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Interactive comment on "Modeling impacts of climate change and grazing effects on plant biomass and soil organic carbon in the Qinghai–Tibetan grasslands" *by* Wenjuan Zhang et al.

Anonymous Referee #2

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General comments: This study evaluated responses of grassland ecosystems to both climate change and changes of grazing intensity using a biogeochemical model, DNDC. This topic is important, especially for the region of Qinghai–Tibetan Plateau (QTP), considering that vegetation is sensitive to changes in climate/human management and soil organic carbon (SOC) content is high and potentially easy to loss in this area. This study conducted a regional simulation by coupling the DNDC with a database, and the results provided some useful information regarding future changes of biomass and SOC in QTP. However, I have several concerns about this study. The

first concern is about the model application and the results reported (such as the results in Tables 2, 3 and 4; see the specific points). Detailed introduction regarding how the simulations were implemented and what are the reported values in tables are necessary because these contents are necessary for a correct interpretation. The second concern is the statistical analysis in this study. The authors did some statistical analysis to evaluate the simulations. My general feeling is that the statistical analysis could lead to an over-interpretation for the simulated results (if my understanding is correct). In this study, variations of simulations are totally resulted from changes in input parameters (such as climate condition and grazing density), instead of any random factors or instrument errors. Because the authors changed climate condition/grazing density that resulted in the variations, it is not surprising that the biomass and SOC were affected by climate and grazing intensity. So, the descriptions of 'significant effect' are somewhat over-interpretations for me. I suggest the authors rethink about the statistical analysis. The authors may need to clarify that the statistical analysis is not like the statistical analysis for observations with random factors/errors to avoid over-interpretation. Finally, I noticed some inaccurate descriptions, mistakes, and grammar errors.

Specific points: Line 28: Delete 'future'. And I suggest delete 'Thus', because it looks like there is no any causal relationship in these two sentences. Line 41: Grammar error in this sentence. Line 93: Are these ranges spatial variations or temporal variations of multi-years? Line 121: Delete 'major'. Lines 123-126: This is not an accurate description. For example, NEE is primarily simulated by tracking vegetation growth and SOC decomposition (instead of nitrification, denitrification or fermentation) in DNDC. Line 148: Here 'Table s2' should be 'Table s4'. Lines 167-169: Grammar errors in this sentence. Line 179: Are these parameters in the Table s3 DNDC default values, or you determined these parameters based on local information? Line 181: '... for the DNDC grazing model...' should be '... for simulating grass growth'. Lines 224-226: Here, could you please specify how did you build the climate data from 2015 to 2044? I notice that there don't have biomass fluctuations between 2015 and 2044, so I guess there is no

rainfall fluctuation between 2015 and 2044 (i.e. no dry vs. wet years). Did you use 2014 (or another year) as a 'base', then add temperature and precipitation changes to build climate data from 2015 to 2044. The model's behaviors may be largely regulated by initial or base conditions, so a detailed description on how the climate data were built is necessary. Line 244: '3 replicates' here but '6 replicates' at the Line 141. In addition, it is repeated description of the Lines 140 to 143. Line 263 and Fig 2: Total biomass or above ground biomass? In the 'grassland database', you mentioned that 'above ground biomass' is available for model validation. Lines 269-274: This part should be in the 'M&M' section for me. Lines 289-291: This sentence is general and not informative for summarizing the results of the sensitivity analysis. I suggest delete this sentence. Line 295: Could you please specify the variances in Table 2? Did the variances include both the inter-annual variations during 1985 to 2044 and the variations due to grazing intensity change? Lines 300 and 303: The explanations for Tables 3 and 4 are poor. Please clearly explain what are the values in these tables as this influences a correct interpretation. For example, are the values spatial-temporal means across the regions and years (such as 1985-2014 for 'realistic'), with SE representing spatial variations (or other variations)? If so, it may not be fair comparisons between realistic and RCP scenarios because they have different initial conditions (i.e. 'realistic' has a soil condition in 1985 while 'RCPs' have a soil condition in 2015). And considering SOC is continuously decreasing (Fig. 6), the 'realistic' is probably higher than 'RCPs' no matter what scenarios were simulated. Lines 313 and 322: See the above comments. Lines 326-328: Could you please specify the 'biomass changes' and 'SOC variations'; temporal changes (i.e. middle panels in Figs 5 and 6) or spatial changes across the study region. A clearly explanation is necessary for a correct interpretation. Line 329: 'air temperature is the best predictor factor for biomass and SOC' is confusing. Do you want to say 'air temperature is the factor contributing most of the changes or variations in biomass and SOC'. Line 330: Change 'with' to 'have'. Line 332: Discuss section, the authors reported model test results, but did not provide any discussion. It would be good to provide some discussions for all main results. Lines 339-341: In this sentence,

did you still describe the DNDC simulation results? Could you explain why increased temp or precipitation had a positive effect on biomass (Fig 4) while biomass was decreasing from 2015 under the RCPs with temp and precipitation increases. Line 360: What is the meaning of 'the influence of the grassland vegetation dynamics'? Line 366: Change 'with' to 'and'. Line 375: What is the meaning of 'different increase'? Line 383: Change 'improve' to 'increase'. And is this a reason for the simulated increase or just a general knowledage? Line 384: For me, this section is more like Results, instead of Discussion. Line 404: Rewrite this sentence. Do you want to say 'There may have uncertainties for the simulated results due to input uncertainties'? Line 406: What is the meaning of ' the uncertainty of the projected climate will increase the time span'? Line 409: Consider another word to replace 'incorporate'. Line 413: Did you conduct any sensitivity analysis to test the importance of root/shoot ratio? Or did you find any publications to support this point? Lines 417-420: Grammar errors in this sentence, consider rewriting. Line 420: Change 'data' into 'mechanisms'. Line 431: I suggest delete 'slight' because you did not conduct any analysis to investigate if this uncertainty is 'slight' or not. Line 440: This sentence is not a conclusion; I suggest delete this sentence. Table s3: The unit of 'Milk C fraction' et al. should not be %. Table s4: Are these parameters really DNDC default values? Based on my understanding, DNDC does not specify different types of grassland, such as meadow class, alpine steppe et al.

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