Solid Earth Discussions

Solid Earth Discuss., referee comment RC3
https://doi.org/10.5194/se-2021-100-RC3, 2021

Reply on AC4

Anonymous Referee #2

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-RC3, 2021

Dear authors,

I read the answers to my comments, and I have to say that I really hope that the Editor and all the SE readers will find the whole paper "well written, carefully explained and thoughtful" . I still think that some parts should be improved, however I just reported my suggestions hoping to help.

In any case, I would like just to comment on the answer regarding Ts dependence on fluids.

The answer was:

We strongly disagree. Pore fluid pressure plays no part in the formal definition of slip tendency (Ts) – see Morris et al., 1996[…].

In the Morris et al paper Ts is defined by Tau/Sigma. Sigma are, generally speaking, the principal stresses that might be interpreted as fluid pressure independent because effective stresses are not mentioned. However, in the same paper, Morris et al., 1996 calculated the Ts for the Yucca Mountain area and, while setting the input sigma, the literally write:

[…] to a depth of 5 km and assuming an average rock density of 2.7 g/cm3, s1 = 133 MPa, s2 = 5 88–108 MPa, and s3 = 5 63–72 MPa. Assuming a water-table depth of 600 m (Stock et al., 1985), and interconnecting permeability hydrostatic pressure at 5 km will be 43 MPa. Thus, effective principal stresses would be: s1=vertical=90 MPa, s2=N258E–N308E = 45–65 MPa (50%–72% of s1), and s3 = N608W–N658W = 20–29 MPa (22%–32% of s1), at 5 km beneath Yucca Mountain.

Please note that the effective stresses are those used by Morris et al., in their calculation of Ts (Figure 3). This is also confirmed by Lisle and Srivastava, 2004 that literally write: "If pore-fluid pressures are involved, then the stresses should be considered effective stresses."

If effective stresses should be used, Ts would change with changing Pf, also because Tau is Pore-pressure independent. I would say, thus, that I "strongly" believe that Ts does depend on Pf.

What can be independent from Pf is the Ts/Tsmax ratio (defined as “T’s” by Lisle and Srivastava, 2004). However, Ts and not T’s is investigated in the present paper by Healy and Hicks.