

The manuscript entitled “Multifractal characteristic-based comparison of elements in soils within the Daxing and Yicheng areas of Hefei, Anhui Province, China” (Reference number NPG-2016-15) authored by X. Li, F. Yuan, S.M. Jowitt, X. Li, T. Zhou, J. Zhou, X. Hu, and Y. Li presents results from a survey focused on heavy metals in two areas with contrasting economic activities (one area is industrial, the other one is agricultural). Authors applied the multifractal formalism to achieve indices that discern between both datasets.

The reported work is interesting and fits perfectly well within the scope of the Special Issue “Multifractal analysis in soil systems” to be published in *Nonlinear Processes in Geophysics*. However, the manuscript is not properly organized, English must be greatly improved and the discussion is very weak and biased to what happened on the agricultural area, which may suggest that it is the most contaminated one, which is not. Besides, there are some mistakes in the results.

In the following lines, I provide the authors with some suggestions in order to improve their manuscript. Therefore, the authors must address these issues prior to the acceptance of their manuscript. They must correct them in order that this manuscript achieves the standard quality for being published in *Nonlinear Processes in Geophysics*.

Therefore, I recommend a major revision prior to its publication in this Special Issue.

#### Specific comments to the authors:

*Please, organize the manuscript in Introduction, Materials and Methods, Results and Discussion, and Conclusions.*

*Title:*

*I suggest the authors to slightly modify the title of their manuscript to: “Comparison of the multifractal characteristics of heavy metals in soils within two areas of contrasting economic activities in China”.*

*Abstract:*

*The abstract is too long from my point of view.*

*Lines 16-17: “causing” instead of “that can have”.*

*Line 23: “allows deeper interrogation”, this expression is not clear. Please, re-phrase it.*

*Lines 26-28: “This study focuses...”, this sentence can be removed since its information is reported in the next one.*

*Line 29: Include “(industrial)” after “Daxing” and “(agricultural)” after “Yicheng”.*

*Lines 31, 32 and 38: Use  $\alpha$  instead of  $a$  in  $\Delta f(\alpha)$ , please.*

*Line 33: There is a mistake here; according to table 2, the  $\Delta f(\alpha)$  in Yicheng decreased as  $Zn > Hg > As > Cd > Pb > Cu$  instead of  $Hg > Zn > As > Cd > Pb > Cu$  as is reported here.*

*Line 34: I would remove the word “geochemical”.*

*Line 36: “clearly different” instead of “distinctly different”.*

*Lines 44-45: I would remove “rather than a single approach to heavy metal pollution” since it is not needed.*

*Introduction:*

*This section is not clear, the state-of-the-art is not put into context and thus the introduction seems out of focus. Moreover, this section begins with a list of references because in the first 6 lines, authors cited 13 references.*

*Line 51: I would remove “recently”.*

*Lines 58-59: “the factors controlling the distribution” instead of “the controls on the distribution”.*

*Line 62: “in soil properties” instead of “in the characteristics of soils”.*

*Line 63: Remove “and”.*

*Lines 63-65: Please, check English, this sentence is unclear.*

*Lines 67-68: “but also in the analysis of” instead of “but can also be used in the analysis of”.*

*Line 70: “and thus” instead of “meaning that”.*

*Lines 73-75: Please, re-phrase this sentence. It is not clear what you mean and must be put in context with the former sentence.*

*Line 77: Please, define “C-A” when first used.*

*Line 79: Please, define “S-A” when first used.*

*Lines 78-83: This is not clear, please, revise it.*

*Line 86: Remove “provincial”.*

*Line 87: Remove “areas”.*

*Line 88: “activities” instead of “activity”.*

*Lines 88-96: This portion of the text is repetitive and unclear. Please, revise it and state clearly the aims of your study.*

*Study area and geochemical data:*

*Line 99: Include “it” before “has”.*

*Line 102: “industrial areas of Hefei” instead of “industrial bases of the Hefei area”.*

*Line 103: Remove the word “industrial”.*

*Line 105-106: “In contrast, the town of Yicheng focuses its economic activities on agricultural production” instead of “In contrast, the town of Yicheng is agricultural, with the economy of the town focused on agricultural production”.*

*Line 107: “ornamentals” instead of “flower planting”.*

*Line 110: I do not understand what you mean by “natural mineralization”.*

*Lines 110-111: “(< 20 cm depth)” instead of “(<20 cm below surface)”.*

*Line 114: “was air-dried” instead of “was dried in air”.*

*Line 117: Remove “in the soil samples described above”, remove also “during this study”.*

*Line 119: “whereas Hg and As concentrations were determined” instead of “”with Hg and As concentrations determined”.*

*Lines 122-125: You repeat too many times the word “analysis”, sometimes you can use the synonym “determinations”.*

*Lines 116-125: Have you got references for the analytical methods? If so, please, add them to this portion of the text.*

*Line 126: “2.3. Results”, this should be a section after the explanations of the materials and methods used.*

*Line 127: “A statistical summary” instead of “The results of a statistical analysis”.*

*Line 134: “the natural background”. Maybe you should indicate what was the natural background.*

*Line 136: I would include Pb with Cu for the Yicheng area since the distribution of its concentrations in soils seems to follow a normal distribution as well.*

*Line 137: I would include “(Fig. 2)” after “outliers”.*

*Line 138: I am not sure, I agree that they are non-normal but how can you tell from the histograms that they are fractal?*

*Line 140: Remove “(Fig. 2)” from here.*

*Lines 143-146: I would rephrase this figure caption to “Location of Hefei in central-eastern China (a); location of the study areas within Hefei (b); 1 x 1 km grid for soil sampling in the towns of Daxin (c) and Yicheng (d)”.*

*Line 148: Re-phrase the title of this table to “Summary statistics of soil heavy metal concentrations from the Daxing and Yicheng samples”.*

*Table 1: Skewness and kurtosis are not concentrations and they are dimensionless. I would put the*

*units below each column title, I mean below “minimum”, “maximum”, “mean” and “standard deviation”. I would remove “Concentrations” from the table.*

*Mutifractal spectrum analysis:*

*Equations should be numbered.*

*Line 159: “the factors controlling the distribution” instead of “the controls on the distribution”. What do you mean by “of key elements within data”.*

*Line 160: Remove the word “multifractal”. “ $f(\alpha)$ ” instead of “ $f(a)$ ”.*

*Line 163: Remove “of estimating  $f(a)$  values” since it is not needed.*

*Line 170: “different from 0” instead of “that  $\neq 0$ ”.*

*Lines 173-174: Move “within a dataset” to after “statistical estimation”.*

*Line 183: “different from 0” instead of “that  $\neq 0$ ”.*

*Lines 184-185: Use alpha ( $\alpha$ ) instead of  $a$  when referring to the multifractal spectra.*

*Line 194: “spectrum is” instead of “spectrum are”.*

*Line 197: Use alpha ( $\alpha$ ) instead of  $a$  when referring to the multifractal spectra.*

*Line 201: “by the following” instead of “using the following”.*

*Calculation processes and discussion:*

*Lines 205-209: This has already been said in the former section.*

*Line 214: Remove “that” and “all of”.*

*Lines 217-223: This description should be greatly improved. Check English, please. Only Cua and Pb for Yicheng area have  $\tau^{(1)}$  values lower than -0.01.*

*Line 225: Use “indices” instead of “elements”. You are not talking about the elements but the multifractal indices that you obtained.*

*Line 226: “decrease” instead of “decreases”. There is a mistake here, Zn have a greater  $f(\alpha)$  value than Hg for the Yicheng samples.*

*Line 227: This has already been observed in the statistical summary.*

*Line 229-231: In fact, you are plotting these data.*

*Lines 232-234: This is not clear. Please, re-phrase it.*

*Line 235: Remove “for all elements”.*

*Lines 235-240: I am not sure about understanding this. Please, re-phrase it.*

*Line 241: “heavy metal contamination of soil” instead of “heavy metal contamination soil contamination”.*

*Line 243: “Yicheng area is caused by Hg” instead of “Yicheng area is Hg contamination”.*

*Lines 243-244: This is not true. According to table 2, As has a very similar  $\Delta f(\alpha)$  value than that of Hg and the value for Zn is even greater than that of Hg.*

*Line 247: “because this element” instead of “as this element”.*

*Line 252: Well, this is not exact. The element from Yicheng samples that showed the highest  $\Delta f(\alpha)$  values was Zn, according to table 2.*

*Line 253: Remove “showing the distribution of Pb in the Daxing area and Hg in the Yicheng area” since it is already said in the former sentence.*

*Lines 255-279: This portion of text is a very poor discussion of your results. You did not discuss anything about Daxing contamination. It is also funny that you talk about Hg contamination in Yicheng but the concentrations of this element were greater in the samples of Daxing (see table 1). I am also not sure about the need of performing a multifractal analysis for obtaining these results; a simple geostatistical approach would be enough.*

*Lines 283-286: Please, re-phrase this caption, it is not clear.*

*Lines 289-291: I would change the caption of this figure to “Filled contour map obtained by inverse distance weighted interpolation showing the spatial distribution of soil Pb concentrations in the Daxing area”.*

*Lines 294-296: I would modify the caption of this figure to “Filled contour map obtained by inverse distance weighted interpolation showing the spatial distribution of soil Hg concentrations in the Yicheng area”.*

*Lines 299-302: I would change the caption of this figure to “Filled contour map obtained by inverse distance weighted interpolation showing the spatial distribution of soil Cu concentrations and the location of breeding facilities in the Yicheng area”.*

*Conclusions:*

*Line 306: Include “the latter” after “although”.*

*Line 307: Remove “for the soil geochemical data”.*

*Line 309: Remove the word “value” before “changes”.*

*Line 310: There is a mistake here; according to table 2, the  $\Delta f(\alpha)$  in Yicheng decreased as Zn>Hg>As>Cd>Pb>Cu instead of Hg>Zn>As>Cd>Pb>Cu as is reported here.*

*Lines 314-319: However, the Hg concentrations in soils from the Daxing area were greater than in Yicheng.*

*Lines 320-326: I am not sure about this conclusion. Further explanations are needed in the discussion section to state this.*

*References:*

*I did not detect any missing references or citations in the text.*

*Line 343: Use the full name of the journal; in this case it should be “Computers and Geosciences” instead of “Comput. Geosci.”.*

*Lines 346-347: It should be spelled with a capital letter: “University of Geosciences”.*

*Line 353: It should be spelled with a capital letter: “Journal of Hazardous Materials”.*