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Dear Editor Hicks,

Thank you very much for your close review and subsequent discussion about our manuscript, *The SCEC/USGS Community Stress Drop Validation Study Using the 2019 Ridgecrest Earthquake Sequence*. We appreciate your comments and those of the peer reviewer.

We have reworked the manuscript to address the major comments, including reworking the first several sections to make them more consistent and shorter, and added much more discussion and a figure of the published submitted results. We are comfortable discussing these published submitted results, and also feel that they represent the range of observations from the remainder of the submitted but unpublished results. We have also made all the minor suggestions and corrections from you and the peer reviewer.

We believe the manuscript to be in better shape after addressing these comments, and hope you agree! We really look forward to having this study published in *Seismica* and know that many in our community study are awaiting its publication.

Below, please find a response to each of the comments from you and the peer reviewer, with review comments in black and our responses in *italic red*. Please don't hesitate to let us know if we can be of any other assistance with this manuscript.

Cheers,

Annemarie Baltay

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### **Comments from Editor:**

Dear Annemarie Baltay, Rachel Abercrombie, Shanna Chu, Taka'aki Taira:

I hope this email finds you well. I have reached a decision regarding your submission to *Seismica*, "The SCEC/USGS Community Stress Drop Validation Study Using the 2019 Ridgecrest Earthquake Sequence". Thank you once again for submitting your work to *Seismica*. Many apologies for the delay in getting a decision to you. This delay happened because the original Handling Editor moved to a new job position, which meant they had a

potential conflict-of-interest, so they decided to recuse themselves from handling all outstanding manuscripts. We also had problems securing reviewers for your submission.

I am pleased to say though that we have a report from one external reviewer, and both myself and a member of Seismica Editorial Board have given your manuscript a detailed read-through, so we are able to make a decision on your submission.

Overall, such a community-based validation study seems like a unique initiative, especially in observational seismology, that will hopefully contribute significantly to our understanding of stress drop computations and their interpretation. On that basis, this is certainly a topic of interest for Seismica, and in principle, we would be happy to publish it in a peer-reviewed "Report" format. The introduction, motivation, and aims of the project are set out very well. However, we feel that some changes need to be made before it is published, and we hope that these changes can help to widen the impact of the paper and the stress drop project overall.

The manuscript is both forward looking (proposal style) and indicates, without sufficient documentation, some of the early results from the community validation. These different sections of the report should be better aligned, and the data to support the preliminary conclusions of the study should be documented.

*We worked to realign the whole manuscript, many of the points below speak to that. We hope it is smoother now!*

The first part of the paper (Sections 1 – 4.1) reads similar to a proposal and the second part of the paper (4.2- end) indicates some early results from the community analysis but these are not adequately documented. Shortening the introductory sections of the manuscript might help to widen its audience. Specifically:

Section 2.1 ("Research Priorities") duplicates ideas set out in the Introduction.

*You are right, a lot of info was indeed repeated. We significantly shortened and streamlined all of Sections 1 and 2 to avoid duplications. (However, we also added information specifically about Brune spectra and details there as requested by the Reviewer).*

- Section 2.2 ("Study organisation") lists several project workshops that have already happened, yet there is no evaluation of what was discussed at these workshops, and what key outstanding questions and aims remain. These details should be presented with the early results

*As for the workshops, we don't want to regurgitate those details here, so we made sure to add that full workshops reports can be found on the study webpage.*

- (Section 4.2). The end paragraph of the Introduction explains how users can join and interact with the TAG, which might fit better at the end of the manuscript in “Outlook”.

*OK we moved this to the very end of the manuscript, thanks!*

- Line 259-260 and 347-348: Use “we” rather than the third person when referring to the authors of this report.

*Changed, thanks!*

- In Section 5 (“Outlook”), some initial findings are stated, yet not elaborated upon or illustrated. It is stated that stress drop estimates already submitted and shown at workshops show a wide variation, and that benchmarking studies show spectral fitting contributes a small amount to stress drop variability. We would really like to see some more details here – even if the results are preliminary and completely anonymised. It would be great to see a novel figure that summarises these points.

*Because we are still sensitive/careful about the un-published results, we have now focused on the subset of results (21 out of 47) that are already published. We have added figures and a discussion comparing these results, and this discussion now illustrates the range of results, variability and uncertainty, and highlights many of the challenges and future directions for the study. We think this really helps illustrate these ideas and strengthens the paper, so we hope this is a good addition, while still respecting the unpublished results.*

We also have concerns over the figures currently presented:

- Figure 1 appears to be taken directly from a published paper (Cocco et al., 2016) that was published in the Journal of Seismology. We have checked in detail the rights of using this figure. A fee is payable to Journal of Seismology to reuse this figure since they own the copyright to it. If you have secured permission to use this, please send us the documentation from the copyright holder. As a free journal, Seismica does not pay other publishers for reuse of copyrighted material. Otherwise, we recommend obtaining the original data points and reproducing the figure.

*We have obtained the original, underlying data from these (or similar) studies from each of the published papers and reproduced a similar figure. (We now have to include all these references in the paper, hope that is OK!)*

- Figure 2 appears to be a simple screenshot of the project website, and in our view, it doesn't add anything to the scientific content of the manuscript. So our view is to remove it.

*We removed, it, thanks for the suggestion.*

- Figure 3 and 4 could be combined into a single figure, by overlaying and highlighting the benchmark/subset catalogue events onto the main catalogue. This figure(s) also needs a regional inset map for those readers not familiar with the location of the Ridgecrest area.

*We combined them, great suggestion, and added an inset map to orient readers.*

Also, from additional email exchanges, Editor Hicks said:

Regarding length, I felt that only Sections 1 and 2 were perhaps a bit wordy, with some general ideas repeated within, and between these sections – I left a couple of specific comments about this, I think. So dealing with these should certainly help. I'm then happy to give your revised version another detailed read through and can suggest further wordsmithing, if required. But I think in general it should be okay. Sections 3-5 felt absolutely fine in terms of length (sorry for not being more explicit about that).

*As we mentioned before, we streamlined sections 1 and 2, and they are now shorter. Although we added the requested discussion from Reviewer 1...*

I think you can still keep the "meta-analysis" section as it is, and just adding some ranges/uncertainties of calculated source parameters would be great (even if it is just for one example event ... e.g., maybe one of the larger, best-recorded aftershocks?). This will then lead nicely onto on you / the community will propose to tackle the reasons for such a large range in values. I was also wondering about possibly renaming this section to something like "preliminary indications of spread in source parameters" (or something a bit more eloquent!) to help emphasise that more analysis is required. How does that sound?

*Here, we renamed the section 4.2 Initial results and meta analysis and added the discussion and figure of the published results, as we mentioned above.*

### **Minor, specific points - Editor**

Abstract: This is approximately 20 words over 200 words in Seismica's guidelines – please make more concise and shorten.

*Shortened!*

L87-89: The symbols  $u$  and  $f$  have not been explicitly defined in Equation (1), and  $\beta$  has not been defined in Equation (2).

*Added, thanks!*

L102: Typo. "Due to".

*Added, thanks!*

L105: change "model independent" to "model-independent" to make this sentence more readable.

*Added, thanks!*

L198-201: Please add examples of citation(s) for studies that show different estimated stress drops for the same events.

*We actually deleted this mention of this as it was found in the introduction already, with references!*

L225: Please change "depend to the" to "depend on the".

*Added, thanks!*

L251-254: I'm not sure such a lengthy list of conferences is needed. Better just to say "international conferences"?

*Fixed, thanks.*

L292: Typo. "We as ask".

*Fixed, thanks.*

L302 and L488-494: Please include the FDSN network citations as full references in the reference list.

*Full references are included!*

L312: Please change "obspy" to "ObsPy" and please add a citation.

*Added, thanks!*

L331. Typo "Malcom".

*Fixed, thanks.*

L391. Typo. Should be "the spectral ratios are fit" or "the spectral ratio is fit".

*Fixed, thanks.*

L427. Typo. "obsersve".

*Fixed, thanks.*

### **Comments from external reviewer**

First, please accept my apologies for my delay.

The paper is well organized and clearly presented and gives for the first time a validation attempt for observational data. This is pretty unique, while more common for numerical simulation validation. I have a few comments and suggestions, but these are minor and the paper could be published after addressing some points if the authors agree.

*Thank you for your review!*

(1) Paragraph Lines 73-82

I think there might be a clarification needed. 1) As said here, there is a difference of the static stress drop versus the dynamic one that may not behave linearly. But 2) what do get by measuring the average stress drop. There are a number of papers by Nadia Lapusta where they also discuss this difference, between the "real" stress drop from a numerical simulation which varies along the area of the fault, and the "measured" stress drop, what here we call the average stress drop. It would be good to add this to the discussion. I don't remember the reference, but know a co-author is Nadia Lapusta.

*Thanks! We added reference and mention of Noda et al. (2023) which I think is the paper you reference, and moved up some of the text from below (also referenced in your later comment) to make this a more coherent discussion. (new lines ~116)*

(2) Lines 94-100

Somewhere around this paragraph, some discussion about other ideas about spectral models, for example ones that have 2 corner frequencies. I know this is not the intention of the validation, but I think as part of the introduction, presenting other potential models or possible spectral shapes would be good. There are a number of studies, including some by Archuleta, or Denolle.

*We (1) generalized EQ 1 to consider other values for  $n$  and  $\gamma$ , and (2) mentioned other source models in this paragraph. Thanks!*

(3) Lines 194-195

The authors state: "... and how random errors, differing data sets and methodological variability may contribute to these discrepancies, so that we can ultimately reduce uncertainties"

Or understand them? Some uncertainties cannot be reduced, the data is what it is. But I suggest here that we would like to understand best practices to analyze, interpret and disseminate the results of future studies. Of course, just my opinion.

*Changed to: "...so that we best understand and account for these uncertainties."*

(4) Lines 201-202

Phrase needs rewording. "we need robust observations of if and how ..."

*Changed to: "...we need robust observations of how earthquake..."*

(5) Lines 236-238

This clarification sort of addresses my comment (1). I think having something on this in the intro is still a good idea.

*Yes, see above, we added something like this to the Introduction.*

(6) EGF approach Lines 380-382

Partially true, the deconvolution does not require knowledge of propagation parameters, except that you would need to assume the source model for both earthquakes to obtain the  $f_c$ . Fitting the spectral ratio for example, or estimating the source duration, you need to assume a behavior of the EGF. Either that it is flat, or it follows a spectral shape.

*Right, good point. We changed this to say: "The deconvolution requires no assumptions about path or site effects," and then again: "It requires an independent estimate of seismic moment of one or both events, a source model with which to fit the corner frequencies (either similar to that given in Eq. 1 or the assumption that the EGF event is flat in displacement spectrum)..."*