

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 E_h 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 l4: not sure here what is meant by 'organic'. OCS is certainly not an organic compound.

p93 l12: 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 l17: 'rather large' is a bit vague. Can you be more specific?

P93 l23: 'reaction occurs and continuously remove' to 'reactions occur and continuously remove'

P94 l6: in eq 1, consider using C_a instead of C .

P94 l7: 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 l17: strike 'Camindu'

P98 l3: Incidentally 'a change in the air composition...' is going to be overwhelmingly dominated by water vapour fluctuations.

P98 l16: 'a diffusive' to 'diffusive'

P98 l23: 'plan' to 'plane'

P100 l7: more efficient to say 'low concentrations of OCS'

P100 l24: insert comma after 'reaction'

P101 l3: earlier 'S' is used for sink; here S_d is completely different. Could you substitute a different letter (Greek?)

P101 l16: 'monotic decrease function' to 'monotonically decreasing function'

P103 l10: 'oxydants' to 'oxidants'

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P104 l4: when saying 'uniform' do you mean 'horizontally uniform'?

P106 l15: make the RHSs of theta formulations consistent so they are easy to compare. I would define all as $\theta_{\text{opt}} = 0.xx \cdot \phi$.

P105 l26: comma after 'In contrast'

P108 l4: would it be clearer to add 'by observations' after 'constrained'?

P108 l8: 'direction' to 'directions'

P109 l15: 'really' is vague. Perhaps replace with 'measurably' or say that the impact on V_d is (e.g.) only a 1% change.

P109 l22: 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 l4: be consistent about soil moisture units (cm^3/cm^3 vs. m^3/m^3)

P111 l7: insert semicolon after 'dry' or change 'this' to 'which'.

P111 l24: 'CA's' to 'CAs' (apply 's only to possessives)

P112 l6: insert 'which is' before 'of the order...'

P112 l11: please provide a citation for the microbial population size.

P112 l14: change 'Any' to 'With any'

P112 l18: It's not clear to me whether identical CA enzymes apply to CO_2 and OCS. Thus, is this test valid?

P113 l3: Consider striking 'at least' given that the following discussion gives reasons to think that f_{CA} values may indeed be reasonable.

P114 l7: On p110 l8, '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?

Interactive comment on Biogeosciences Discuss., 12, 15687, 2015.