We thank the reviewer for her/his very careful reading of the manuscript and the resulting constructive comments! All reviewer comments are in italics, whereas our response/[action] is described in Times New Roman font.

2.2 Materials and Methods

§2.1.1 What do the authors make of the varying estimates in grassland area? Is the digitizing method the most accurate ?

Answer: In China, different research organizations or government departments have different grassland area estimations due to the differences both of the data collection method and the classification criterion. All the data used in this research were published by Chinese government. Although we cannot say it is most accurate, we are confident that these data are the best-quality data published in China now. An intersection of different dataset is a decent way to assimilate datasets from different sources as it can decrease the uncertainty in grassland map dataset and produces the most accurate estimations.. The authors listed various Chinese grassland area estimations in order to show readers some backgrounds of Chinese grassland and show the confused situation in chinese grassland statistic.

§2.1.2 Soil data set: are all the DNDC parameters included in the soil map, and what is their accuracy? Why use only the topsoil data in DNDC (does not the model simulate plant growth and its rooting system, which goes beyond the 10-cm depth) ?

Answer: maximum and minimum soil surface organic carbon content, bulk density, clay fraction and pH are provided by soil map; other soil profile parameters are calculated use those parameters,. More detail about algorithm on Li's papers (Li et al., 1994;Li, 1992). About the soil map's accuracy, we cannot find an explicit accuracy report of it; but it comes from the second national soil survey, this date is the best available and most reliable national soil data now. DNDC assumed that the top 10 cm of soil is chemically uniform and contains most of the organic residues, which would decrease exponentially with depth model under the top 10 cm of soil. Therefore, the model will use 0-10 cm soil properties to initialize the 0-50 cm soil profile, then simulate vegetation growths both above ground and below ground (Li, 1992).

§2.1.3: what about solar radiation data (needed to grow the grass) ?

Answer: DNDC model has taken solar radiation into account, which is a key factor to the vegetation growth.The solar radiation can be inputted as a parameter or be calculated by the model. In this research, day length and day horizontal potential insolation were calculated use algorithm in Swift,1976 and Sellers,1965, respectively.

§2.1.4: using a fixed grazing stock over the whole of China is for sure a Crude assumption. Should be looked into in the uncertainty analysis (and it came out in the sensitivity test).

Answer: The authors strongly agree with review's point. In Chinese natural grassland regions, the rotation grazing method is usually adopted, which requires transferring the livestocks from one pasture to another in different seasons and staying in same pasture during the whole season. For example, in Qinghai-Tibet grassland region, there are three types of pastures, namely spring-winter, summer, and autumn pasture. Every pasture will be grazed in tune. This grassland management was simplified in this research. China as a developing country is rather weak in basic statistical data, we can not find more detail grazing data. So we assumed that livestockss stay in the same pasture whole year with 12 hours grazing time per day and the stocking rates are same throughout the country. Furthermore, we assumed all grasslands are useable. These assumptions could induce some uncertainties in the simulation result. The average grazing rate may be underestimated compare to the real since not all grasslands can be grazed. As Fig3 (d, e) shown, the higher grazing rate is, the more N2O is emitted. The underestimation of stocking rate could underestimate the N2O emission

[The authors add new paragraph to discuss the uncertainty. See 3.5 Uncertainty analysis]

§2.2 Where are the results of the uncertainty analysis on soil C content? Other parameters should be included in the analysis (eg grazing stock rate). The last sentence belongs in validation (2.3)

Answer: The authors accepted suggestion, and add new uncertainties analysis paragraph. This paragraph including SOC, grassland management, and climate induced uncertainties analysis. The last sentence was move to new paragraph.

[See 3.5 uncertainty analysis]

§2.3 The methodology for 'validation' is obscure. How was DNDC parameterized for the 8 test sites in China (based on grid-cell simulations?) What about the other inputs (management, grazing, weather data)? The time scale of the observations (these must have consisted of daily emission rates rather than annual totals)? Simply presenting a regression with annual emissions is not sufficient (especially since some of the model inputs may have been tweaked to reach a good fit). I am still puzzled by the use of the 2 US sites to validate simulations in China. Also, the alpine meadow site in China presented a serious challenge for DNDC, so it was set aside in the validation regression, but the authors do not offer any explanation as to the misfit.

Answer: These 8 test points in China were extract from the simulated national N2O emission map by points' coordinates which were reported in literatures. All the validation points were located in natural grasslands, no fertilizer nor grazing. As there are few researches focusing on the grassland in China in our research period (2000-2007), it's very difficult for the authors to find the field observed data between this period to validate. These eight points almost all published natural grassland N2O emission research data in China now. The authors would like to compare daily simulated data with observed data, but there are no published work provides whole annual daily N2O emission data on the paper, and it's a hard work to collect national scale daily N2O emission data.

The authors strongly agree with review's opinion. It is undeniable that soils in China differ from those in America. The author chose two American points was because these two points are natural grassland without grazing which were similar to China.. In section 2.3, the authors explained the reason of set aside the Du's alpine meadow point in regression. Du's observed values were much higher than that reported by other researchers for montane grasslands in China (Pei et al., 2003, 2004) and that in other countries (Mosier et al., 1993), and were also higher than that from fertilized grassland in Europe (Levy et al., 2007). Du also pointed out, this high emission flux might include the plants N2O emission.

§2.4 and Figure 3: it is easier to interpret the results of the sensitivity analysis when presenting variations relative to a nominal value rather than absolute values (we do not know what the nominal N2O efflux is).
Answer: The suggestion was accepted and the authors had redrawn the Figure 3.
[See Figure 3]

§3.1 to 3.4: no need for separate sub-sections of only a few sentences here, they should be merged. It is not because a model is sensitive to both management and soil/climate factors that it will necessarily provide good projections in relation to climate change (p. 1683, top).
Answer: The authors accepted suggestion and merged the subsection. The sentence was rephrased.

§3.5: what is the basis for the 'ecological zoning' (no reference here)? and for the climatological zoning presented afterward ? What is the spread around the mean values for the 3 zones, and are these means statistically different?
Answer: The 'ecological zoning' and 'ecological climate zone' had the same meaning. These 3 zones were not real vegetation classification system. The reason that we classified 18 types of grassland to 3 zones is to facilitate the results demonstration and to compare with similar grassland in other continental. Therefore, the authors merged the original 18 classes into 3 ecological zones based on the differences among the zones in climate without statistically calculation of their means(China Metrological Administration, 2002). The three zones are named after the most common character on the 18 grassland types. e.g. *Temperate* Meadow Steppe, *Temperate* Steppe, *Temperate* Desert Steppe et.al. for *temperate* grassland.

§3.6: the increase of N2O emissions from grasslands with time (l. 15 p. 1685) is puzzling, given the strong inter-annual variations of N2O emissions. The authors offer climate change as an explanation, which would no doubt be interesting, with maps supporting the increase in temperature and precipitation in the north. Some factorial analysis might be helpful to substantiate that claim (for instance running the model with the same input data except climate for all years). The last sentence hints that some other factors seem to have come into play (eg the area of temperate grassland). The authors should be more specific.
Answer: The authors accepted the suggestion, and rephrased some sentences use more precise words. In the simulation, the only changed factor is climate and other variables keep constant. Although the N2O emission positive trend not statistically significant, we still can

infer climate play important role in the N2O emission process.

§3.7: for sure the hypotheses on nitrification and denitrification activities could be checked by looking at simulated data (l. 3 p. 1686).

Answer: The suggestion was accept, and the authors rephrased the sentence.

[The poor soils and low precipitation can limit N_2O emissions due to the depressed nitrification and denitrification processes.]

§3.7.1: I am not sure it is relevant to compare the montane grasslands of China with subalpine meadows of the US. The climate may be similar but no doubt the soils are not, and DNDC is quite sensitive to soil parameters (among which soil carbon content). The authors should look into that too to make sure their comparison is relevant. The same could be said of European grasslands (which have higher inputs, anyway).

Overall, given that the model was only run on a sample of 8 meteorological years, I am not sure its results may be generalized so far as the overall N2O source strength of grasslands in the world. What are semi-natural grasslands (l. 26 p. 1687) ?

Answer: The authors strongly agree with review's opinion. Neither physical properties nor management was same between China grassland with the U.S.A or European. However, this study is an inventory of N2O emission in Chinese grasslands, the authors would like to show readers some special situations of Chinese grassland. By the comparison of N2O between China and others, readers could know N2O emission rank of China in the world..

Authors agree with review's point. Although eight years simulation results may not generalized enough to calculate world N2O emission, and most grassland in China is natural grassland, which has relatively low emission rates compare to intensive managed grassland in European or other continental, this world scale N2O estimation still provide readers some information about grassland can contributed to the world anthropogenic greenhouse gases emission in case of natural grassland.

Semi-natural grasslands are defined here as grassland ecosystems managed by farmers, who improved grassland artificially through fertilizer, plowing or irrigation et al. In some literatures, it called 'improved grassland'.

What are 'grassland-farming' rotation systems? (l. 6 p. 1688)

Answer: 'grassland-farming' rotation system also called 'forage and crop rotation system'. Under this regime, the field usually planted in the order like this: legume grass-crop-legume grass. It is one of 'improved grasslands'

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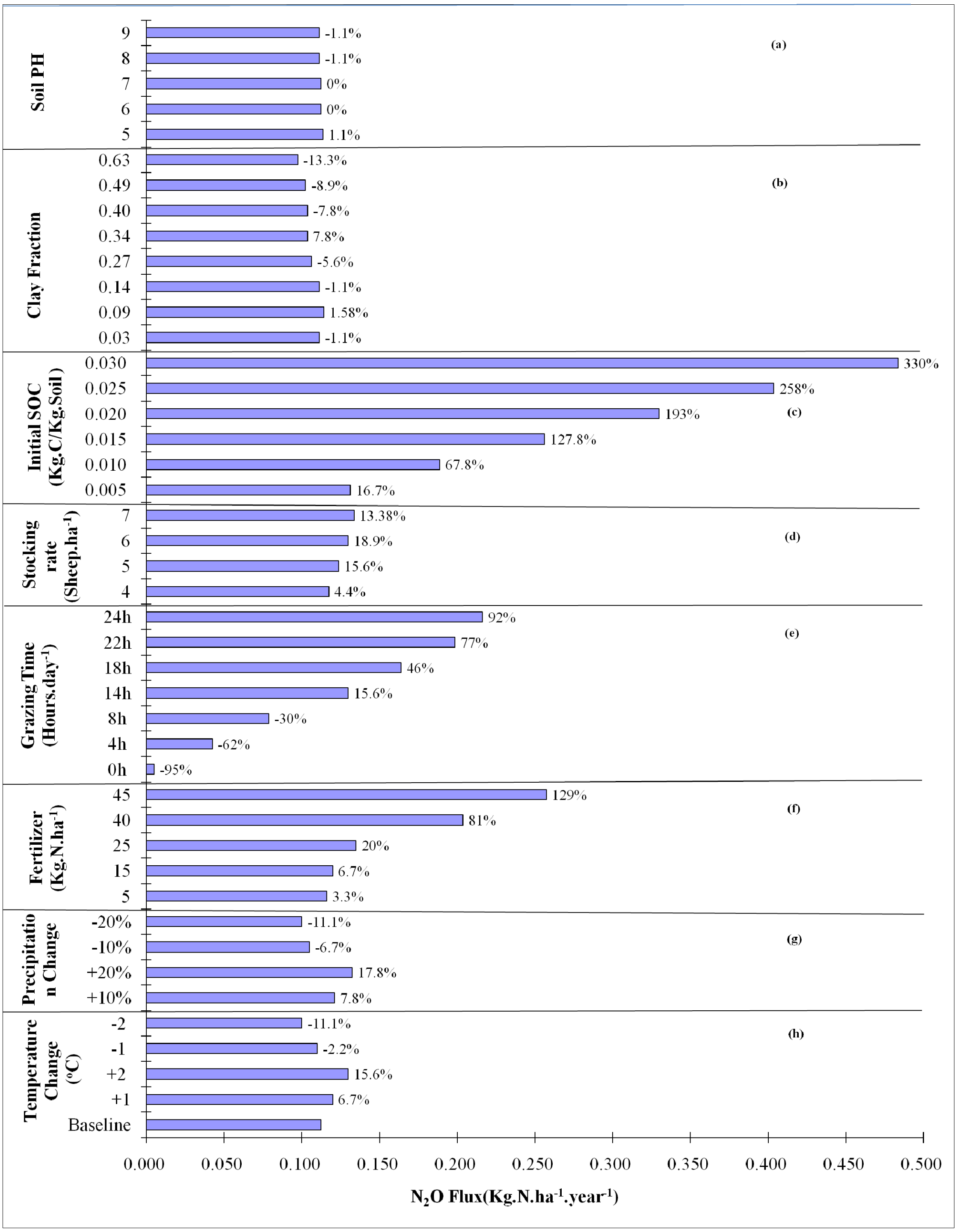
Fig 3 Effect of changing a single factor of soil, management and climate on sensitivity analysis scenario.



3.5 Uncertainty analysis

This study has made great efforts to reduce the uncertainties in the estimation of N_2O inventory, especially in the input data. All input datasets are from official statistical data of China and the national survey in order to simulate as precisely as possible. However, there are still uncertainties

associated with the climate data, grazing and soil data.
As Fig3 shown, climate is a key parameter of DNDC model. In this research, we interpolated precipitation, which produces larger number of rainfall events with less rainfall per event, but the total precipitation is similar with the observed value. This can be source of the uncertainty of simulated results.
In Chinese natural grassland regions, the rotation grazing method is usually adopted, which requires transferring live stocks from one pasture to another in different seasons and staying in same pasture during the whole season. For example, in Qinghai-Tibet grassland region, there are three types of pastures, namely spring-winter, summer, and autumn pasture. In real, every pasture will be grazed in turn according to the seasons. This grassland management, however, was simplified in this research as we could not find any specific data about it. We assumed that live stocks stay in the same pasture whole year with 12 hours grazing time per day and the stocking rates are same throughout the country. Furthermore, we assumed all grasslands are useable. These assumptions could induce some uncertainties in the simulation results. The average stocking density rate may be underestimated compare to the real since not all grasslands usable or be grazed in same time. As Fig3 (d,e) shown, this simplified grazing assumption could induce underestimated N_2O emission.
Accurate soil properties can help to reduce uncertainties. This research, we used the second national soil survey data conducted from 1979-1994 as initial model input value. This value should have some changes since then. As Fig3 shown, soil properties was one of most sensitive factors, the outdate soil value will increase uncertainties.