Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2020-396-AC2, 2021

Biogeosciences Discussions
Open Access
EGU

Interactive comment on "Different responses of CO_2, CH_4, and N_2O fluxes to seasonally asymmetric warming in an alpine grassland of Tianshan Mountains" *by* Yanming Gong et al.

Yanming Gong et al.

gongym@ms.xjb.ac.cn

Received and published: 11 January 2021

Anonymous Referee #1 I have reviewed this paper by Gong et al. This study revealed the effect of seasonally asymmetric warming on greenhouse gas fluxes in alpine grassland, and it advances our understanding of warming effects on greenhouse gas fluxes. I think there are a few minor issues that could be improved Before it could be accepted for publication. 1) The authors should focus more on the mechanisms behind the different responses of greenhouse gas fluxes to seasonally asymmetric warming. Response: Thank you for your precise comment. We revised the manuscript. L421-438, "Ecosystem CH4 flux is the net result of CH4 production and consumption occur

Printer-friendly version

Discussion paper

simultaneously under the action of methanogenic archaea and methane-oxidizing bacteria (e.g., Mer and Roger, 2001; Blodau, 2002; Galbally et al., 2008). CH4 fluxes are dependent on temperature, pH, and the availability of substrate (e.g., Moore & Dalva, 1997; Treat et al., 2015). For example, lower levels of soil moisture would decrease C release, indicating that drier soils are the major CH4 sink (Denman et al., 2007). The CH4 uptake observed during the three growing and non-growing seasons implied that the alpine grassland soil could act as an atmospheric CH4 sink, which agrees with the findings of many previous studies in similar region (Li et al., 2015; Wei et al., 2015; Zhao et al., 2017; Wu et al., 2020). As well as, our results demonstrated that warming increased CH4 uptake in the growing season, but decreased CH4 uptake in the non-growing season in the alpine grassland, similar to the results from other grassland ecosystems (Lin et al., 2015; Zhu et al., 2015; Wu et al., 2020). Moreover, a warming-induced soil moisture decrease may be a potential mechanism for the positive influence of warming on soil CH4 uptake in the alpine grassland (Lin et al., 2015). Our results also demonstrated that seasonally asymmetric warming did not significantly affect the response rate of CH4 uptake to temperature increase (Figure 2 d-f, $P > 0.05$)." L441-502, "Unlike CH4 fluxes in alpine grasslands, Treat et al. (2018) confirmed that nongrowing season wetland were small CH4 sources, and uplands varied from CH4 sinks to CH4 sources." L515-518, "As well as N2O emissions was positively related to soil temperature, Pärn et al. (2018) found that N2O emission from organic soils increases with rising soil NO3-, follows a bell-shaped distribution with soil moisture." L512-518, "However, our results displayed emissions peaks of N2O during the freeze–thaw periods (e.g., May 2017, June 2018 and April 2019). Warming increased N2O emissions in the thawing period owning to disrupt the gas diffusion barrier and greater C and N availability for microbial activity (Nyborg et al., 1997). Wagner-Riddle et al. (2017) also confirmed that the magnitude of freeze–thaw-induced N2O emissions was related to the number of days with soil temperatures below 0 oC"

2) There are a few minor things needed to be revised throughout the manuscript. For example, Line 16: "greenhouse gas flux" should be changed to "greenhouse gas

fluxes”; Line 154: ”Figure 2” should be ”Fig. 2” to be consistent with other places. Response: Thank you for your precise comment. Line 16: we revised as “greenhouse gas fluxes”. See L20 of the revised manuscript.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2020-396, 2020.

Printer-friendly version

Discussion paper