

Interactive comment on “Atmospheric N deposition causes carbon balance gains in a seven year field experiment in subalpine grassland” by Matthias Volk et al.

E. Veldkamp (Referee)

evelka@gwdg.de

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In this manuscript the authors report on an replicated experiment conducted on a high elevation alpine grassland in which they test the effects of five N additions (equivalent to 4 (control), 9, 14, 29, and 54 kg N ha⁻¹ yr⁻¹) and three ozone treatments (ambient O₃ control and 1.4 × and 1.7 × ambient concentrations). Treatments were done on soil monolith in split plot design with O₃ treatments at the main plot level and N treatments at the sub-plot level. The authors show that SOC increase strongly in the control monolith which they relate to the change in management (manual cutting instead of grazing). Cumulative yield increase strongly with N additions, but not ozone effects was detected. Cumulative NEP and SOC appeared to increase more at low

C1

N levels (N14) than at higher N levels (N54) although these effects were not significant. The authors suggest that this may be caused by an increase in heterotrophic soil respiration at higher N levels and a lower C input due to a shift in plant C allocation

I think this is an interesting study, however, I think there are some methodological issues that should be addressed so that readers will have a more complete overview. In §2.1 you describe that the monoliths that were manipulated for 7 years were placed in drained plastic boxes. I think it is very likely that this affected the soil water regime of the monoliths and with that indirectly potentially the soil temperature. If you dig out a soil monolith and put it in a plastic box, it is not connected to the soil below through the normal pores. It is quite likely that this will affect the soil water regime of your monoliths. For example, soil water will only drain from your monoliths when water is not held against gravity (i.e. at field capacity) however, if your monolith is not excavated, water will also drain at lower soil water content. Furthermore during very dry period, plants in normal soil may profit from capillary rise of soil water from the subsoil, which is probably not the case in your soil monoliths. Since humid soil is normally cooler than drier soil, especially in spring, these effects may indirectly affect your results on soil temperature. My question is whether you have any information on soil water content or soil temperature in your monoliths in comparison with the normal grassland soil (that is not in plastic boxes)? I would be very interested to see these results, including a discussion whether and how this might have affected your results.

I also noticed that you used 200ml of water to add the nitrogen. Is it possible that this ‘water’ treatment affected some of your results (e.g. the increase in SOC in the control)? Have you calculated how much water you added to your monoliths and does this correspond with a significant increase in water compared to the rainfall?

If I understand it correctly you assumed that there was no change in bulk density (please use bulk density instead of soil density) over the 7 year period. While I understand your reasoning, it is somewhat in contrast with general knowledge because several studies have shown that bulk density depends on SOC levels. I suggest that

C2

you look at some of these studies (maybe you can find one for alpine grasslands) and use as an alternative this relation in your calculation (thus assuming that bulk density decreased with your increasing SOC levels) to see how this may affect your results.

Throughout your manuscript you use the term 'time' effects, but if I saw it correctly you always mean interannual effects. Since 'time' is less specific than 'interannual' , I suggest that you change 'time' effects to 'interannual' effects.

Finally, I think it is not necessary to split you results into 'mini-paragraphs' I suggest no to split your results into different, numbered paragraphs. I also have problems with the discussion of 'strong, yet statistically insignificant effects' and suggest to only discuss effects that are statistically significant. You can probably deal with this by rewording the respective parts of the discussion.

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