

Solid Earth Discuss., referee comment RC3
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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 T_s dependence on fluids.

The answer was:

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

In the Morris et al paper T_s is defined by τ/σ . σ 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 T_s for the Yucca Mountain area and, while setting the input σ , the literally write:

[...] to a depth of 5 km and assuming an average rock density of 2.7 g/cm³, $s_1 = 133$ MPa, $s_2 = 58-108$ MPa, and $s_3 = 63-72$ 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: $s_1 = \text{vertical} = 90$ MPa, $s_2 = \text{N258E-N308E} = 45-65$ MPa (50%-72% of s_1), and $s_3 = \text{N608W-N658W} = 20-29$ MPa (22%-32% of s_1), at 5 km beneath Yucca Mountain.

Please note that the effective stresses are those used by Morris et al., in their calculation of T_s (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, T_s would change with changing P_f , also because τ is Pore-pressure independent. I would say, thus, that I "strongly" believe that T_s does depend on P_f .

What can be independent from Pf is the T_s/T_{smax} ratio (defined as "T's" by Lisle and Srivastava, 2004). However, T_s and not T's is investigated in the present paper by Healy and Hicks.