

Interactive comment on “CO₂ enrichment increases nutrient leaching from model forest ecosystems in subtropical China” by J. X. Liu et al.

J. X. Liu et al.

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Dear Referee 1,

We would like to express our sincere thanks to you for the positive comments about our manuscript. We have incorporated your suggestions into our revised manuscript.

Here are our detailed responses to the relevant comments.

A) Responses to the Referee 1’s general comments

Comments: Subtropical forests cover large areas in China. Together with high atmospheric deposition of N, other nutrients, and pollutants, these forests are also subjected to increasing CO₂, as the most prominent effect of global change. Liu et al., studied the

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effect of effects of a CO₂ enrichment on the leaching of plant nutrients using an open top chamber technique. The manuscript is well written, easy to understand, presents interesting data and matches the scopes of BG. Their approach to study both the effect of high CO₂ and high N loads on nutrient leaching is original and well adapted to the local environmental conditions. The last point makes it possible to provide information to decision makers about risks and future environmental changes in the studied area. The data obtained had been analysed using adapted statistical tools, the resulting tables and figures supported the main points of this manuscript. Nevertheless, it would be of interest to see of the observed evolution of the nutrient concentrations will vary in the same way over a longer time period.

Response: Thanks a lot for the referee 1's positive comments. As suggested by the referee, we will do the further experiment to see whether the nutrient concentrations will vary in the same way over a long time period.

B) Responses to the Referee 1's specific comments

1. Comments: Abstract: more precise "weathering of minerals" instead of soil weathering.

Response: Agreed. "soil weathering" has been replaced by "weathering of minerals" in the revision.

2. Comments: Line 9-10: should be changed, especially the end of this sentence.

Response: Agreed. Line 9-10 has been changed as "Increased losses following exposure to elevated CO₂ were related to both faster weathering of minerals /organic matter decomposition and greater amounts of water leaching".

3. Comments: Line 23-25: delete dangerous or the whole sentence, because it is quite trivial.

Response: Agreed. "dangerous" has been deleted.

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4. Comments: Line 27-30: sinks for CO₂ are: SOM, tree biomass, but sinks can turn into sources, depends on forest management, environmental conditions...

Response: Agreed. This sentence has been clarified more clearly.

5. Comments: Page 2681, line 26: Soil moisture controls microbial activity but in subtropical climate, higher moisture should be interpreted in terms of a reservoir for the dry season.

Response: Agreed. Hence the litter decomposition rate could be changed by the higher soil moisture.

6. Comments: Mixing of soils by sieving destroys aggregates and may increase mineral surface which could be weathered by the soil solution. As done by the authors they waited 9 month before the measurements started, a time span which seems long enough that the soil recovers from this treatment (see for instance the FACE experimental set up of Hagedorn et al., 2000).

Response: Agreed. Since there were control chambers in our experiment, soil recovers mentioned above by the referee would not affect our results.

7. Comments: Figure 2: How do you explain the increase in the soil pH (from 4.2 to 7.7)? Suggestion: compile Figures 3 and 5, and Figure 4 and 6, this will reduce the number of the figures without reduction of the information. Table 1: add the C (%), verify the N (%) which is quite high (3–2 %), and add the total amounts of each nutrient as kg/ha. This makes it possible to see how much of the total is lost per year (losses presented Table 2)

Response: There are two reasons which would lead to the increase in soil water pH values from February to December in the experiment. Firstly, high precipitation amounts and temperatures since April led to the higher rates of weathering of soil minerals and soil organic matter decomposition, which produced more cations and accelerated the exchange of H⁺ with cations, and led to higher soil water pH values. On the other hand,

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in January and February, the weather temperature and precipitation amount were relatively low compared to the other months. Hence, the rates of weathering of soil minerals and soil organic matter decomposition were low, and then low soil water pH values were found. Secondly, soil water pH values were affected by the pH value of rainfall (Rainfall pH values were not shown in the paper). Rainfall pH values were related to the precipitation amount and the contents of atmospheric particulate. From October to December, as the weather was dry, more atmospheric particulate had been found, and less precipitation amount had been obtained, which led to higher rainfall pH values. The figures and Table 1 have changed according to the referee's advice.

8.Comments: Could you provide more information about the increase in pH? This is a dramatic increase within one year, an effect rarely observed in other forest ecosystems.

Response: Agreed. We have done this in the revised manuscript.

9.Comments: Moisture effect on litter decomposition is rather speculative; it would be highly improved if litter decomposition had been measured. Even direct measurement of litter decomposition is critical because this should be done for pure and mixed litters from the 8 tree species.

Response: Agreed. We will add this experiment in the future research.

10.Comments: Aber et al is studied N saturation in northern temperate forests in the U.S and in Europe

Response: Agreed. We have changed the sentence and make it clearer.

11.Comments: Another point is the high N loads into this ecosystem, which will increase growth, if N was limiting or Liebig's law should be kept in mind.

Response: Agreed. We have changed the paragraph and make it clearer.

C) Summary

We wish to thank the Referee 1 for the valuable comments, which help us to improve

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the manuscript considerably. We hope that you would find our revised ms to be satisfactory for the publication in Biogeosciences.

Sincerely,

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