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Biogeosciences Discussions

Interactive comment on "Nitrogen retention patterns and their controlling factors in an alpine meadow: implications for carbon sequestration" *by* X. L. Xu et al.

X. L. Xu et al.

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Thank you for opening the discussion on our manuscript. Your comments are helpful to improve the manuscript, and we agree with most of them. Please see in detail as following:

1. The statistical design of the investigation is inadequate, since state of the art statistic for such investigations are randomized block designs. With respect to the described design it is impossible to distinguish between treatment effects and spatial heterogeneity in the ecosystem regardless the fact that the authors assure that a block uniform in species composition and cover was selected.

We do not agree that the statistical design of the investigation is inadequate. Similar

analysis has also been made in a number of studies, e.g. Perakis Hedin (2001). We feel that the referee misunderstood our statistical analysis because we presented the result of one-way and two-way ANOVA together in the table 3. We believe that it is possible to distinguish between treatment effects since the same trend of the difference in 15N treatments when calculating at the same site.

2. In addition, it must be noted that correlation between two parameters doesn't point out a causal relationship between these two parameters. Therefore the part controlling actors of the title must be reconsidered. In general the title is not appropriate for this manuscript.

It is clear that soil moisture affected the fate of added 15NO3- and 15NH4+ in this ecosystem (Table 3). In contrast, temperature and SOC did not show a significant effect on the fate of added 15NO3- and 15NH4+, except the effect of temperature on the fate of added 15NO3-. Therefore, we agree that the part controlling factors of the title need to be reconsidered.

3. The relationship N-input and carbon sequestration is demonstrated in work 2 (Xu et al 2004a) in detail, but no new knowledge about this point is presented in the current manuscript.

In our work 2, the relationship N-input and carbon sequestration was made only based on one year scale. In the current study, we provide sound evidence using four year data. We believe that the current manuscript can improve our understanding of the relationship N-input and carbon sequestration in alpine meadows.

4. In my opinion this manuscript should be focused on the unpublished 15N measurements after 4 years. The time course of the pools and their 15N abundance must be analyzed and then calculation of fluxes between the pools can be carried out. This may be confirming the hypothesis that the N-form of nitrogen input is more important on the short time scale then on the long time scale, as described in the abstract.

BGD
4, S1469–S1472, 2007

EGU

We used some published and unpublished data, combining abiotic and biotic factors, mainly to correlate the fate of added 15NO3- and 15NH4+ with these factors over a short term scale. In this study we attempt to show that these factors affected short-term 15N retention patterns while in a long run vegetation and SOC played a great role in N retention. Unfortunately, we didn8217;t clarify this question. In the revised manuscript we try our best to clarify it. We are also ready to present the 15N abundance of different pools.

5. I am assumed that the reconstruction of the measured pools by a mathematical model will be helping us to expand our knowledge of the N-cycles in this ecosystem.

This is really a nice idea, we would like to conceive a mathematic model next step but in this one.

6. I am left with a feeling that this paper contributes little to our real knowledge about the N cycles in this ecosystem and the risk by atmospheric N input. It shows that ammonium and nitrate have different manner in the soil, but that is already commonly accepted8221;

We completely agree that the idea of ammonium and nitrate showing different manner in the soil is already commonly accepted. However, Perakis and Hedin (2001) showed a very similar N pattern of 15NO3- and 15NH4+ in an unpolluted temperate forest over short-term and long-term time scales. In contrast, we know little in this regard in alpine meadows because there have been few reports in alpine grasslands up to date. Hence, we believe that this manuscript can help us improve our understanding N cycles in this ecosystem.

7. I think Figure 1 can be deleted, because the soil moisture is described in general in the text. However, if the soil moisture is available in this high resolution over the full 4 years, then this data seems to be very interesting and should be kept in the manuscript as a figure.

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4, S1469–S1472, 2007

EGU

We will delete this figure in the new edition.

8. Figure 2 and 3. It is more interesting to present the time course of pools and the 15N abundance in the pools than this correlation after 2 weeks (why after 2 weeks and not with the data after 4 or 8 weeks or after 1 or 4 years?)

We calculated the relationship between the fate of added N and impact factors on a short-term scale. In this case, using the data after 2 weeks will be better. If using longer time than 2 weeks, 15N turnover perhaps conceal the relationship between the fate of added N and impact factors. We hope to keep Figure 2 and delete Figure 3 and add new figure of 15N abundance in new edition.

9. P2648 l 26 Soil temperatures must be decreased with increasing altitude, or otherwise the data presented in Table 1 is not consistent with Figure 2

We are sorry for the error. We will correct it.

10. P 2649 L 11-17 This paragraph is a description and no discussion

We used this part as a general description before discussion. We will omit this paragraph in the new edition.

11. P2653 L 10 to 20 There are to many assumptions and no calculation errors. Is this the long term trend? E.g., is the calculation right if the N-loss increases with increasing input over long time? There are a lot of uncertainties in this calculation and therefore this is not acceptable for me in the present form.

When calculating these values, we generally selected a value less than the average. For example, C/N ratio of vegetation and SOC was about 20 and 30, here we only using 15. Therefore, the number we estimated can be as a minimum. Because this calculation was made using a four year scale, it is the long term trend.

Interactive comment on Biogeosciences Discuss., 4, 2641, 2007.