

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

Anonymous Referee #2

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Review of Ogée et al, “A new mechanistic framework to predict OCS fluxes from soils”

General comments: Overall, this paper, and the model framework it describes, represents a significant advance in our theoretical understanding of soil-atmosphere OCS fluxes. The derivation of the model is thorough and well thought out, and the sensitivity tests give a good sense of the model behavior. The ability of the model to reproduce (qualitatively, if not quantitatively) a wide range of laboratory and field results, including both net production and consumption of OCS, is impressive. Without a doubt, this should be published in BG.

That said, there are a few issues that need to be dealt with first:

1. Considering that you say “For this study we thus consider that Eh is the primary

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driver of OCS production, independently of pH:” and that “The soil redox potential (E_h) is a very dynamic variable that is not easily measured in the field ...”, there does not seem to be proportionate attention paid to E_h in the Discussion and Perspectives regarding how to make progress with its specification in the future. For example, no sensitivity tests regarding V_d and E_h seem to have been performed.

2. In the same vein, what is the prognosis for specifying f_{CA} in ‘real-world’ applications of the model? That is, while f_{CA} was tuned to give good matches with laboratory data, how would one choose values of CA to apply the model at regional (or global) scales? Fig. 6 shows a substantial difference between f_{CA}=10,000 and f_{CA}=100,000, which (more or less) bounds the range of plausible f_{CA} values.

3. [Minor] Given that the paper title includes the word ‘flux’, deposition velocity is used extensively. Wouldn’t it be better to convert the observed V_d values to fluxes to conform to the derived theory? For both (1) and (2) please suggest a way forward and also indicate how these uncertainties might manifest themselves under various conditions.

Specific comments:

p 88, l2: ‘is’ to ‘are’

p 88, l27: ‘evoked’ to ‘invoked’

p 89, l25: ‘interconverted’ to ‘converted’

p 90 l20: ‘with also’ to ‘but with’

p92 l2: ‘specificity’ is not clear to me; could this be replaced with ‘rate constant’?

p92 l9: For symmetry with other subscripts, could you use ‘C_a’ instead of ‘C’?

p92 l18: to be consistent with earlier notation, change K_{sw} to K_{sl}.

p92 l2: ‘was’ to ‘is’

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p93 I4: not sure here what is meant by 'organic'. OCS is certainly not an organic compound.

p93 I12: Sentence starting with "However": if these relationships are not applicable to OCS, then why discuss? Also note here and elsewhere that 'However', 'Interestingly', etc. should generally be followed by a comma when starting a sentence.

P93 I17: 'rather large' is a bit vague. Can you be more specific?

P93 I23: 'reaction occurs and continuously remove' to 'reactions occur and continuously remove'

P94 I6: in eq 1, consider using C_a instead of C.

P94 I7: I'm a bit confused here. In the definition of eps_{tot} , why is the third term included if you earlier say "In the following we will neglect adsorption of OCS on solid surfaces..."

P95 I17: strike 'Camindu'

P98 I3: Incidentally 'a change in the air composition...' is going to be overwhelmingly dominated by water vapour fluctuations.

P98 I16: 'a diffusive' to 'diffusive'

P98 I23: 'plan' to 'plane'

P100 I7: more efficient to say 'low concentrations of OCS'

P100 I24: insert comma after 'reaction'

P101 I3: earlier 'S' is used for sink; here S_d is completely different. Could you substitute a different letter (Greek?)

P101 I16: 'monotic decrease function' to 'monotonically decreasing function'

P103 I10: 'oxydants' to 'oxidants'

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P104 I4: when saying 'uniform' do you mean 'horizontally uniform'?

P106 I15: make the RHSs of theta formulations consistent so they are easy to compare. I would define all as $\theta_{opt} = 0.xx \cdot \phi$.

P105 I26: comma after 'In contrast'

P108 I4: would it be clearer to add 'by observations' after 'constrained'?

P108 I8: 'direction' to 'directions'

P109 I15: 'really' is vague. Perhaps replace with 'measurably' or say that the impact on V_d is (e.g.) only a 1% change.

P109 I22: It's not clear to me what justifies setting the source term to zero. Couldn't V_d being positive just be the result of larger uptake than production fluxes?

P110 I4: be consistent about soil moisture units (cm^3/cm^3 vs. m^3/m^3)

P111 I7: insert semicolon after 'dry' or change 'this' to 'which'.

P111 I24: 'CA's' to 'CAs' (apply 's only to possessives)

P112 I6: insert 'which is' before 'of the order...'

P112 I11: please provide a citation for the microbial population size.

P112 I14: change 'Any' to 'With any'

P112 I18: It's not clear to me whether identical CA enzymes apply to CO_2 and OCS. Thus, is this test valid?

P113 I3: Consider striking 'at least' given that the following discussion gives reasons to think that f_{CA} values may indeed be reasonable.

P114 I7: On p110 I8, '12% of soil weight' is used, but here the 12% is a volumetric ratio. Am I missing something?

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P115 I18: 'by a factor of two at least', but as mentioned earlier, you also argue that CA contents could well be realistic.

Figures:

2. insert 'normalized' after 'Response of the'?
3. In Figs 3, 4, 6, 7, 8, change 'thick line in left panel' to 'right panel'
5. Could you overplot the data that the dotted line is fit to?

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