

The revised version of the manuscript with reference NPG-2016-15-R1 and entitled “Comparison of the multifractal characteristics of heavy metals in soils within two areas of contrasting economic activities in China” authored by X. Li, F. Yuan, S.M. Jowitt, X. Li, T. Zhou, J. Zhou, X. Hu, and Y. Li and submitted to the Special Issue “Multifractal analysis in soil systems” to be published in *Nonlinear Processes in Geophysics* represents an improvement from the former version submitted to the journal. Authors have addressed the comments and suggestions made by the reviewers and English has been carefully revised.

However, there are still several issues to be corrected prior to an eventual publication in the journal. I detected a mistake in the results section and a number of them within the methodology, besides the discussion is weak and uses wrong concepts that authors must correct in order to get reliable conclusions. The last figure does not reflect what the authors imply in their discussion and should be re-arranged. Apart from this, a number of minor issues have been raised in the introduction section.

Therefore, I still advice for a major revision prior to the acceptance of the manuscript.

In the following pages, I provide the authors with a number of suggestions/comments for improving their manuscript.

#### **Specific comments to the authors:**

*Abstract:*

*The abstract is rather long and redundant from my point of view.*

*Line 23; “within urban or developed areas”, is this really needed?*

*Line 24: I would remove “an area” since it is not needed.*

*Line 26: “geochemistry of soils”, this is to wide and not really what you have done since you only applied multifractal formalisms to heavy metal concentrations.*

*Lines 27-33: I think this portion could be re-phrased and reduced. Besides, there is a mistake in line 32, according to table 3, the overall multifractality in Yicheng decreased as  $Hg > As > Zn > Cd > Pb > Cu$  and not as  $Hg > Zn > As > Cd > Pb > Cu$  as is reported here. In line 33, it should be “indicate” instead of “indicates” since you refer to “differences”.*

*Lines 38-40: I would remove this sentence: “The larger values [...] to industrial activities than agriculture”.*

*Line 46: I do not agree with this statement. You did not identify any source of pollution using multifractality, the spatial analysis was performed using a deterministic method (inverse distance weighing).*

*Introduction:*

*I did not like this way of introducing because you did not set the basis for performing your study. Anyway, this a personnal opinion. However, certain objective remarks need to be addressed:*

*Line 54: I would remove “in recent years”. You cited here works from 1997, that is 20 years ago, therefore, I do not think is very recent. By the way, in what order did you put your citations? It is neither chronological nor alphabetical! Please, edit according to journal’s instructions.*

*Lines 55-59: Please, try to reduce this sentence because it is too long.*

*Lines 61-62: I would remove “using multifractal techniques to” and substitute “determine” for “determining”.*

*Line 63: I would use other term instead of “further”. Maybe “enhance” or “improve”.*

*Line 64: What activities are you referring to?*

*Lines 65-74: This is somewhat confusing since you did not define any threshold, separated anomalies or identified behaviours in your study. At least I did not understand it that way.*

*Line 76: Remove “and so on”.*

*Line 78: “polluntation”??? Do you mean “pollution”?*

*Line 80: Remove “be used”.*

*Lines 74-84: What order did you follow for citations? It is neither chronological nor alphabetical.*

*Lines 87-90: In this sentence the word “multifractal” is repeated four times, please, re-phrase.*

*Line 91: Remove “the” before “anthropogenic”.*

*Study area and geochemical data:*

*Line 114: Remove “during this study, with” and use a dot to separate the sentence after “determined”. Then begin the new sentence as “The concentrations of”.*

*Line 115: Remove “concentrations” and use “were” before “determined”.*

*Line 116: Use “were” before “determined”.*

*Lines 114-117: Please, add references for the methods used for heavy metal determination.*

*Lines 119-122: This is not clear, please, re-phrase it.*

*Multifractal spectrum analysis*

*Lines 148-149: Again, order of citations!*

*Line 151: Since you used the gliding box method, why explaining the calculation of the box-counting method in lines 140-144?*

*Line 154: Please, improve the readability of this equation.*

*Line 159: “ $f(\alpha)$ ” does not appear in equation 4.*

*Lines 160-161: What is “ $q$ ” in these equations?*

*Lines 162-163: These symbols do not appear in the equations 3 and 4, why beginning with “where”? You must specify the meaning of the symbols in each equation, otherwise, readers will not know what are you describing mathematically.*

*Lines 173-174: “multifractality associated with ordinary spatial analysis parameters”, what parameters? What is the relation?*

*Line 178: “is the box-counting dimension”, but you were using the gliding-box approach. I am lost.*

*Line 179: “smaller values”. Not clear, smaller than what? Positive or negative?*

*Line 181: “used” instead of “use”.*

*Line 182: “heterogeneous patterns”, of what?*

*Lines 183-184: “as well as enabling the comparison of the distribution of differing elements in the soils in this region”. If you say so, but I am not so sure, in fact, you performed this using inverse distance weighting interpolation.*

#### *Geochemical analysis results*

*Line 187: You do not indicate that means were also higher for the Daxing area. Besides, they are also higher in this area for Hg.*

*Line 196: “yielded concentration histograms” instead of “yield histograms”.*

*Lines 198-200: And also that these concentrations depended on the type of human activities developed within each area.*

#### *Calculation processes of multifractal spectrum and discussion*

*Lines 210-211: This is already explained in the description of the multifractal analysis that has been carried out.*

*Lines 211-212: “used a range of  $q$  values from  $-10$  to  $10$ ”, did you select this range? Besides, you did not explain what “ $q$ ” is.*

*Line 216: I would remove “showing the multifractal characteristics of all”.*

*Line 217: I would remove “(barring Cu)” and add “Daxing” to the figure caption.*

*Lines 219-220: I would remove “combine the singularity exponent  $\alpha$  and the corresponding fractal*

*dimension  $f(\alpha)$  to generate a multifractal spectrum with” and use just “showed”.*

*Line 221: “are also” should be substituted for “were” and “is” for “was”.*

*Line 223: “samples” instead of “the soils”.*

*Line 226: Remove “analytical” and use “indicated” instead of “indicate”.*

*Line 227: “were characterized” instead of “are characterized”.*

*Lines 227-230: Please, re-phrase. Use the past tense and remove unnecessary words.*

*Line 232: “had” instead of “have”.*

*Lines 232-233: Are these differences significant?*

*Lines 235-236: “the significant heavy metal pollution associated with agriculture”; however, concentrations of Hg were greater in the industrial area.*

*Lines 237-240: I do not agree with this explanation. The high values for the multifractal indices used in this study just mean that in your data series high concentration values were very different from low concentrations for a given element.*

*Lines 241-243: I do not see why you only concentrate on Hg pollution in your discussion, what about the other elements?*

*Lines 243-244: “deleterious effects”, on what?*

*Line 246: I would remove “within the soil samples”.*

*Lines 249-251: This should be explained in the materials and methods. Besides, you should indicate that data were sorted within each area and not on both at the same time.*

*Line 260: I would remove “the analyses afforded by classic”.*

*Lines 263-265: This is not clear, please, re-phrase it.*

*Line 267: I would change “parameters and coefficient of variation values” to “and basic statistic indices”.*

*Table 3: Using standard deviation is of not very much use here since its effect would depend on the magnitude of your data. For instance Zn has a very high standard deviation compared to Hg, so logically, this index would give Zn always the first order. I suggest only using coefficient of variation, since this index is normalized for all elements.*

*Line 273: According to table 3, it should be “Hg>As>Zn>Cd>Pb>Cu”.*

*Line 280: Why not performing this inverse distance weighting interpolation for the rest of the elements? Besides, be careful since here you are not using multifractals; however, your discussion is oriented as if this technique was multifractal.*

*Lines 284-285: Not exactly, only in the area where is a bunch of breeding facilities. In the case of*

*Pb, this concentration would depend on the type of industry involved.*

*Lines 287-290: What are they using as Hg source? It must appear from somewhere!!!*

*Lines 293-295: Please, re-phrase. This is not clear.*

*Line 296: “a significant” instead of “an significant”.*

*Lines 297-299: I do not see this from your figure. In fact, the evolution of both elements is very similar at lower classes.*

*Lines 301-302: I do not totally agree. You can see that the shape of the curve is similar for Cu and Hg, only different for the greater classes.*

*Line 304: “can efficiently reflect the multifractality”, of course, they are designed to do this.*

*Line 305: Remove “by”.*

*Lines 317-319: This is unclear. Please, re-phrase it.*

*Line 320: Remove “especially in areas with significant heavy metal pollution”. From my viewpoint, it is not needed.*

*Line 324: Remove “in this area”.*

*Figure 4: In the upper left-hand side of the map there are some industries and the Pb concentration is rather low. Similar values are observed in the lower left-hand side of the map. This may indicate that Pb concentrations in soils depend more on the type of industry than on the fact that there is an industry, as you imply in your discussion.*

*Figure 5: In contrast with the former figure, in the right-hand side of this map, we can observe high concentrations of Hg in the soil, but there are no breeding facilities on this part of the map... Then, why do these high Hg concentrations appear? According to your discussion, there is a direct relationship between the existence of a breeding facility and the high concentrations of Hg observed.*

*Figure 6: Coinciding with the former map, there are very high Cu concentrations in the right-hand side of this map, why? What is over there?*

*Figure 7: To me, this graph is difficult to interpret. Both lines show correlations between number of facilities and Hg or Cu concentrations in soils. Besides, the caption is not clear. You talk about an anti-correlation and this is not observed in the graph.*

*Conclusions:*

*Line 355: According to table 3, the overall multifractality in Yicheng decreased as  $Hg > As > Zn > Cd > Pb > Cu$  and not as  $Hg > Zn > As > Cd > Pb > Cu$  as is reported here.*

*Lines 356-364: What about other problems caused by the other heavy metals? People in Daxing are immune to heavy metal pollution?*

*Line 365: “The initial results”, I do not understand why you termed your results as “initial”.*

*Lines 366-367: “multifractal parameters can efficiently reflect the multifractality caused by industrial and agricultural activities”, well, of course, multifractal indices are designed to do this.*

*Lines 369-370: “and the identification of major sources of heavy metal contamination”. I do not agree, the identification of these sources was made through inverse distance weighting interpolation, which is not a multifractal technique.*