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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A new model of the global biogeochemical cycle of carbonyl sulfide – Part 2: Use of ocs to constrain gross primary productivity of current vegetation models" *by* T. Launois et al.

Anonymous Referee #2

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Launois et al. present a modeling framework that evaluates the gross primary production (GPP) from three vegetation models (LPJ, NCAR-CLM4 and ORCHIDEE) using atmospheric OCS. The surface fluxes of OCS are optimized using an inversion system that optimizes the scaling factors for various fluxes within prescribed uncertainties. Furthermore, a series of sensitivity tests have been performed to study the influences of the model setup on the simulated results, and the amplitude and the phase of the seasonal cycle of OCS and other features are discussed. As GPP cannot be directly measured at a large scale, a number of methods have been utilized to estimate GPP,

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e.g. eddy covariance, fluorescence, isotopes, and OCS, which are all, to a certain extend, promising but have limiting factors. Specifically, the use of OCS is limited by our understanding of the correlation between the uptake of OCS and the gross uptake of CO2, and of the other OCS budget terms. Furthermore, the transport uncertainty also plays an important role in such studies. It is therefore necessary to take into account the abovementioned uncertainties in the evaluations and interpretations of the GPP estimates.

General remarks:

1) As the LRU from Seibt et al. (2010) with a global average value of 2.8 is in the upper range of estimates discussed in section 2.1.2 and section 4.1.1, wouldn't it make more sense to allow the scaling parameter kplant_uptake to vary more in the lower range than in the upper range? Actually the mean values of LRU from Berkelhammer et al. (2013) and Stimler et al. (2012) differ more than 30% from the value of 2.8. Lowering the LRU would have a significant impact on the optimized fluxes.

2) The plant uptake and the net soil uptake of OCS are collocated sinks. Can the authors specify what differences have caused the inversion system to scale the plant uptake vs. the soil uptake? It is alarming to see that both the soil uptake and the plant uptake of OCS are reduced to the lower limit (30%) for the LPJ and the ORC models in section 3.3.2. It may indicate that both are still overestimated in the optimized fluxes.

3) Given the coarse spatial resolution (3.75degree x 2.5degree) of the model, it is true that the representation errors for sites in the Northern Hemisphere should be larger than for those in the Southern Hemisphere, as defined in section 2.4.3. However, I wonder whether the value of 26 ppt for the Northern Hemisphere is too large. It is 5% of the annual mean value, however, is up to 15-20 % of the seasonal amplitude. This may be also part of the reason why the annual mean differences in the Northern Hemisphere sites are larger than those in the Southern Hemisphere shown in Figure 10?

ACPD
14, C12213–C12215, 2015

Detailed remarks:

P27670, L1: removing “during photosynthesis”. The hydrolysis of OCS is expected inside the leaf, but independent of the photosynthesis process. P27670, L10: what does DGVMs stand for? P27671, L2-3: Where do the ambient concentrations of OCS and CO2 come from? P27672, L12: replacing “soil water content” with “the fraction of water filled pore space” P27678, L21: “range and uncertainty of -30/+50%” means the variation range from -30% to +50%? And what is the prior uncertainty? P27679, L9: how are the forward model errors estimated? P27680, L9: “EDGARD-v4.1” → “EDGAR-v4.1” P27681, L3: “Table 3” → “Table 1” P27682, L24: “Table 1” → “Table 2” P27687: the section of 3.2.1 should be shortened or be removed. It is so obvious that unbalanced fluxes lead to annual trend in the simulations, isn’t it? P27727, Figure 10. What does the sentence mean? “Note that the global mean for each mixing ratio series has been set to the global mean of the observations”. P27728, Figure 11. The axis labels are hard to read. An increase of the font size will be helpful.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 27663, 2014.