

Interactive comment on “Rn and CO₂ geochemistry of soil gas across the active fault zones in the capital area of China” by X. Han et al.

Anonymous Referee #1

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This paper is an interesting one, which examines Rn and CO₂ values both spatially and temporally, particularly in relationship to various faults. It is overall well written, and I believe will contribute to the literature, as long as it is careful to stick to basic facts and information, and not make inferences beyond the study itself.

Below are my comments in no order of importance:

(a) Anomaly thresholds. Although there is a large amount of explanation how these were derived in Section 4.1, I still came out of this not being exactly clear the amount of uncertainty on these thresholds. I believe it is important, as they play a key to other parts of the paper, that a bit more depth is put into these, potentially some figures to help the reader better understand their derivation, and in particular, a better exploration

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of the potential uncertainties leading to the anomaly thresholds themselves. Overall, I believe this is one of the most important changes needed for the paper, as these anomaly thresholds play into all the later figures, that they are really explained ‘why’ these are anomalous thresholds, and a careful discussion is had as to other variables that might impact them, including seasonal variations, lithological, anthropogenic, etc. There is already some discussion, but more depth is needed.

(b) Profiles, study site. Based only on Figure 1 and the text, I found it difficult to get a feel for the field measurement study sites (no photos? No explanations of potential errors on the equipment itself) and thus no feeling for potential errors in the equipment and measurements. I also found, from Figure 1, that it was difficult to get an overview for the profiles. The Figure 1 is ‘well’ done for an overview, but then to get a good feeling for an overview of each profile for later figures, I had none. I could not tell which way the profiles in later figures went (i.e., the direction – I see the 274 degrees in Figure 3, but was unsure what it meant, is this the direction of the profile?), or any feeling for what might be encountered in the 0.5 to 0.7 km profiles. A much stronger job of giving the reader an overview and understanding of the equipment, samples, and profiles needs to be given, even if in supplementary material. Finally, I did not understand why the LY profile in Figure 1 seems to go for >5 km, but the profile in later figures (Figure 3) is just 0.5 km = 500 m. Something doesn’t seem right here, or I have not understand what is being graphed in Figure 1.

(c) Meteorological variables (Figure 2 and text). It is not explained what these monthly average values are based on (daily, weekly, hourly values?) or any feeling of uncertainty given. Nor are the locations of the instrumental stations given in Figure 1 (so we have no feeling for where the stations are from). I would recommend also that if the average monthly values are based on daily or hourly measurements, that each average value is plotted, plus or minus some measure of the spread of those data. Note misspelling of y-axis ‘temperature’.

(d) Fig. 10. (i) Spatiotemporal variations, x-axis for figure. I don’t understand the

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decision to plot the different profiles along the x-axis in the way that was done. By connecting the values by a line, it implies that the profiles are SPATIALLY along one pathway, which they are not. Think again about the order used along the x-axis (spatial, something else), explain this in the text, and also remove the line connecting the values. (ii) Can you put some sort of measure of uncertainty on ALL of the values for all the variables in Figure 10? This would increase your argument and discussion greatly. For example, average +/- some measure of dispersion of the values. (iii) [See below] In some cases, is it more appropriate to plot medians vs. averages? Or perhaps box plots?

(e) Table I also as box plots? Would it be helpful to the reader to plot these, for each profile and specific variables (in addition to the Figures 3+ which you do) as box plots (do not put in any 'outliers' as these would be inappropriate) so that the reader has a better idea of what the distribution of data looks like? I know I kept having to think about the distribution of the data itself, as I looked at methodology.

(f) Minor. Use Qave not Qaver.

(g) ACR. (i) Is it really appropriate to be looking at ACR, or should you also be looking at a measure of the medians (50th percentile) for each year divided by each other. My concern is the underlying distribution, and if not strictly normal, then there would be issues for ACR, and the extreme values might influence the ratio. I realize you've done some study of normality, but you are dealing with small numbers here. (ii) Could you put some sort of error bar on ACR and MCR? This could be based on the distribution of data for each year, and I'd be much more comfortable if you had some sort of uncertainty carried through to ACR (and MCR if possible, although more difficult) if you are going to make conclusions based on it.

(h) Seismicity. In your paper, you make statements relating ACR with seismicity. Can you give a time series (and the location region) of seismicity so the reader can better understand the relationship? Other: In Fig. 1 you show half a dozen Eqs, but it is

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confusing going between a, b, c, and d, as in 'b', it shows three Eqs which are not in 'a', in c it shows an EQ not in 'a', and in d it shows one Eq but in a it shows three Eqs for the subregion d, which is very confusing. Throughout, there is no discussion of minimum magnitude that is measured completely, or where the data is from. This becomes important if you are going to make statements about seismicity increasing, as it could be related (I'm not saying it is) to increased sensitivity of instruments.

(i) Papers in Chinese. Twelve of the papers you refer to are in Chinese, and not easy to access. I believe strongly in opening up the academic literature from China to 'English' speaking journals, but am concerned that because many of these are not accessible, they may be more difficult to base an argument on. Please leave them, but do consider whether or not you might be able to supplement the Chinese literature with other (English speaking) literature, for those facts being cited. I am not 'requesting this strongly' but rather, would like it considered to create a larger impact for the final paper.

(j) Overall relating of Rn and CO2 to stress/strain. I find the overall discussion of relating Rn and CO2 to stress/strain somewhat tenuous. I'm fine if it is advanced as a hypothesis in the discussion, but as part of the conclusions, I don't think it holds based on the paper's data. There are a lot of unknowns, plus uncertainty in the measurements based on small number of values. I think if left hypothetical, without overstretching the conclusions and statements, and sticking to what you have found, then that is fine, but please remove any 'strong' statements about potential relationships. Again, I'm fine with a broad discussion surrounding this, but soften the conclusions of what you believe you have found (I am stating this based on the data you have presented).

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