

# ***Interactive comment on “Soil fluxes of carbonyl sulfide (COS), carbon monoxide, and carbon dioxide in a boreal forest in southern Finland” by Wu Sun et al.***

**Anonymous Referee #1**

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## General comments:

Gas exchange processes at the atmosphere-soil interface play a key role in regulating both atmospheric chemistry and soil ecosystem. As in this paper, the exchange behaviors of three important gas species including COS, CO, and CO<sub>2</sub> at a representative boreal forest floor are investigated and, their potential implications are further discussed. Under the measured soil temperature and moisture ranges, soil more likely acts as a sink for COS and CO. The effects of biotic and abiotic factors on the uptake/exchange mechanism are usually closely combined under natural conditions and are difficult to be distinguished, unless the soil samples undergo specific pre-treatments (e.g., soil sterilization). The coexistence of both factors makes the analysis of uptake/exchange

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mechanism even more complicated. However, the results proposed in this paper, to some extent, emphasize one important point that, both the biotic processes and the abiotic processes can have crucial influences on gas uptake/exchange and their relative importance depends on the soil conditions.

For clarity of the context of this paper, some more detailed elucidation and several minor corrections are further needed, as shown in the following specific comments and technical corrections.

Specific comments:

Page 2, line 4: "Earth's radiative balance", how do the concentrations and distributions of COS and CO affect the Earth's radiative balance? Please give an explanation for easier understanding. Page 2, line 14: "are geographically separated from the terrestrial sinks of COS" how do the terrestrial sinks of COS affect the COS emissions from the ocean? To what extent the plant and soil can be the sources of COS? Page 3, line 14: "As the uptake of CO and COS is due to microbial activity" the uptake of CO and COS can also be related to physical or chemical processes (abiotic processes), it is better to add "possibly" or "partly" in front of "due to". Page 5, line 1: "air was sampled for 9-10 minutes" what is the gas residence time in the chamber? The sampling time period should be larger than the residence time. What is the chamber outlet position? Please provide more detailed information about the chamber configuration. Page 5, line 15: "To prevent pressure-related flux biases, . . ." according to this sentence, a vent at the top of the chamber exists during the sampling time period, then how to keep the mass balance inside the chamber, please give a further explanation while interpreting the Eq. (1) (Page 5, line 24). Page 24: For Figure 6, why the flux ratios come to a plateau at higher temperature bins? Does this ratio to some extent reflect the relative effects between biotic and abiotic processes in COS/CO fluxes? Please give explanations about the meanings/implications of the flux ratios.

Technical corrections:

Page 2, line 4: Please add “the” before “Earth’s radiative balance”. Page 2, line 17: Please change “over” to “from”. Page 2, line 30: It seems that the sentence “These phenomena have presented . . .” needs to be further edited as it reads awkwardly. Page 3, line 15: Please re-edit this part of “as CO and COS are consumption processes” to make it more clear to be understood. Page 4, line 1: What does “(ibid)” mean? Page 6, line 15: Please change “in” to “of”. Page 7, line 7: Please add “, respectively.” after “SC2”.

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