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Atmospheric Chemistry and Physics Discussions

Interactive comment on “Multi-species inversion of CH_4, CO and H_2 emissions from surface measurements” *by* I. Pison et al.

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Fig. 1: As stated before, the SACS scheme is not well described. For example: is OH prescribed or calculated interactively (if yes, how?)? What are the values of the j- and k- constants? How are VOCs included?
We will add the description of SACS in the text as stated above. j-, OH and the production of HCHO due to VOCs are taken from a forward simulation with the full chemical mechanism INCA.
Fig. 1: The caption says that all variables in italics are optimized. Does this mean that VOCs are optimized?
It is not VOC concentrations that are optimized but the chemical production of HCHO due to VOCs: this term is optimized through the use of a scaling factor for each column as described in answer to the question on P20690, L16-20.

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Is deposition optimized for H2 (and how?), but not for MCF?
The deposition velocity is not optimized but the deposited mass is modified by the optimization since it is proportional to the velocity (fixed) and the concentration (optimized). For MCF, there is no deposition in our system, this will be deleted in the Figure.
How is OH optimized? As a 3-D field or with a general scaling factor? And with which temporal resolution?
As stated in answer to the question on P20690, L16-20, OH concentrations are optimized with a scaling factor for the average column in four latitudinal bands at the same 8-day temporal resolution as the emission fluxes.

Fig. 2: Was the standard deviation based on (instantaneous) tracer distributions at the end of January 2004? Or on monthly means? The latter would not be fair, concentrations from the beginning of the month (which are the same because of the initialization) would be mixed into the statistics.
The instantaneous distributions were used, not means.
Fig. 2: The differences between INCA and SACS are very large for CH2O. How can this be explained? Would this be a problem if CH2O observations were added in later studies?
The two chemical schemes mainly differ in terms of VOC chemistry. Since HCHO is a short-lived species that reacts with many of these compounds, it is not surprising that the largest differences between the two chemical schemes are found for this species. This may be limiting when exploiting HCHO observations.
Fig. 2: From the text I got the impression that OH is fixed in SACS. But then the MCF differences between INCA and SACS should be zero, which is not the case. Thus, please provide more details on how OH is treated in SACS?
For a simple direct simulation, the OH fields of SACS come from a full INCA simulation indeed. But in INCA, OH does not react only with MCF: many other compounds 'compete' with MCF for OH radicals whereas they are not present in SACS. Therefore, with the same OH concentrations and MCF emissions, different

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MCF concentrations can be obtained.

Fig. 4: Why are values for slopes and correlation coefficients so different from Table 2? This is confusing.
This is because the figure and the table do not contain the same information: in Table 2, the values are the median of the various indicators computed for each station (which gives information on the performances of the model at the points of constraint) whereas this Figure gives an overview of what happens for all the measurements in the same big sample. We couldn't really find a better way to make this easy to read.

Fig. 5c: Is panel c ok? The large grey area, extending even over the oceans, seems like an error.
The Figure is OK, the grey area over the oceans is due to the small fluxes of CO emitted by the oceans: since they are slightly modified by the inversion, they appear here.
Fig. 5a and c: Increases in emissions by more than a factor 20 on a pixel basis (and 229% over a big region) are extremely large. I wonder what prior errors settings have been used to accommodate emission increments of this magnitude.
We will give a better description of the error settings as answer to the question for P20694, L10-14: "[. . .]the errors are then set to 100% of the maximal flux over the inversion period for CO and CH_4 [. . .]".

Fig. 6: What is the meaning of white?
White stands for a modification of fluxes by less than one percent. This should be clearer on the new Figure, here `http://www-lsceorchidee.cea.fr/ACPD/acpd-2008-0504-f06bis.eps`**.**

Fig. 7: Why not make this figure in color, like all the others? This would improve clarity. Also, I recommend adding a panel with a similar plot for CO emissions.
We have a color version of this Figure, we will put it in the place of the black and

white one. For CO, we will add Figure "07bis" (`http://www-lsceorchidee.cea.fr/ACPD/acpd-2008-0504-f07bis.eps`**) as stated in answer to the question on P20700, L10-21.**

Fig. 8: Replace '2-D-' and '3-D-mobile' by 'ship' and 'aircraft', and explain what the colors mean.
This will be changed.

Fig. 9: It is more logical to plot bias and standard deviation, since these constitute two independent components of the error. I suspect the authors have avoided to plot the bias, since the bias appears to have increased significantly at ORL.
What we wanted to show here was the impact on the variability, here `http://www-lsceorchidee.cea.fr/ACPD/acpd-2008-0504-f09bis.eps` **is the figure with bias and standard deviation instead of standard deviation and RMS. It shows that the bias near the surface is decreased in ORL, as expected, but that it is increased in the free troposphere.**

Fig. 9: Why are the profiles so different between the two stations? I.e.: why is the correspondence between model and observations near the surface so much better in ORL than in HNG?
These two locations are interesting to compare because they are very different. We will add the following information: "The two sites are very different: ORL is under rather marine influence most of the time whereas HNG is a continental site i.e. under the influence of industrial and natural sources. It is known that the forward models are less accurate in continental sites than in 'oceanic' ones because of the influence of the multiple types of sources that is to be taken into account (Geels et al. 2007)."

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 20687, 2008.

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