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Comment on bg-2021-193

Anonymous Referee #1

Referee comment on "Radiation, soil water content, and temperature effects on carbon cycling in an alpine swamp meadow of the northeastern Qinghai–Tibetan Plateau" by Junqi Wei et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-193-RC1, 2021

Wei et al. reports that "Effects of soil water content on carbon sink strength in an alpine swamp meadow of the northeastern Qinghai-Tibet Plateau". This study investigated the diurnal, seasonal and annual variability of CO2 fluxes and their drivers in an alpine swamp on the northeastern Tibetan Plateau. This helps to more clearly understand the role of alpine swamp in alpine ecosystem carbon (C) cycling in Tibetan Plateau, because alpine swamp cycling in Tibetan Plateau is less focused at regional scale, compared with alpine steppe and alpine meadow. The text is well-written and clear. Nevertheless, I have reservations about the innovation of scientific questions and the reliability of some results that need to be addressed before the publication of this manuscript.

(1) The experimental site is located at Haibei in the northeastern Tibetan Plateau. According to Wei et. al (2021), there are at least six eddy covariance sites at Haibei, including alpine swamp CO2 fluxes monitoring site. Haibei is the most densely distributed area of eddy covariance sites on the Tibetan Plateau. The strength of CO2 sink and its diurnal, seasonal and interannual characteristics in alpine swamp at Haibei have been reported in previous publications, such as Zhao et al. (2005) and Zhao et al. (2010), yet it is also the first objective of this study. Thus, the innovation of the objective is not clear to me.

(2) The main drivers of NEE variation based on the different approaches are contradictory in this study. Net radiation is the leading factor affecting seasonal and annual variability of NEE based on machine learning approach (Fig. 5, Lines 231-250). However, the combined effect of temperature and soil moisture change is the main factor influencing the annual

variation of NEE in Section 4.3 and Table 2. The title of this manuscript only emphasizes the effect of soil moisture. Therefore, there are three different descriptions of the dominant factor of CO2 sink in this manuscript. The mechanism underlying NEE variation needs to be more rigorously analyzed.

(3) A key conclusion of this study is that ecosystem respiration (Re) increases with decreasing soil water content (SWC). This is based on the comparisons of Re and SWC observations in the late growing seasons of 2014 and 2015 (Section 4.1). However, both SWC and Re in the late growing season are largest in 2017 during the observational period (2014-2017) (Figs. 2 and 4). Thus, the conclusion of "Section 4.1 Low soil moisture is associated with enhanced ecosystem respiration" (Lines 262-312) is likely to be unreliable. All observational years (2014, 2015, 2017 and 2018) are recommended to be considered in the analyses, rather than only two years (2014 and 2015).

(4) Another key conclusion of this study is that warming leads to higher C losses rather than enhanced C uptake. This is based on the comparisons of Re and GPP observations in the late growing seasons of 2014 and 2018 (Section 4.2). Warming decreases NEE in late growing season but this does not indicate that warming decreases annual NEE. Recently, Wei et al. (2021) found that "plant uptake of CO2 outpaces losses from permafrost and plant respiration on the Tibetan Plateau" at annual scale based on 32 eddy covariance sites in the Tibetan Plateau. Thus, the authors should more rigorously examine whether warming decreases net C sink of alpine swamp on the Tibetan Plateau.

(5) Line 26, "-168.0 ±-62.5" may should be "-168.0 ± 62.5".

(6) Lines 75-76, "only a few experiments have been conducted to specifically characterise alpine swamp meadow ecosystem C dynamics.", but no study focusing on alpine swamp C cycling is mentioned at here. The previous studies focusing on alpine swamp CO2 fluxes in the Tibetan Plateau are recommended to be mentioned, such as alpine swamp CO2 fluxes observations at Haibei (Zhao et al., 2005, 2010), Shenzha (Qi et al., 2021), Nam Co (Liu et al., 2020), and Huanhaizi (Zhu et al., 2020).

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