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Discussions

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Interactive comment on "A new mechanistic framework to predict OCS fluxes from soils" *by* J. Ogée et al.

Anonymous Referee #3

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Summary:

This manuscript presents a rigorous and much needed framework for modeling OCS fluxes in soils. This contribution will aid in the re-analysis of existing data sets and will prompt new experimental undertakings to clarify processes that Ogee et al identify as data poor.

Comments:

- The discussion of diffusivity terms that go into the final model could be clarified. How does one determine the input values for D in eqn 15? The rational for moving forward with D (eqn 15) depending only on dispersive and not effective diffusion could be discussed in more detail. Situations where one would use the dispersion flux instead

of the diffusive flux and vice versa could be explained. Relatedly, in p. 15698 l. 21: values or example values for the terms going equations 7a and 7b would help facilitate model utilization (i.e., longitudinal dynamic dispersivities (alpha), dispersive diffusivities (D_{disp}), velocity fields (q)) as these values are used in expression 15. Similarly, p. 15713 l. 21, which diffusive terms were used if dispersion fluxes were neglected?

- p. 15698 l. 8: details on the measurements used to test the model would be useful to include (e.g. measurement time, zmax, repacking) that are relevant to the assumptions made in the model description (e.g., neglecting advective fluxes). This could be done in Sec 3.5.

- p. 15700 l. 16: The kcat and Km may not only be spatially averaged at the organism level, but also the microbial community or population level.

- The production model includes drivers of emissions that are not tested in this study. Is there any way to assess the proposed model with extant data in terms of the temperature or Eh sensitivity? Production assumed to be zero in model tests, although agricultural soils have been found to have large emission components. Can the value of Q10 be estimated?

- p. 15709 section 3.4 on sensitivity to soil pH could use a summarizing sentence to tie it all together.

- p. 15711: Regarding the discussion of possible impacts of the treatment of soils over the long period that the temperature and moisture responses were measured. The soil microbial community and its activity could have very likely changed by these treatments, and a citation could be included to point to a case where the the size and diversity of the microbial population would be sensitive to this. As this is a pivotal part of the data interpretation, e.g., how can such large changes in fCA be justified, the justification might be made more quantitative. This could be done by indicating which measurements were made within a short time period versus those that were separated by long periods. In addition, it could be noted which measurements were done at the

same site, but using soils from a different time of sampling. If the differences in fCA are aligned with soil age or different samples, it could strengthen the argument.

Minor comments:

- p. 15692 l. 25: KH off by factor of 100?

- p. 15695 l. 1: what is meant by "binary" diffusivity.

- p. 15696 l. 16: the wording in this sentence is a bit unclear. Was the value of D0,a derived from these values (diffusivity of water vapor in air, CO2/OCS diffusivity, etc...)? Or are those provided as justification for why the D0,a is reasonable? Using "derived from" if the former is the case would clarify.

- p. 15698 l. 23: do you mean "plane" instead of "plan"?

- p. 15699 l. 3: what is meant by "drift velocity"?

- p. 15700 l. 17: "limitation" instead of "limination"

- p. 15700 l. 22: values illustrating the point that OCS uptake is not limited by diffusion could be given in the sentence, as they were in the previous sentence to prove the point.

- p. 15703 l. 10: "oxidants" instead of "oxydants"

- p. 15710 l. 13: the terminology "almost exactly" could be changed, especially since there were differences in some of the data-model fit for soil moisture responses, eg Fig 12, and the summary of goodness of fit could be more descriptive.

- throughout: Should cite "Van Diest" and not "VanDiest"?

- p. 15712 l. 27: It's not clear to me that OCS emissions are the result of enzymatic processes. They could be abiotic, right?

- p. 15712 l. 7: I think it's fair to assume this CA concentration in microbial cells, but I would note that the same concentrations do not necessarily need to be maintained in

microbes with different metabolisms that might require very different levels of CA. The examples of known CA concentrations seem to all come from phototrophs.

- p. 15715 l. 20: "could have greatly" instead of "could greatly"

- all figures: There appears to be a black outline on all text in the figures (even on black text) that makes the text look grainy. This also contributes to making the text highly compressed and difficult to read in figures 9-12. Perhaps removing the outline or changing the fonts would help.

- figure 5 caption: It would be easier to read this sentence if it were converted to a serial list instead of the "respectively" framework: Soil column depth is also converted into soil weight assuming a soil surface area of 165.1 cm2 and a soil bulk density and pH of 0.85 kg m3 and 7.2, respectively, to be comparable with the experimental setup used in Kesselmeier et al. (1999) to derive the observed response curve.