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Interactive comment on “Biogeochemistry of an amazonian podzol-ferralsol soil system with white kaolin” by Y. Lucas et al.

Anonymous Referee #2

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This study examines groundwater properties at a number of sites in a podzol-ferralsol soil catena located in the Alto Rio Negro region. The authors focus upon identifying the soil mineralogy and dissolved organic matter (DOM) concentration through their defined catena. By comparing groundwater sample availability during three precipitation events they conclude that there are two groundwater pathways in their studied catena. The first, permanent pathway is located at an approximate depth of 2 m, within the kaolin horizon. The second, more temporal pathway is located just below the surface and only occurs during heavier precipitation events. In the context of these two pathways, the authors present their mineralogical and DOM concentration data with the objective of understanding these soils more fully.

General Comments

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The study of the podzol-ferralsol soils in the Amazonian area is interesting, and understanding the soil processes governing these environments is important. However, the overall reasoning behind such a study is unclear. The authors state that they are constructing a database to study ground waters in a podzol-ferralsol region due to a lack of geochemical information in the study by Montes et al. (2007). The novelty of the podzol-ferralsol environments and their importance in soil dynamics is not clearly indicated in the abstract or the introduction and so it makes putting the data in the manuscript within an appropriate context difficult. The choice to study ground waters rather than other pools seems mainly due to the fact that other previous studies were unable to do so. The authors do not clearly describe why ground waters are so important to these environments, other than that they can potentially contain high levels of dissolved organic carbon (DOC). The objectives of the study stated in the introduction are vague and I am not entirely sure they are all fully addressed with the current data presentation. After reviewing this paper, I still do not feel able to 'evaluate the possible changes in the natural organic matter (NOM) dynamics through global change'.

The number of study sites within the catena seems appropriate and well placed, and in theory much information could be yielded from their investigation. However, much of the methods, results and discussions sections were difficult to understand due to many grammatical errors and poor explanations. Although the mineralogical aspect of this study was thorough, due to a lack of further chemical study of the DOC, often broad and poorly evidenced conclusions were made throughout the results and discussions sections. Much of the basis of this study is upon the setup of two water pathways. The authors define the two pathways upon only three sampling periods at seemingly random precipitation events. A more strategic sampling plan would have yielded a much more convincing definition. With the evidence presented thus far, the two defined pathways seem valid but I am not sure how well they expand to other times of the year.

Overall, the objectives of this study are not clear, and need to be stated in both the abstract and introduction instead of a vague mention. The number of grammatical and

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spelling errors throughout the manuscript is extensive, and this needs to be corrected. A major overhaul of much of the manuscript is required in order to provide a more succinct, easily followed study description.

Specific comments

Abstract

-The aims of the study need to be clearly defined in the first paragraph and how the authors set about solving these.

-There does not seem to be a logical explanation of the most important points of the data, rather seemingly random parameters are presented with no clear story.

-The author's mention a database L6 P2234 but they do not state what was in the database and why did they study those parameters. Also 'the sampling periods allowed to sample under high- and low-level water-table conditions' makes no sense, rewrite.

-L10 P2234 what are the currently observed mineral and organic paragenesis? What is this compared to?

- The second and third paragraphs should be switched.

-L11 P2234 insert 'the' between in and acid.

-L13 P2234 what is the aggressiveness of groundwater? This is the wrong word to use here, please replace.

-L17 P2234 this is an extremely broad statement, and there is no chemistry in this study to back this statement up, please revise.

-L27 P2234 this sentence makes no sense, rewrite for clarity.

Introduction

-Similar to the abstract, a clear logical reasoning for the study needs to be developed in this section. Restructure this section to begin with broad, widely applicable information

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important for your site, and then work towards focusing upon the most salient objectives of the study.

- L6 P2235 replace 'allowed' with 'allow'.
- L12 P2235 a positive feedback of what? Separate this sentence into two, and rewrite the second part for clarity.
- L18 P2235 restructure this sentence.
- L22 P2235 which authors? State the name.
- L23 P2235 this is the only mention of atmospheric importance and this statement is not supported in the manuscript explanation, suggest deletion.
- L2 P2236 split this sentence into two after 'Montes et al. (2007).
- L5 P2235 delete 'the' between of and iron.
- L7 P2236 what type of geochemical properties?
- L13 P2236 Why is studying groundwater solutions so important?
- L15 P2236 is there a reference for this statement?
- L16 P2236 rewrite the objectives to reflect the data presented. Also briefly mention how/what will be studied.
- L19 P2236 Delete the last sentence this is not answered in the study.

Materials and Methods

- L8 P2237 what is the name of the river network?
- Section 2.1 is overly descriptive and could be shortened.
- L20 P2237 Mineralogy. . . sentence is repeated in the next paragraph and only one is needed. Also a very brief description of the methodology would be helpful.

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-One point of confusion was the labelling system for the studied sequence. CA2-20 and CA1-150 are described but there seems to be no reasoning or ease to follow the sampling points in the sequence shown in Fig.2. I suggest a relabeling for clarity. Also what is the difference between an observation pit and borehole? Is it necessary to include these on Fig. 2? Spell out FAO in the Fig. 2 legend. Can the Spring point be indicated on Fig. 1 or Fig. 2?

-Fig. 3 is this for pit 1? Why are only these parameters plotted? What about plotting the other pits in a similar plot for easy comparison? Why is TOC not stated in mg/L? Is this supposed to be DOC, were the samples filtered prior to this measurement? If so, how?

- Section 2.2.2 the choice of these three periods does not seem entirely logical, and even though the original reason for their choice did not come true, it is not necessary to state this. Only discuss what was more importantly different between them. What are the seasons for each of the collection times? What are the average rainfall numbers for past years and how does these sampling periods compare, with cited numbers?

-L10 P2241 what analyses were conducted on each of the four aliquots? What was the fifth container poisoned for? Were blanks also filtered to ensure no additional contributions?

-L16 P2241 a reference for past use of this method would be appropriate here.

-L20 P2241 if iron measurements were made within an hour, what is the point in testing whether it is the same after 6 hours?

-L23 P2241 what were the absorbencies used for each of the parameters measured? How significant is DOM contribution at these specific absorbencies? Can you provide some references for this?

-L26 P2241 how long after sampling was DOC analyses performed? Delete equipment in this sentence.

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-L4 P2242 change 'but' to 'and'.

-L7 P2242 include a reference to substantiate this oxidation of DOM test.

-L23 P2242 change 'depending' to 'dependent'.

-L21 P2242 DOM being charged is no great surprise, and of course it affects pH values. I wonder how much this adjustment in pH affected some of the conclusions later in the paper. An example of how much one or two of the pH values changed would be helpful.

-P2242 last paragraph the reasoning for the microtitration is not clear, and I am not sure doing this experiment is necessary for this study.

Results

-Similar to the previous sections, the authors need to thoroughly revise this section to make a more easily followed argument.

-L8 P2243 change '2dn' to '2nd'.

-L15 P2243 description of PMVB-15 point in next paragraph should be moved forward to this point.

-L19 P2243 delete 'ing' in excepting. Do this for the rest of the paper.

-L10 P2244 What is the objective in including Supplemental Table 1? The summary tables included in the main text are more than adequate. I suggest this table be removed. In the Table 2 legend, I suggest changing 'statistics' to 'summary'.

-L18 P2244 'This assessed. . .' rewrite this sentence or delete it is confusing.

-L25 P2244 Change 'one sampling day to the other' to 'sampling days'.

-Fig. 5 is this figure really important to include in the main text? This could be moved to the supplementary. Also there are commas in the y axis, these should be periods.

-Fig. 6 is very difficult to see, and really there are few differences between a-d, as

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stated on L26 P2242. Therefore, to make it clearer the authors could consider just showing Fig. 6d and stating the differences in a-c.

-L27 P2242 rewrite this sentence on this line, it is confusing.

-L11 P2245 a statistical test to demonstrate this would be helpful.

-L17 P2245 diminution is used many times in the text; this is incorrect and should be revised.

-L1 P2246 swap always and had.

-L11 P2246 a strong decrease is not really accurate, since they both decreased by about a half.

-L13 P2246 shorten, split and revise this sentence for clarity.

-L22 P2246 what is the quantification limit?

-Just looking at the redox numbers and the iron concentrations, there seems to be some disparity based on normal logic. A more thorough discussion and consideration of these numbers should be conducted.

-L20 P2247 rewrite these next two sentences for clarity.

-L3 P2248 delete 'the' between on and average.

-L13 P2248 shouldn't there be a correlation? This needs further thought and consideration.

-L20 P2248 rewrite for clarity.

-L26 P2248 only 4 acidic sites to represent all of the DOM molecules seems very low, and I wonder how well this model works.

Discussion

-This section can be shortened to the most pertinent points, and a logical discussion

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needs to be developed. This section is particularly difficult to follow.

-L11 P2249 is the soil and vegetation exactly the same? This seems difficult to believe.

-L21 P2249 shorten, split up and rewrite this sentence.

-L25 P2249 why are molar ratios calculated? The point is already made.

-L2 P2250 The last sentence of this section, seems like an afterthought and not thoroughly thought out and discussed. Also the data presented do not unambiguously confirm this statement. Either remove or expand and reword.

-L8 P2250 suffered is not appropriate to describe water. A better word is exhibited.

-L9 P2250 this cannot be confirmed, therefore, 'is' should be changed to 'can be'. Also a reference would be appropriate here.

-L10 P2250 rewrite this sentence it is confusing.

-L13 P2250 a few references in these explanations in this paragraph would be helpful. Also how long do the authors anticipate the mineralization to take? Is this a realistic time period for their study and observations?

-L23 P2250 delete 'progressive'. This whole sentence is confusing and should be rewritten.

-L5 P2251 change 'loosed' to 'lost'.

-L6 P2251 'Such water. . .' this is confusing and should be rewritten.

-L7 P2251 Change 'is' to 'can be'.

-L10 P2251 PMVB-15 is so different from all other points, and this short discussion should be expanded.

-Section 4.3 there is no reasoning behind why this first calculation is performed. I am not sure ZDOM really means anything. If it does, then this is not clear and warrants

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much more explanation. Also what is COD in equation 1? Calculation of the acid site density is intriguing but without more chemical evidence, I strongly question the validity of the conclusions made in regard to these calculations. There are methods that could help to confirm the idea that carboxylic groups are important, e.g. IR, NMR, GC-MS.

-Table 4, I cannot find any discussion of this table. Therefore, maybe it should be omitted and discussed only since there are so few numbers within it.

-L22 P2253 this sentence is confusing and should be rewritten.

-L25 P2253 insert 'the' between in and upper.

-L2 P2254 I don't think that all of the points are close to the "kaolinite 1" line, but they seem to be spaced between that and the second kaolinite line. I suggest a revision of this sentence.

-L14 P2254 why test the complexation by DOM? The calculation seems odd and it does not add anything extra, so why include this?

-Section 4.4.2 the fact that Fe^{2+} is so predominant in these oxic soils is really interesting. Testing some of the explanation for the rapid change in redox condition in a laboratory setting to validate the suggestions made here would be a good addition to this section. P13-160 point does not seem very differently positioned than the others around it, this statement should be rethought out.

-L12 P2255 many broad statements are made in this paragraph which are currently very thinly substantiated. These suggestions need more thought and evidence before this paragraph can be included as it stands.

Conclusions

-This section is not very conclusive. It is extremely confusing at times and there is no logical thought pattern. This section is designed to be understandable without having read the paper beforehand, and currently this is not possible. The authors should think

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about the most salient points of their study, and then put them together in a logical conclusion for a more easily understood section.

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