

Interactive
Comment

***Interactive comment on “Soil atmosphere
exchange of Carbonyl Sulfide (COS) regulated by
diffusivity depending on water-filled pore space”
by H. Van Diest and J. Kesselmeier***

Anonymous Referee #1

Received and published: 23 October 2007

The paper presents laboratory soil chamber measurements of carbonyl sulfide uptake in relation to a range of temperatures and water contents. Chemical and physical properties of the soils were also measured. Four soil samples were used: three arable soils (Germany, China, Finland) and one forest soil (Siberia). A parabolic relationship was found between COS deposition and the following parameters: water content, water filled pore space (WFPS), and temperature. A linear relationship was found between COS deposition and bulk density. The discussion considered the results in relation to the role of biological and physical uptake of COS by soils. The authors suggest a larger role for diffusivity, as parameterized by WFPS, in estimating global COS soil uptake than previously thought. The data is novel, the results are relevant to Biogeosciences,

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

and the methods are clearly outlined. The experiments are relevant to significant biogeochemical science questions given the uncertain fluxes in the global COS budget (an overestimation of sinks or underestimation of sources).

Specific Comments

1) It seems crucial that the maximum observed uptake is four times the value observed in Kesselmeier et al. (1999) for soils from the same site and that there is no known explanation for this. The authors seems to neglect the importance of this uncertainty. Is this because the maximum uptake is not important in extrapolating laboratory results to regional/global budgets. Is this is the case please say so. If not please address the following. If we don't know why the maximum uptakes are off by a factor of 4, then what does this say about our ability to predict soil uptake? Furthermore, what is a possible way forward in determining why the results are off by a factor of four (e.g. studying inter-site variability, time variability, other factors).

2) Page7 The present study reports a comparison of the maximum uptake rates with Kesselmeier et al. (1999). Would it also be important to provide a general comparison of the magnitude of the uptake rates (not just the maximum uptake rates)?

3) Page9 "The experimental results obtained in this study have confirmed, in agreement with others, that soil is a significant sink for COS."; I don't see how the results of this paper or the discussion of the results indicate that soil is a significant sink for COS. To make this conclusion, the paper would need to apply the lab measurements to estimate a global soil sink. That global sink estimate would need to be significant relative to other sources and sinks. A similar statement is made in the abstract, "All investigated soils acted as significant sinks for COS."

4) This studies references past studies that report a large underestimation of the net surface flux of COS in current budget (either due to underestimation of sources or overestimation of sinks). Do your results suggest an overestimation of soil sinks?

5) I assume that these laboratory measurements are being done because they are useful in predicting regional/global soil sinks or in interpreting regional/global measurements. Please explain briefly in the introduction or discussion. How have these experimental measurements been useful in the past (extrapolation, model parameters) or how should they be made useful in the future to estimate global and regional soil sinks?

6) "a much more distinct optimum was found at a soil WC around 11.5 " Both Fig1 and Fig2 seem to have a distinct optimum. I think what you are trying to indicate is that the peak in Fig2 is narrower than the peak in Fig1. This narrowness doesn't make the optimum any more distinct. Maybe there is some other significance of the narrowness worth reporting here.

7) Is the variability between sites really between sites or would this variability exist within a single location? At a given site, were samples taken from a single grab or were samples composited from multiple grabs? Does the comparison with Kesselmeier et al. 1999 suggest variability within a site or over time? The paper indicates over time but its not clear how you ruled out the possibility of variability within a site.

8) What are the values for the reference concentration (c_{ref}) and the dry weight (dw)?

9) It would be nice to see the Kesselmeier et al. (1999) results also plotted on Fig1.

10) Might be helpful to have another row in Table 1 with general site description (e.g. arable, sandy, boreal,). This seems important later in the paper when the sites are compared by temperature and the importance of boreal vs. Germany is suggested.

11) Page7 showed maximum uptake rates which were roughly a factor of 4 higher than those from 1999, but with optimal exchange rates at similar soil WC It seems that exchange rate and uptake rate are used here to both refer to the same data (y-axis of fig1). If they mean the same thing in this sentence then for clarity, please use the same word. And similarly use just one of these words for clarity throughout the paper (text,

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

figures, tables, captions).

12) Could you compare the temperature and water content ranges tested in the laboratory compare with the seasonal temperature and water contents typical of each of the soils in the field?

13) Page10: "All four soils followed a similar exchange pattern. The uptake increased with temperature up to an optimal range, followed by a sharp decrease at higher temperatures." This shown in Fig3 for the German soil. The lowest temperature has the highest deposition.

Interactive comment on Biogeosciences Discuss., 4, 3701, 2007.

BGD

4, S1678–S1681, 2007

Interactive
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper