My Reply to the Comments by Reviewer 1
Title: A Theory of Earthquake Prediction Author(s): Wang, J.-H. Article reference: DOI:10.5194/egusphere-2025-3192 Referee comments

In reply to the comments given by Reviewer 1, my answers to three main questions are described below.

The manuscript discusses a theory to predict the time to failure, moment, and location of the earthquake by monitoring precursory signals of strain rate increase in Earth's crust before the earthquake. The author also discusses various geochemical and geoelectric signals associated with the mechanical deformation of rocks due to the increase in the strain rate, which can be monitored as precursors before the earthquake. I would like to recommend rejecting the manuscript for publication in its current version due to conceptual errors in reasoning. The detailed response is as follows: The manuscript discuss three main results regarding time to failure, moment and location of an earthquake in Sec. 3.
[Answer] I am much appreciated with your comments which have helped me to re-think related problems in depth.

(i)Time to failure (Sec 3.1): The author assumes a power law scaling of strain rate simplifying Eq. 4 (which is based on Voigt equation or quasi-static crack growth theory), $\epsilon'(t) \sim (t-t_f)^{1/(1-\alpha)}$, by making assumption that magnitude of strain rate at failure time $\epsilon'(t_f)$ will be much larger than "1 strain /sec". This statement is simply wrong. The correct statement is $\epsilon'(t_f) \gg [a(\alpha-1)t_f]^{1/(1-\alpha)}$, which means it depends of a and α, the fitting parameters of the above power law. Further, Eq. 8-11 is just explaining a way to obtain three parameters of model $\epsilon'(t_f)$, a, and α by fitting three data points. In natural observations, these precursory "quasi-static" strain rates can be monitored by GPS stations using ground deformations, which typically have a reading per day. This means these precursory signals need to be fitted against much more dense data, and elaborate methods will be required for that. Apart from that, the Figures 1-4 used to explain these equations are shown without any information of units or using non-nondimensionalization. At least they should be shown on a log-scale to clearly see t_c, t_f, etc.
[Answer] From numerous observations, the values of α are usually in between 1 and 2. This can be seen in the text of my manuscript. Hence, the condition $1<\alpha<2$ is considered in the study. For $\alpha>1$, the strain rate is $\varepsilon_t=[a(\alpha-1)](t_f-t)+\varepsilon_{tf}^{(1-\alpha)}]^{1/(1-\alpha)}$, which is Eq. (4), which depends on a and α, in my manuscript. Due to $1-\alpha<0$, $\varepsilon_{tf}^{1-\alpha}$ is much smaller than 1 strain/sec because the strain rate, ε_{tf}, at the failure time should be much larger than 1 strain/sec, and thus this term can be excluded in Eq. (4). This makes Eq. (4) become $\varepsilon_t=[a(\alpha-1)](t_f-t)]^{1/(1-\alpha)}$ (i.e., Eq. (6) in the manuscript) rather than the inequality: $\varepsilon_t>>[a(\alpha-1)(t_f-t)]^{1/(1-\alpha)}$ as claimed by Reviewer 1. This suggests that my assumption could be OK.
In order to compare the variations in strain rate for different values of α, I used the normalized values in Figures 1–4. Actually, it is necessary to plot the real observed values in the practical applications. Of course, a log-scale for t or a log-log scale for $\varepsilon/\varepsilon_{max}$ versus t is also a good choice.

(ii) Moment of earthquake (Sec 3.2): (ii) Moment of earthquake (Sec 3.2): The author argues that the strain at time of failure $\epsilon(t_f)=\epsilon_f$ can be considered as average strain

after failure (or an earthquake) as the duration of the earthquake is small. This statement is completely wrong. The co-seismic deformation during an earthquake is much larger than any ”quasi-static” deformation during the precursory phase; therefore, Shaw 2023 scaling (line 305), which relates the co-seismic slip with the rupture length (not fault length), is simply not applicable here. Due to the conceptual mistake in this argument, the main result of this section, i.e. Eq. 18, is not correct, and all other discussions based on it in the rest of the manuscript are highly doubtful.
[Answer] Although the Voight equation is a kind of quasi-static subcritical crack growth theory, but the strain changes from a small value to a big one after $t>t_c$ as displayed in Figure 1. After t_c, numerous precursors will appear. At time of failure $\varepsilon(t_f)=\varepsilon_f$ must be very large. My assumption is that ε_f plays an actor of the source of strain energy of an impending earthquake and thus it can be considered as average strain after failure (or an earthquake) because the duration of the earthquake is usually small. Could you show me some theoretical results to demonstrate the difference, if you cannot accept my assumption? Thanks.
On the other hand, the average co-seismic strain, ε_{cs}, should be K times of ε_f on the basis of your viewpoint, thus leading to $\varepsilon_{cs}=K\varepsilon_f$. This would make Eq. (16) become $\log(K\varepsilon_f)=\log(\lambda)-\log(L)/2$ or $\log(\varepsilon_f)=-\log(K)+\log(\lambda)-\log(L)/2$. This means that we should add K or $\log(K)$ into the related equations after Eq. (16). This makes us be still able to predict the magnitude of an impending earthquake from the present theory. Of course, we should study the value of K in advance. Could you accept my consideration?

(iii) Location of earthquake (Sec 3.3): This section does not present any mechanical model or argument regarding the location of an impending earthquake with respect to observation points. A general discussion about how precursory signals can be utilized to locate earthquakes does not constitute a scientific argument that warrants publication.
[Answer] In spite of the case that the sites of strain-meters are near the fault where an earthquake will occur soon, it is not easy to predict the location of an impending earthquake on the basis on the present theory. This is a weak point of my theory. Hence, I introduced some ways to predict the location of an impending earthquake suggested by other earthquake scientists. I hope this will help the readers who are not so familiar with this study area. Could you accept my viewpoint?