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Atmospheric Chemistry and Physics Discussions

Interactive comment on "C_3-C_5 alkanes in the atmosphere: concentration, seasonal cycle and contribution to the atmospheric budgets of acetone and acetaldehyde" *by* A. Pozzer et al.

A. Pozzer et al.

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We thank the anonymous Referee 1 for the comments.

We understand the concerns of the referee and we will improve the scientific conclusion of this study in the revised manuscript, especially with a more detailed description of the relative importance of C_3-C_5 alkanes on the budget of acetone and acetaldehyde. Moreover, we will add more figures for the observation-to-model comparison. Finally, we will add the figures for all available measurements in comparison to the model simulation to the electronic supplement, in order to avoid a drastic increase in the paper size.

Specific comments:

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1. We agree that some confusion arises from the usage of different versions of the same database. Whereas EDGAR v2.0 contains an emission estimate for the year 1990 for different non methane volatile compounds (NMVC), like butanes and pentanes, in EDGAR v3.2, only the total amount of emissions of NMVC is given. Therefore, an a priori speciation is required to assess the butanes and pentanes emissions. We hence decided to use version 2 which already includes such speciation.

2. Unfortunately, we cannot conclude which emission inventories are better (the one used in this study, or the one used in Jacob et al 2002). However, we pointed out that we do not totally agree with the conclusion of Jacob et al 2002, who obtained a net underestimation of these tracers in the NH using the EDGAR v2.0 database. This is a new result contradicting a previous study. We also concluded that the EDGAR v2.0 database gives reasonable (or somewhat overestimated) results for C_3-C_5 alkanes (except for iso-pentanes), when used in a chemistry climate model. This is also a new result.

3. We agree with the referee: The OH concentration is very important for a correct simulation of NMVC. However, Joeckel et al. (2006) performed a detailed evaluation of the model, including an evaluation of the simulated OH abundance. In summary, OH compares very well with that of other models of similar complexity. Compared to Spivakovsky et al.(2000), EMAC OH shows slightly higher values in the lower troposphere and lower values in the upper troposphere. We refer to Jöckel et al. (2006) for any further detail.

4. We will move the section in the revised version as suggested.

5. As mentioned to referee 2, only a portion of the available data has been shown to allow a statistically robust analysis. We will however include more figures to give a complete overview of the model-observation comparison.

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6. We tried to find observations which could confirm (or not) the presence of such a "peak" at $\sim$30°S. The measurements available (for Autumn and Spring at this latitude) strongly suggest that the presence of such a pattern is a model artifact. However, because we were not able to find observations at these location during winter which confirm without any doubt such a pattern, we cannot rule out its presence.

7. We think that the emissions are responsible for this overestimation. As pointed out previously (see 3.), OH is reasonably reproduced by the model and we can rule out any large influence of these alkanes on the OH photochemistry.

8. In figure 9, the model results (represented by black triangles) are well below the observations and nearly zero. The same in figure 10, where the simulated iso-pentane mixing ratios are zero during summer. As the referee mentioned, this is due to the very short lifetime and relatively large distance from the sources. At the same time, only during the south hemisphere winter, due to the longer lifetime iso-pentane shows maximum mixing ratios close to 5 $\mathrm{pmol/mol}$. As described in the paper, the values observed should be taken with care, due to the fact that C_3-C_5 alkanes are close to the instrument detection limit.

9. We completely agree that the acetone production by C_3-C_5 alkanes cannot explain the observations (which we never claimed). Moreover (see also the reply to the referee 2), still many components for a complete budget of acetone are missing, like oceanic emission/deposition. Figures showing the comparisons with measurements in the SH are also available, although the difference from the previous study (see Pozzer et al. 2007, figure 23, where 3 SH locations are shown) and this study is almost negligible (see fig.12, SH) . We do not pretend to explain completely the acetone observations, but rather show that the inclusion of these oxidation processes improved the simulation S1 (which did not included C_4-C_5 alkanes chemistry) with respect to acetone.

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