Author Response to Short Comment 1 (S. Mechernich)

We thank the referee for the detailed and constructive feedback. Point-by-point replies to the comments are provided below.

1) It would be helpful to provide more detailed supplementary information to better understand the code. For instance, some of the folders and parameters are not yet fully explained yet. E.g. the meaning of parameters.lambda_Sp and parameters.lambda_mu is probably not clear to most of the applicants. Furthermore, it would be helpful to differentiate "gamma" further. It is described as "upper eroded scarp dip (degrees)." Is this meant as being the footwall or the degraded scarp?

   `Lambda_sp` and `Lambda_mu` are explained on page 5 of the manuscript. We have added the explanation to the code as suggested. The parameter "gamma" is the dip of the upper slope of the footwall. We have changed the corresponding code comment.

2) If feasible, the inclusion of some further parameters could allow a broader use of the code. As of now, the surrounding topographic shielding and the erosion of the fault plane is not accounted for (page 5 line 13: erosion does never stop completely). Maybe also uncertainties of the site geometry might be an interesting point for the future.

   We agree that the modeling of the site geometry or the erosion process could be refined (e.g., we say "We approximate the effects of the LGM on erosion in a binary manner [...]" in the manuscript) and plan to do so in future versions of BED. For anyone wishing to do so on their own, we note that extensions or even replacements of the 36Cl simulation model can be done without significant changes to the MCMC algorithm (just add the line `settings.modelscarp=<yoursimulator>` and add additional parameters in the case study file).

3) Fig. 2: description of y-axis is missing.

   The y-axis represents the dimensionless value of the stochastic process that is used as a statistical model of earthquake recurrence.

4) Fig. 3ff: It appears to be more intuitive to have the height on the y-axis.

   Since this a matter of preference, we suggest that users simply swap axes using `figure(3); view([90,-90])` when required. This could be added at the end of `BED_plots.m` to swap axes permanently.

5) Fig. 4b,7b: Intensity figure: please show the modelled and the true intensity of the input data for comparison. Like the blue dots used in Fig. 4c,7c.

The plots of displacement size versus time plot and of accumulated displacement versus time contain the same information. The latter is best suited for a comparison between posterior and truth.

More precisely, the problem with displaying the truth in the intensity plot is the following: The posterior slip intensity as shown in the manuscript is defined as the *derivative* of the posterior mean displacement history. This produces a nice and well-defined result because the latter is relatively smooth (if enough posterior samples are used in its computation). However, since the true displacement history is a step function, its derivative is a sum of delta peaks, which is not suited for visualization or comparison to the posterior. Mathematically speaking, it is better to compare the displacement history because two very similar displacement histories may exhibit very different slip intensities. Think, for example, of a linearly growing displacement history and a staircase history with very small steps. The intensity of the former is uniform, the intensity of the latter is a series of peaks. The slip intensity should thus best be seen as a mere aid in the representation of the posterior displacement history.

6) The reference of the most recent 36Cl production rates is missing: Marrero et al. 2016, CRONUS-Earth cosmogenic 36Cl calibration, Quaternary Geochronology (e.g. page 3 line 21).

We include the reference as suggested.