**Biogeosciences
Discussions**

Interactive comment on "Experimental nitrogen, phosphorus, and potassium deposition decreases summer soil temperatures, water contents, and soil CO_2 concentrations in a northern bog" *by* S. Wendel et al.

Anonymous Referee #1

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General comments

It is very interesting to measure soil temperatures, water contents and gaseous CO2 and CH4 concentrations in a long-term fertilization experiment in which after 5 years of nutrient additions vegetation structure has changed drastically. Most fertilization experiments study only the vegetation response, but shifts in species composition or vegetation structure can have important consequences for the microclimate and soil environment, which in turn control biogeochemical processes. This study contributes new data, which are clearly within the scope of Biogeosciences.

Although the data have been collected in an appropriate way, I have many difficulties with the data analyses. It is not clear how most of the statistical analyses have been done. For several soil depths, measurements were done at only 1 replicate plot per treatment. I can understand that it was impossible to have intensive monitoring at all plots, however, also for these soil depths, differences among plots are presented as significant treatment effects! Apparently, there were consistent, but very small (see for example fig. 3 Temp 10 cm or WC 5 cm), differences between one plot of treatment A and one plot of treatment B, which resulted in a significant difference due to the numerous recordings over time. However, such a difference between two plots does not say anything about a treatment effect, it can also be the result of a small difference in topographic position. Testing for treatment effects requires replicate plots. I do not understand how the repeated measures anova could reveal significant treatment effects while, in case of Temp 10 cm, measurements were done at only 1 replicate plot per treatment.

In the discussion the authors give plausible explanations for the observed differences in soil physical parameters. It is clear that the differences among experimental plots are not direct effects of the nutrient additions, but the result of changes in vegetation structure. Why not relate the soil temperature and moisture regimes to vegetation variables as vascular biomass and leaf area index, which seem to be available? There are 18 plots (6 treatments x 3 replicates) with varying Sphagnum cover and vascular plant biomass, which should be sufficient for a regression analysis. Such an analysis would also be more interesting for ecosystem modelers who want to include the indirect effects of climatic changes through changes in vegetation composition/structure on biogeochemical cycling.

Concluding, the obtained data on soil temperature, moisture content and CO2 concentration in a long-term fertilization experiment deserve publication, but not in the way they are presented in this manuscript.

Specific comments

Abstract: It is not clear what you mean with the word interaction, be more specific.

2.2 Instrumentation: At what frequency were the recordings of soil temperature and moisture and the sampling of CO2 and CH4?

2.4 Data analysis: Why is it necessary to correct for autocorrelation? I do not understand how you can test for treatment effects when using the average of the triplicates or using the one replicate available per treatment. It seems like you used the numerous time steps as replicates. This is not how to test for treatment effects. A proper statistical analysis separates for the effects of timestep and treatment, for example timestep as the within-subject factor and nutrient treatment as the between-subject factor. The plots are the subjects.

3 Results: This chapter is poorly written. The results from statistical analyses should be integrated in the sections with temperature and water content results. The results section should describe the main results, not methodological issues as regression coefficients among the triplicates and autocorrelation. Many sentences are not clear.

3.1 Temperature Do you know why control plot b behaved unusual? Was this plot also in other aspects unusual? Or was the R2 of 0.65 (not bad) the only reason to omit control plot b from data analyses? In a field experiment it is normal that plots, also within a treatment, are somewhat different. That is natural variation and that is why often 5 or more replicate plots are needed to test for the effects of treatments.

Table 2: Why is volumetric water content included (as a covariable?) in the analysis of temperature data, and vice versa? Are in this analysis only the treatments Control, 5N, PK, and 5NPK included to test for the interaction between 5N and PK treatments?

Fig. 3: Why only compare to control and not among all treatments as in fig. 5? For such multiple comparisons among treatments usually a Tukey post-hoc test is performed.