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Interactive comment on "Response of carbon dioxide emissions to sheep grazing and nitrogen application in an alpine grassland" *by* Y. M. Gong et al.

Anonymous Referee #2

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This manuscript provides informative and interesting data on grassland management (grazing and N application) effects on ecosystem respiration and its heterotrophic and autotrophic components. However, there are some serious problems with the discussion and conclusions that are drawn from the data that must be addressed. First, and most serious, is that the main conclusions are contradictory and in some cases are not supported by the data. In particular, figures 2, 3, and 4 all indicate that there were no statistically significant effects of either grazing management or N application rate on ecosystem respiration or either of its components. This fact is confirmed in the first sentence of the conclusions (P.12299. L. 20-22), yet later in that same paragraph the authors state "Our observations strongly indicate that grazing exclusion and N addi-

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tion played a critical role in accumulation of soil organic C". How is it possible for the treatments to have no effect on ecosystem respiration but play a critical role in the accumulation of soil organic C, especially when no data were presented on soil organic C to show whether it changed or not? In addition, Figure 5 should be removed from the manuscript. If there are no significant differences among treatments then there is no reason to construct a figure showing percentage change. Another serious problem is with the Discussion section. There is really no discussion presented at all. Instead, additional data on plant cover and biomass, which should have been included in the Results section, are presented along with a reiteration of data previously presented. A proper discussion needs to put the results in context of other published results and provide some explanation of why they matter. This section needs to be completely rewritten. Finally, the authors tend to make broad sweeping statements about grasslands and ecosystems that may be appropriate for the cold, dry grasslands that they work with but do not necessarily apply to all grasslands or ecosystems. They need to be more careful in specifying which grasslands their comments apply to. Specific Comments: P.12288 L.3-4: The range in soil C flux from grasslands is much greater than suggested here. This is one instance where the authors need to be more careful in specifying the type of grassland they are referring to. A more comprehensive summary of ecosystem respiration for all grasslands can be found in Gilmanov et al. Rangeland Ecol Manage 63:16-39 (2010). They show that grassland ecosystem respiration can range from less than 50 to more than 2000 g C/m2/yr. P.12288. L.11-12: Again, this may be true for some grasslands but certainly not for all grasslands (see Skinner Crop Sci 53:1-8 (2013) for an example where soil respiration can be 25% or less of ecosystem respiration in a managed grassland). Be specific as to what type of grassland you are referring to. P.12289. L.10-11: Specify which type of ecosystem you are referring to. P.12290. L.5-7: The authors are ignoring the extensive work on grassland respiration in Europe. If they are only referring to rangelands they need to specifically say so. P.12290. L.20: Chose a better them than "indispensable". "Substantial" might be a better choice. P.12291. L.15-16: Does grazed in a full year mean continuous, year-round

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grazing including the non-growing season? P.12292: Were living plants left intact in the static closed chamber plots? P.12293. L.3: Should read Ra = Re – Rh P.12293. L.14-16: Please identify the sensors that were used to monitor soil temperature and water content. P.12294. L.16-18: Why do you conclude that annual emissions will be underestimated by 6.3% if the non-growing season respiration was 7.1 and 6.4% of growing season respiration? What about respiration during the two months that you did not measure? Are you assuming it was zero? Is that a valid assumption? P.12294-12295: The seasonal totals did not significantly differ among any of the treatments but what about the monthly fluxes? Were there any significant treatment x month interactions? P.12295. L.11 and 18-19: Here is an example of a contradiction. L.11 states there were no significant differences under different N addition rates yet L.18-19 states that ecosystem respiration increased for each N addition rate. When differences are not significant you cannot talk about them as if they are. P.12299. L.9-10: How can you conclude there was a net C sequestration without measuring soil C content? Figure 1c: Change y-axis units from degree C to %. Figures 2, 3, 4: Are the data presented the averages of all measurements taken within a given month? Figure 3a: Why not separate the two growing seasons like you did for Figures 2 and 4? Figure 5: Remove this figure from the paper. Figure 6: Which treatments are included in this figure?

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