We thank the reviewers for their constructive comments and suggestions. We have carefully studied each of these comments and incorporated all of them into this revision. As a result, we believe that the manuscript has been improved considerably. The following is a detailed list of our responses and the changes we have made.

Anonymous Referee #1

General comments

I reviewed the manuscript entitled "Responses of soil respiration to elevated carbon dioxide and nitrogen addition in subtropical forest ecosystems in China" by Deng et al. This is work address an important issue about the combined effects of N deposition and elevated CO2 on soil respiration. The strength of the study is that is unclear how SR will respond to elevated CO2 under high N deposition and this is relevant for ecosystems that are currently receiving high N deposition rates (e.g. subtropical forests ecosystems in China). In general the manuscript is well written but a few grammar corrections are needed throughout the text. Here I list a series of comments that I hope will help the authors improve the manuscript.

Response: We thank this reviewer for the positive comments and constructive suggestions. We have revised the manuscript accordingly.

1- **The title is misleading. This study is based on seedlings planted in 10 chambers with a diameter of 3 m. Thus these chambers do not represent subtropical forests ecosystems in China. I suggest changing the last part of the title to better inform about the experiment and results discussed in this study.**

Response: As suggested by the reviewer, we changed to "young subtropical forests" to reflect this fact. Now the title reads as "Responses of soil respiration to elevated carbon dioxide and nitrogen addition in young subtropical forest ecosystems in China".

2- **The introduction is well written but I would suggest to clearly state: How this study is different from previous studies looking at N and CO2 addition? Why this study is needed for seedlings of native species of subtropical forests in China? I think the key to these questions are in the last paragraph of page 8373.**

Response: In this revision, we emphasized the importance of this study and the uniqueness of this study. Compared to previous studies, this study was conducted in an area with high ambient N deposition. How the increase of [CO_2] would influence soil respiration under a high ambient N deposition in subtropical forests in China remains unclear, and how N deposition and elevated [CO_2] would interactively influence soil respiration in subtropical forests has not been well investigated. In this study, we observed that the stimulatory effect of elevated [CO_2] on soil respiration was maintained throughout the experimental period (Table. 5). This is not consistent with some other reports that which showed that soil respiration gradually declined over time because of the N limitation (e.g., Bernhardt et al., 2006). Due to the high ambient N deposition in southern China, plant growth is not limited by N under elevated [CO_2] in a long term. This may be the reason that the stimulatory effect of elevated [CO_2] on soil respiration might be sustained over time, at least during the current experimental period. (the last paragraph in section 4.3).

3- **The major objective is also misleading. Again the study was not designed to assess the effects of elevated CO2 and N addition on soil respiration in subtropical forests (page 8363 lines 12-13). The study was based on seedlings planted in small chambers and therefore the title, the objective and the discussion should be based on this experimental design to avoid over interpretation of the results. I encourage the authors to revise the manuscript based on their findings and to be careful in over interpreting the results to the ecosystem scale of subtropical forests.**

Response: We revised the objective to eliminate the confusing. The main objective of this study was to assess the individual and interactive effects of elevated [CO_2] and N addition on soil respiration in young subtropical forest ecosystems in China. We understand that due to the facility limitation, it is very difficult to study the tall and mature subtropical forests directly. Compared to other studies, the facility we used in this study was relative large and allowed us to grow young trees over several years. We hope that the results gained in this study could provide some valuable information on the long-term impact of elevated [CO_2] and N addition in subtropical forest ecosystems.

4- **I like how the introduction clearly states what the authors examined (page 8363 lines 17-22). I would like to suggest rephrasing this section as hypotheses supported by a few references. In other words, which were the expectations of the authors before performing the experiment? This is important because in the discussion the authors show that previous studies differ from the present results (e.g. page 8376 line1-5). This is also important to highlight for the overall significance of the study.**

Response: Thanks for the suggestion. Accordingly, we proposed these as hypotheses in the introduction. This part now reads as “We hypothesized that 1) elevated [CO_2] would stimulate soil respiration due to greater soil C input (root biomass and SOM); 2) the stimulatory effect would be sustained over time due to the high ambient N deposition in subtropical China; and 3) the combined effect of elevated [CO_2] and N addition would be greater than the impact of either one alone due to positive interaction.”

5- I think more discussion is needed to explain why the combined effect of N and CO2 increased soil respiration rates. Did the authors expect this a priori? Which are the possible mechanisms that were triggered? This is a study using seedlings. . .are there any differences with previous studies using larger and older plants (e.g. FACE experiments)?

Response: We further discussed the interactive (combined) effects of elevated [CO_2] and N addition on soil respiration and compared our results with some previous studies using FACE in temperate forests (section 4.5, page 14-15). We think that elevated [CO_2] could maintain increasing plant growth and provide more soil C input under N addition (Finzi et al., 2002). The greatest root biomass and SOM were also revealed in the CN treatment at our study sites (Fig. 4), which would lead to the response of soil respiration in the young subtropical forest ecosystems to elevated [CO_2] under high N deposition could be much stronger than under low N deposition.

In addition, soil respiration was gradually suppressed when soil moisture was below 15% (Table. 2). However, decreased soil moisture under N addition was offset by elevated [CO_2]. Soil moisture in the CN treatment was significantly higher than that in the NN treatment (Table. 3), which indicated the effect of N on soil respiration was enhanced by CO_2 treatment, further indicating a strong interactive effect of these two factors on soil respiration.

This may be why the combined effect of these two factors on soil respiration at our study sites was greater than the impact of either one alone. (more details showed in this revision)

Finzi, A.C., DeLucia, E.H., Hamilton, J.G., Richter, D.D., and Schlesinger, W.H.: The nitrogen budget of a pine forest under Free Air CO_2 Enrichment, Oecologia, 132(4), 567–578, 2002.

6- The authors calculated the temperature sensitivity based on Q10 (equation4). However, the authors do not present the error bars, the confidence intervals of these estimates, or any statistical test between treatments. This is important because Q10 values vary from 1.5 to 1.84 and it is possible that the error in this calculation is larger than the reported range. If there are no significant differences (which should be tested in a revised version) I would suggest removing or editing section 4.2 in page 8372. In the current version of the manuscript there is stated that a one-way anova test was used to compare the b values among treatments (page 8369 line 4-5) but I do not see the results of this test that would support the arguments presented in this section 4.2.

Response: In this revision, we added confidence intervals of the Q_{10} estimates (we originally presented the standard errors of Q_{10} in Table 4). In response to the specific comments point 4 below, we recalculated soil temperature sensitivity based on the soil moisture threshold (15%). Since there is no relationship between soil respiration and soil temperature when soil moisture was below 15%, we only calculated temperature sensitivity Q_{10} when soil moisture was larger than 15%. And under this conditions (soil moisture >15%), soil respiration is only influence by soil temperature, not soil moisture. The revised temperature sensitivity (Q_{10}) was 1.87, 1.90, 1.86 and 1.57 in the CN, CC, NN and CK treatments, respectively (Table. 4). While the relative values changed from the previous estimations, the conclusion is still the same: temperature sensitivity (Q_{10}) of soil respiration was significant higher in the CN, CC, NN treatments than that in CK (Table. 4 and Fig. 2). We believed the higher the temperature sensitivity (Q_{10}) of soil respiration was due to the additional substrates of root biomass and SOM (Fig. 4), which would stimulate soil respiration in these treatments.

Specific comments

1- **The seedlings used had ages between 1-2 years (page 8365 line 6). These seedlings were randomly collected but it would be important to test if there were significant differences in the biomass of these seedlings. If a chamber was planted with consistently larger seedling then this pre-treatment condition should be taken into account. This probably can be clarified by a line showing the height or biomass of the seedlings per plot with the respective statistical test.**

Response: We agreed with the reviewer that the initial seedling biomass could influence the results. We tested whether there were significant differences in initial seedling height and basal diameter among treatments, and did not find significant differences among treatments. The results were added in Table 1 in this revision.

2- **Although reporting annual soil respiration calculations are important I would suggest to avoid these estimates for the year 2006. This is important because a treatment could have an effect that is shown in the next year and therefore the response of a variable (i.e. soil respiration) to environmental factors may not be the same for the first year. Maybe a possible test could be a two way ANOVA where the treatment and the year are tested and then the interaction between year*treatment.**

Response: In this revision, we did not try to estimate the whole year's soil respiration in 2006, but only reported the total soil respiration from July to December.

3- **I encourage to report the F values along the P values for all the results in the manuscript. Also I would suggest being careful in the use of the word "interaction" when referring to the treatment with high CO2 and high N. The use of that word when reporting statistical results (e.g. page 8370 luine12-13) is misleading and suggest that the "interaction" was a statistical effect (e.g. as in a two way anova). I am not sure if the authors intended to test a statistical interaction or if they were**

referring to the combined treatment.

Response: We added the F values in the revision. Strictly, the interaction is a statistical term and should be used to describe the interactive effect of two or more variables. We changed the interaction to combined effects when necessary.

4- **The authors state that soil moisture may play a more important role in soil respiration rate as the soil becomes dryer (page 8372 lines7-8). This result has been shown in many other studies and the authors should also explore what happen at the other end of the moisture spectrum. . ..what about the interaction of soil temperature and water? If the idea is to revise interactions I believe that it is important to explore how the combined effect of high CO2 and high N influence the combined effect of soil temperature and soil moisture on soil respiration.**

Response: We did test if there was a significant relationship between soil respiration and soil moisture when soil moisture is high. We found that there was no significant relationship between soil respiration rates and soil moisture when soil moisture was above 15%. Only soil temperature controlled soil respiration under this relative moisture conditions. We also found that there was no relationship between soil respiration and soil temperature when soil moisture was below 15%. Thus, we believed that there was no interaction of soil temperature and water on soil respiration.
We also tried to explore how the combined effect of high CO_2 and high N influence the combined effect of soil temperature and soil moisture on soil respiration. We believed that varied soil moisture due to CO_2 treatment may affect soil respiration response to N addition. At our study sites, soil respiration was gradually suppressed when soil moisture was below 15% at our study sites (Table. 2). We found that soil moisture was significantly reduced by N addition alone (Tables. 2 and 3), particularly in dry season (all below 15%), which also led to reduced soil respiration. But this decreased soil moisture was offset by elevated [CO_2]. As a result, Soil moisture in the CN treatment was significantly higher than that in the NN treatment (Table. 3). Thus, the effect of N on soil respiration was enhanced by CO_2 treatment, further indicating a strong interactive effect of these two factors on soil respiration.
We added these in the section 4.5 of this revision.