The manuscript entitled "Fractal behavior of soil water storage at multiple depths" (Reference number NPG-2015-81) authored by W. Ji, M. Lin, A. Biswas, B.C. Si, H.W. Chau, and P. Cresswell presents results from a five-year study on the soil water storage from a transect in a hummocky landscape of central Canada. The authors applied multifractal and joint multifractal theories to this huge dataset in order to describe the fractal behavior of this variable at different depths along the transect.

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 rather long and information can be condensed as well as reduced since it seems repetitive in some portions. Tables can be improved and, from my point of view, figure 9 is not needed and can be deleted. Finally, a few English mistakes must be corrected.

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 <u>a moderate revision</u> prior to its publication in this journal.

Specific comments to the authors:

Abstract:

Line 16: "hold at deep layer. Current study" could be changed to "are kept at deeper layers. The current study".

Line 17: "its relationship", shouldn't it be "their relationships"?

Line 18: Remove the word "the" before "supporting" and "plant root".

Line 20: Please, indicate here the years and the study site.

Line 21: I would remove "with large SWS". I would use "for multiple scaling" instead of "of multiple scaling".

Line 23: "for a single scaling" instead of "of single scaling".

Lines 24-25: "The dynamic nature…" Please, re-phrase this sentence, since it is confusing.

Line 26: "of the growing season", of what? I would also remove "with low SWS".

Lines 28-30: Only for the dry period? This is somewhat unclear.

Keywords:

I would use only one, either "scaling" or "scale invariance".

Introduction:

This section is well-written and provides enough information about the background of the presented work; however, it looks rather repetitive. Could you condense some information, please?

Lines 44-46: You used the word "scale" too many times in this sentence.

Line 53: "a typical of scaling process", a typical what?

Line 55: "using the fractal theory" instead of "using fractal theory".

Line 57: Remove the word "scaling" between "single" and "coefficient".

Line 58: Remove the word "scaling" between "monofractal" and "behaviour"; by the way, should it be spelled like that or "behavior" as you used in the title?

Line 60: "(multifractals) for quantifying its spatial" instead of "(multifractal scaling) in quantifying spatial".

Lines 62-63: Please, remove this sentence because it is not needed since this statement is implied in the next sentences.

Line 65: "and drying cycles have been reported" instead of "and drying has been reported".

Line 67: "can provide a quick estimate" instead of "can provide an estimate".

Line 68: Remove the word "quickly".

Lines 68-69: I am not sure that "indicating the superficial properties" is needed.

Line 71: "is the most dynamic in nature" instead of "are most dynamic in nature".

Line 72: Please, check English in "the observed scaling properties holds for the deep layers".

Line 78: "to examine over time the scaling properties" instead of "to examine the scaling properties".

Line 79: Remove "over time".

Lines 80-81: "multiple depth layers and at soil layers with increasing depth from the surface (cumulative depth)", this is somewhat unclear. Please, re-phrase.

Line 83: Remove the word "layer" after "surface".

Materials and Methods:

Line 87: Please, indicate the elevation above sea level of the study site.

Line 89: “differently” instead of “different”.

Line 93: “extending in the north-south” instead of “extending in north-south”.

Line 95: “intervals” instead of “interval”.

Line 96: “at every 20 cm depth”, you should indicate down to what depth.

Line 97: Remove “of” after “depths”.

Line 112: “and better characterize its spatial variability” instead of “and characterize its spatial variability better”.

Lines 113-114: I think that this is not needed and can be removed.

Line 119: Remove “(scaling)”.

Line 131: “with their associated masses” instead of “with its associated mass”.

Line 135: “to characterize”, to characterize what?

Lines 135-138: This last sentence is not clear, please, re-phrase it.

Line 146: Define UM when first used, please.

Line 147: “a reference line that represented” instead of “a linear reference line which represented”.

Line 153: “intervals” instead of “interval”.

Line 155: “was also completed” instead of “were also completed”.

Line 156: “was checked” instead of “was tested”.

Line 158: “proven” instead of “proved”.

Lines 174-175: From my point of view you could delete this sentence “This spectrum also enabled us to examine the local scaling property”.

Lines 181-184: Here, you talk about models but I think you should use indicators or indices instead.

Line 197: “When this value equals to 1” instead of “The value equal to 1”.

Line 202: “in size ε” should be “of size ε”.

Line 210: “is the partition function” instead of “is partition function”.

Line 219: Remove “value of”.

Lines 220-221: “Pair value...”, this sentence is unclear. Please, re-phrase it.

Results:

Lines 226-229: These values are not included in Table 1. Why did you mention this table here?

Lines 230-231: "The highest average SWS…" this is not true for all depths.

Line 231: "large amount of spring rainfall", data on rainfall are not shown.

Line 233: "summers" instead of "summers". Besides, this is not true for all depths.

Line 236: "wider" instead of "bigger".

Lines 235-240: Please, re-phrase, this is rather confusing.

Line 241: "coefficients of variation" instead of "coefficient of variations".

Line 245: The minimum is 6.71 cm according to table 1 and not 6.72 cm as you said in the text.

Line 250: "field-average because they were situated" instead of "field-average and were situated".

Line 257: Remove the word "even".

Line 260: "decreased" instead of "decrease".

Lines 267-268: I would remove the last sentence because this statement is logical since coefficient of variation and standard deviation are related variables.

Lines 270-271: This first sentence is not needed and can be removed.

Lines 271-273: This looks like materials and methods and not results.

Line 275: Remove "The scale invariance" and substitute it for "which".

Line 277: I would use "dates" instead of "measurements".

Line 279: What do you mean by "soil layers with cumulative depths".

Lines 281-282: Define UM and SSR when first used, please.

Line 291: Remove "the" before "deep layers".

Line 298: "increasing" instead of "the increase of".

Line 302: "went" instead of "going".

Line 304: Remove the word "statically".

Line 305: "of the first three" instead of "of first three".

Lines 321-329: This is messy and unclear, even somewhat repetitive. Please, re-phrase.

Lines 330-331: I would re-phrase this sentence to "The height of the multifractal spectrum at

different depths was very similar over time".

Line 333: "smaller with depth" instead of "smaller at depths".

Line 339: "on 21 June 2008" instead of "measurement of 21 June 2008".

Line 343: "in the first three" instead of "in first three".

Line 356: Remove the word "all".

Line 371: "A very similar trend was observed in other years". These data are not shown. Indicate this and also briefly specify the similarity.

Discussion:

This section can be reduced since it seems repetitive and information can be condensed because some paragraphs look like materials and methods.

Line 373: "in the soil" instead of "in soil layers".

Line 377: "within a short period" instead of "within short period".

Line 378: "contributes" instead of "contribute".

Line 384: Remove one dot at the end of the sentence.

Line 389: "of water" instead of "of the water".

Line 390: "stored a larger" instead of "stored larger".

Line 394: Remove one dot at the end of the sentence.

Line 396: "average SWS in a year", only in one year?

Line 397: "compared" instead of "comparing".

Line 400-402: "Stronger demand…" This sentence is not clear, please, re-phrase it.

Line 404: "deeper" instead "deep".

Line 405: I would use "factors" or "forces" instead of "forcing".

Line 406: I would remove "and was very dynamic in nature".

Line 412: "the presence of scaling laws" can be changed to "that SWS behaved under scaling laws".

Lines 413-418: This portion looks like materials and methods.

Line 430: "factors" instead of "forcing". "and this exhibited a monofractal" instead of "and

exhibited monofractal".

Line 435: I would remove "to describe scaling property".

Lines 439-450: This looks like materials and methods. In addition, it is quite repetitive.

Lines 451-457: Is this paragraph really needed? It repeats the former paragraphs.

Line 466: "Surface one or two layers", do you mean the two upper soil layers?

Lines 469-471: This last sentence is rather confusing. Please, re-phrase it.

Lines 476-477: I do not understand what you mean here.

Line 479: "indicated the multifractal" instead of "indicated multifractal".

Line 480: Remove the word "closer".

Line 481: "indicated a monofractal" instead of "indicated monofractal".

Line 482: "distributions" instead of "distribution".

Line 485: "layers were similar to those of the top layer" instead of "layers was more similar to the top layer". Besides, what do you mean by "showed more observable"?

Line 488: "a higher dynamic" instead of "higher dynamic".

Line 489: "a stronger effect" instead of "stronger effect".

Line 490: "small variations" of what? Besides, "soil layers that showed a stronger" instead of "soil layers and showed stronger".

Line 492: "our results revealed a multifractal" instead of "our result revealed multifractal".

Line 493: "due to its dynamic nature" of what? The wet period? The soil? The SWS? Not clear.

Line 496: "in the semi-arid" instead of "in semi-arid".

Line 497: "environmental factors showed a uniform" instead of "environment forcing showed uniform".

Line 498: Is figure 9 really needed?

Conclusions:

Line 501: "scaling indices" instead of "scaling index".

Line 503: "require" instead of "requires".

Lines 504-506: The idea mentioned in this last sentence is not well developed throughout the text,

especially it is not discussed at all in the discussion section. However, it appeared in the abstract.

Line 508: "over a five-year" instead of "over five-year".

Line 509: "suggested a monofractal" instead of "suggested monofractal".

Line 512: Remove "in nature".

Lines 513-514: Please, check English on this sentence.

Line 516: "requires a single scaling" instead of "requires single scaling".

Line 520: "very persistence"? Do you mean "consistent"?

Lines 520-522: "Therefore, the observation completed…", I am not sure about this conclusion.

References:

Lines 544-545: Use the abbreviated title for the journal "Phys. Rev. Lett."
Line 556: Use the abbreviated title for the journal "Phys. Rev. Lett."
Lines 558-559: Why is the title of the article in capital letters?
Line 565: Use the abbreviated title for the journal "Remote Sens. Environ."
Lines 569-570: Use the abbreviated title for the journal "Remote Sens. Environ."
Line 584: Use the abbreviated title for the journal "Phys. Rev."
Lines 596-597: Why is the title of the article in capital letters?
Line 600: Use the abbreviated title for the journal "J. Geophys. Res."

Figure captions
In the caption for the first figure include "for three selected dates".
Lines 619-636: In these figures data from 2011 are also shown; however, you indicate 2008 and 2010 in the caption. Please, include also 2011.
Lines 640-642: Is figure 9 really needed?

Table 1: Please, include the five-year averages, since you refer to them in the text.
Table 2: Please, indicate the number of data used for each correlation. Was it the same for all dates and depths? I would re-phrase the title of this table to "Correlation coefficients between joint multifractal indices (α and β) of the surface layer with those from subsurface layers at 20 cm

intervals in 2008”.

Figures:

Figure 1: Why not showing the Y-scale in all left graphs?

Figure 2 and 3: It is very difficult to distinguish the points from each depth. Besides, the UM model is missing from the graphs.

Figures 6 and 7: Some values are overlapped in the Y-axis.

Figure 9: Is this figure really needed?