' angle of internal friction for compacted rocks. I would find it useful if this point could be explained in slightly more detail.

Jonathan Turner