Natural Hazards
and Earth System
Sciences

Discussions

# Interactive comment on "Rn and $CO_2$ geochemistry of soil gas across the active fault zones in the capital area of China" by X. Han et al.

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Dear anonymous referee #1,

Thank you very much for your valuable and instructive comments on the manuscript. The paper has been thoroughly and carefully revised according to your comments. The reply to each comment is as followed:

(a) Comment: Anomaly thresholds. Reply: Thank you very much for this comment. Concerning the anomaly thresholds, more discussions of anomaly thresholds were added in this section, including the potential uncertainties and the amount of uncertainty on the thresholds. The heterogeneity of bedrock, tectonics and soil thickness leads to variations of anomaly thresholds of soil gas in the study areas, such as the

occurrence of granite having significant effects on the values of anomaly threshold of soil gas Rn. As for the density function of normal distribution, the credibility of the anomaly threshold values selected as [mean + SD] is established by probability of 84.1 %. Therefore, the soil gas values greater than [mean + SD] could be regarded as true anomalies. We think the readers can get enough information from the contents in this part to understand better the anomaly threshold and potential uncertainty calculating process.

(b) Comment: Profiles, study site. Reply: Thank you very much for this comment. For this comment we did a detail modification. Firstly, more detail explanations of measuring error of the equipment and measurements including the calibration method were introduced and the references which introduced the measurement errors and calibrations of the instruments were added for index in this part. The measurement error of radon detector is $\pm5\%$ and the measurement error of gas chromatography is $\pm5\%$. Secondly, in order to show a clear overview of the profiles to the readers, we modified all the figures which indicate the positions and directions of survey profiles including Fig.1, Fig.4-10. All the locations of LY, DY, QX, PG, DG, GY and FN profiles of this study are labeled by numbers with 1, 2, 3, 4, 5, 6 and 7, respectively (Fig.1). Arrows added in the Fig. 4-10 to indicate the direction of each survey profile with necessary figure captions. The overview of profile length in Figure 1 has also been improved. The profiles which ranged from 440 m to 960 m are very small plotted directly in Fig. 1b-d (small rectangular boxes), thus we zoomed them in and indicated by arrows to a larger view at survey lines in Fig 1b-d (larger rectangular boxes). The legend of Fig. 1 has also been modified.

(c) Comment: Meteorological variables. Reply: Thank you very much for this comment. In this part, we added the computing processes of monthly average values and the detection limits of meteorological parameters. Monthly average values of air temperature, air humidity, wind speed and barometric pressure were based on daily average values, which were computed by the observation data at 02:00, 08:00, 14:00 and 20:00. The

values of monthly precipitation were based on accumulation of daily precipitation. The detection limits of precipitation, air temperature, air humidity, wind speed and barometric pressure are 0.1 mm, 0.1âĎČ, 1%, 0.1 m/s and 0.1hPa, respectively. The locations of meteorological observation stations have been given in Figure 1a. The word 'temperture' on y-axis in Fig.2 has been changed to 'temperature'.

(d) Comment: Fig. 10. (i) Spatiotemporal variations, x-axis for figure. (ii) Can you put some sort of measure of uncertainty on ALL of the values for all the variables in Figure 10? (iii) [See below] In some cases, is it more appropriate to plot medians vs. averages? Reply: Thank you very much for these comments. (i)Fig.1 was modified, the profile order used along the x-axis was based on the profile number in Fig.1 and we explained this in the figure caption. The line connecting the values was removed. (ii) The error bars were added on the ACR and the average concentrations of $CO_2$ and Rn. (iii) The median concentration ratios were plotted in the paper.

(e) Comment: Table 1 also as box plots? Reply: Thank you very much for this comment. The Table 1 was replaced with the box plots.

(f) Comment: Minor. Use Qave not Qaver. Reply: Thank you very much for this comment. The 'Qaver' was replaced by 'Qave'.

(g) Comment: ACR. Reply: Thank you very much for this comment. (i) Rn at PG profile in 2011 and LY profile in 2012 and $CO_2$ at PG profile in 2011, DG profile in 2011 and FN profile in 2011 are not strictly normal distribution, so the median concentration ratios have been computed and plotted. (ii) Error bars were added on ACR. However, as we only obtained the soil gas data for two times survey, the error bars of the maximum concentration of Rn and $CO_2$ may not be estimated and such the error bars on the maximum concentration ratio could not be obtained.

(h) Comment: Seismicity. Reply: Thank you very much for this comment. The time series of seismicity in the capital area of China during 2011 and 2012 were added (Fig.12), which was provided by China Earthquake Data Center. The earthquakes in

Fig.1a-d have been modified. We added the measured minimum magnitude in the capital area and the data sources in the paper.

(i) Comment: Papers in Chinese. Reply: Thank you very much for this comment. We tried our best to index English articles rather than Chinese articles for wider readers. The references 'Gao & Fan, 1992' and 'Lin et al.,1994' in Chinese have been replaced by paper 'Wang et al., 2014'. Paper 'Yu et al., 2004' in Chinese has been removed, because the facts (Page 1733, lines 6-8) could be cited from the literature 'Gao and Ma, 1993'. The main content of these papers are about seismotectonic settings of study area, and the results are mainly introduced by Chinese papers. They are necessary for the introduction of seismic faults in this study, so we have to keep them fortunately with English abstracts provided.

(j) Comment: Overall relating of Rn and $CO_2$ to stress/strain. Reply: Thank you very much for this comment. In the conclusions, we have removed the 'strong' statement that 'a sharp increase in Rn and $CO_2$ concentrations at the same sampling site was mainly controlled by stress/strain redistribution related to seismotectonic activity'. It seems more reasonable according to the data attained by the study itself.