We thank the editor for his notes on the manuscript which with help the clarity of the text to the readers, and provide hereafter the suggestions to meet the required changes.

The page numbers are now included in the resubmitted manuscript.

*** Abstract: "The abstract should clearly state the limitations of your study."**

We added the following sentences (in bold) to the abstract which now reads as :

"Clear analogies between carbonyl sulfide (OCS) and carbon dioxide (CO_2) diffusion pathways through leaves have been revealed by experimental studies with plant uptake playing an important role for the atmospheric budget of both species. Here we use atmospheric OCS to evaluate the gross primary production (GPP) of three dynamic global vegetation models (LPJ, NCAR-CLM4 and ORCHIDEE). Vegetation uptake of OCS is modeled as a linear function of GPP and leaf relative uptake (LRU), the ratio of OCS to CO_2 deposition velocities of plants. New parameterizations for the non-photosynthetic sinks (oxic soils, atmospheric oxidation) and biogenic sources (oceans and anoxic soils) of OCS are also provided. Despite new large oceanic emissions, global OCS budgets created with each vegetation model show exceeding sinks by several hundreds of GgS yr^{-1}. An inversion of the surface fluxes (optimization of a global scalar which accounts for flux uncertainties) led to balanced OCS global budgets, as atmospheric measurements suggest, mainly by drastic reduction (up to -50%) in soil and vegetation uptakes**.**

The amplitude of variations in atmospheric OCS mixing ratios is mainly dictated by the vegetation sink over the Northern Hemisphere. This allows for bias recognition in the GPP representations of the three selected models. Main bias patterns are i) the terrestrial GPP of ORCHIDEE at high Northern latitudes is currently over-estimated, ii) the seasonal variations of the GPP are out of phase in the NCAR-CLM4 model, showing a maximum carbon uptake too early in spring in the northernmost ecosystems, iii) the overall amplitude of the seasonal variations of GPP in NCAR-CLM4 is too small, and iv) for the LPJ model, the GPP is slightly out of phase for northernmost ecosystems and the respiration fluxes might be too large in summer in the Northern Hemisphere. **These results rely on the robustness of the OCS modeling framework and in particular the choice of the LRU values (assumed constant in time) and the parameterization of soil OCS uptake with small seasonal variations. Refined optimization with regional-scale and seasonally varying coefficients might help to test some of these hypothesis.** "

*** " 'new parameterizations' is not correct for all of the sources you mention"**

We agree with the editor and we have change the text:

New parameterizations for the non-photosynthetic sinks (oxic soils, atmospheric oxidation) and biogenic sources (oceans and anoxic soils) of OCS are also provided." now reads as "New parameterizations for the non-photosynthetic sinks (oxic soils, atmospheric oxidation) and biogenic sources of OCS (oceans) are also provided. Revised inventory-based estimates for OCS sources (anoxic soils) are also used in the present paper."

OCS leaf uptake

*** Line 13: but in your approach, you use a global constant kLRU ?**

As described in the method section, "kLRU is the leaf relative uptake of OCS compared to CO2 [...] and defined for different plant functional type. K LRU is species- specific […]."

In the present study, we did not consider kLRU as a global constant. On the contrary, each PFT was attributed a LRU value. Then, based on "a map combining Köppen-Geiger climate zones with phenology-type from satellite land-cover data provided by the MODIS instrument" we "determined the major plant functional type for each pixel (Poulter et al., 2011, Kottek et al., 2006)." (appendix A.2).

Therefore, for each grid cell, we have attributed the leading PFT with thus a corresponding LRU value. "The resulting global mask of kLRU was then used to scale the GPP from the three DGVMs to obtain three different global seasonal OCS uptake fluxes by plants."

k_{plant_uptake} *is a global constant, not kLRU, which potentially changes for each grid cell.*

*We thus only change the text to reflect that Kplant_uptake is global coefficient. We added the word "global" in the sentence: "*We also added a global scaling parameter, k_{plant_uptake}, to further … »

** Equation 3: underlines were modified to now match the description below the equation*

2.3 model used

Why do you choose only the period 2006- 2009 for the models?

The TRENDY models were available on 2000-2010 period. Some observation sites only started recording OCS concentrations in 2004. The graphs were shown on 2007-2009 only, although the simulations cover a longer period (2005-2009), because the objective is only to show the mean seasonal cycle and the mean trend. For all figures, the x-axis was correct, it might just be misleading that the extreme right side states "2010" while it represents the 31th of December 2009.

For the optimization, they were conducted using the extended 2004-2009 period.

Why is the landcover fixed ?

The present paper compares modeled and observed annual OCS budgets at only a small set of atmospheric stations and for a relatively short period, thus focusing on the global OCS budget, the mean seasonal cycle and the mean trend., Landcover changes will not significantly change the GPP and thus will contribute only little to the mean OCS trend and mean seasonal cycle. Moreover, we only had access for the three selected models to a simulation with fixed landcover.
However, we acknowledge that this is a relevant question and we thus added a little complement to the text:
« We took the simulated values over the period 2006-2009 where the models were run with the

same 11 climate forcing, variable atmospheric CO2 concentrations and fixed land cover (as a first order analysis) »

Table1/Table2/Table3: The tables are not correctly referenced in the text. In most of the cases, references to Table 1 actually should refer to Table 2. Please check.

This has been corrected

Oxic soil uptake of OCS (page11)

Line16: you might want to add "regional distribution" and the single sensitivity experiments.

Changing the H2 flux might also slightly change the regional distribution, thus, the suggested complement was implemented in the text.

Plant uptake of OCS:

'**seasonal cycle peaks' → "seasonal cycle shows a distinct peak"**

This has been corrected

"**see figure A3" : I can't find this in the figure**

see Fig. A3 for integrated values over latitudinal bands of the Northern Hemisphere: the figure clearly illustrates the large differences in amplitudebetween the models (by up to a factor 2) but the phase differences are less pronounced. The text was therefore adapted and we added "especially in terms of amplitude and to a small extend in terms of phase of the seasonal cycle"

differences between the GPPs are significant: did you check for the significance ?

This sentence has been rephrased and now reads as : "Differences between the GPP of the three models are large, especially in terms of phase (2month-shift) and amplitude of the seasonal variations (60%, at global scale)"

3.2 annual trends

Figure 3 shows only STD-ORC

This paragraph only deals with trend tests, and is only illustrated using simulations based on the GPP from Kettle and STD-ORC.

Figure5: the smoothing procedure should move from the appendix into the main text.

The corresponding method has been moved back into the method section, in the paragraph dealing with "data processing and analysis"

Also, the figures showing smoothed results have to clearly state that the data was transformed (not in the last sentence, please). The same applies for the normalisation in figure 7.

*The smoothing of the curves is now explicitely described once in the "**Data processing and analysis**" paragraph, before the graphs are commented The description of the normalisation used in figure 7 has also been moved to the beginning of the caption.*

Figure5 compared three different simulations, not four.

This has been corrected in the text, and the use of Kettle was explicitely changed to a call on his inventory-based sources and sinks of OCS.

" **and cancelling out" : please rephrase**

This part of the sentence, which might have been misleading, is now skipped.

4.1. Atmospheric trend

... are likely what ? Too large/small ?

The sentence has been completed : **"This suggests that LRUs provided by Seibt et al. (2010) are likely too large."**

Figure11: what is the line in the last 2 rows for ?

The horizontal solid line represents the observed value. This has been added to the caption of the figure.

Phase and amplitude of atmospheric seasonal cycle

Line15: 7 is not correct . The unit is also not ppt but ppp/year*2

The typo (it was 70, not 7) and the unit have been corrected.

Figure 12: what are filled and open symbols ?

This corresponds to the prior/post comparison. This has been explicitely re-stated in the caption too for clarity.

LPJ model/Line14: How are the differences coherent ? Please detail this out

The expression "coherence of the deficiency" could be misleading, and it has now been replaced with "The results obtained for the combined OCS-based and CO_2-based analyses are coherent between the three models. For instance, the decrease of ORC GPP for temperate and high latitude ecosystems or the phase-shift of CLM4CN GPP would bring the different GPP estimates close together." The reason why is provided in the next sentence (both OCS-based and CO_2-based analyses would tell that an improvement of "ORC" simulations are possible

with a reduction of the GPP in the high latitude (NH) and that an improvement of "CLM4CN" and "LPJ" simulations are achievable with a shift of the phase of the GPP throughout the year.

Line 20.: 1--> 2.

This has been corrected

Your single points on the limitations are they listed according to the importance ? I'd rank them differently

The order (1,2,3 → 3,2,1) has been inversed, so that the limitations are now ordered by impact on the optimization scheme (thus, talking resp. about the limitation imposed by uncertainties on the LRU values, then the uncertainties about the phasing of the OCS-air soil exchange, then the uncertainties about the transport model).

Achnowledgements: I guess you want to tahnk Samuel Levis. Were the CLM4 simulations not part of TRENDY ?

The typo has been corrected as indeed it is Samuel Levis.

Yes the CLM4 simulations were also part of TRENDY but Samuel Levis had not time to contribute to the study and only asked for acknowledgements for having provided his TRENDY simulation.

The new affiliation of Thomas Launois is now also indicated (as a thank for INRA for the time spent under the new contract to finish publishing the present study)