

Interactive comment on “C₃-C₅ 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.

Received and published: 11 March 2009

We thank the anonymous referee 2 for the constructive comments.

First of all we completely agree that only a subset of the available data has been shown in the paper. We have two comments to clarify this point:

- The observations were compared to results from a global atmospheric chemistry general circulation model, which has a rather low resolution. Hence, we tried to capture the overall patterns of C₃–C₅ alkanes by comparing the model with monthly averages of the data.
- The measurements collected from the 40 stations are not homogeneously dis-

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper



[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

tributed. The data distribution in time and space is quite patchy, rendering a statistically sound comparison with all the stations difficult. In some months, for example, data from less than 20 stations are available. As further example, for Ochsenkopf, Germany (code: OXK) only 2 values (as monthly averages) are available throughout the simulated years (2005-2006).

Therefore, in the zonal figures only 24 stations are plotted. In fact, in December 2005 (this month is chosen, because of the strong South-North gradient of alkanes), measurements from only 24 stations are available. At the same time, the comparison with only 8 stations is shown, because at these stations a more complete series of data for all simulated years are available. These stations are further representative for the respective latitude. In summary, we included stations with the most complete observations for all months and therefore provide the overall picture of the seasonal variations of the considered species. A manuscript is in preparation with a complete detailed description of the measurements. The interested researchers should contact Detlev Helmig at Detlev.Helmig@colorado.edu for the availability of the data. We will add this information into the revised version of the manuscript.

Regarding fig.2, we agree that the winter maximum is not correctly captured by the model. One possible explanation is that no inter-annual variation in the emissions is present. Meteorology (i.e., the model dynamics) is the only inter-annual difference in the model. This implies that the model is most likely reproducing the same seasonal pattern every year.

We completely agree that chemistry is important for C_3 – C_5 gases. However we want to point out that for C_3 – C_5 alkanes, the main source of uncertainties is related to the emissions (strength and distribution). The reaction rate between C_3 – C_5 alkanes and OH is well constrained (see Atkinson 2003, and references therein), compared to the uncertainty of emissions. Nevertheless, we completely agree that this is not true for all C_3 – C_5 tracers. As the referee mentioned, for acetone, chemistry plays an important

role which is not completely understood. In this paper, we showed that the reactions of the peroxy radicals (formed from C_3 – C_5 iso-alkanes through reaction with OH) with HO_2 and/or CH_3O_2 can enhance the production of acetone from C_4 – C_5 iso-alkanes. We will reformulate and clarify this point in the revised manuscript. We agree that the use of the “new” quantum yield for acetone is necessary for future research in this direction. It has also been implemented in the EMAC model. However, we wanted to compare the model results including the C_3 – C_5 alkanes chemistry, with an evaluated reference simulation, for which the “new” quantum yield had not been considered. Hence we were forced to conduct our experiments with a standard set-up, which did not include the findings of Blitz et al.. Yet, we performed already a sensitivity study with the “new”; quantum yield with the EMAC model. Please refer to Pozzer et. al, 2007 for further details.

Regarding the differences between acetone in the study of Jacob et al. (2002) and our study, we have to mention that no oceanic emissions have been taken into account here. These emissions account for 30% of the total acetone emissions in the study of Jacob et al. Due to the relative long lifetime of acetone (up to 3 months), an increase of acetone throughout the troposphere is expected, even in the upper troposphere region, especially in the tropics over the ocean.

Regarding the role of Cl and NO_3 , we have pointed out above that monthly averages of the measurements have been used in the comparison. The influence of Cl strongly depends on the dynamics (e.g., the height of the planetary boundary layer) and hence it is highly variable. For a correct analysis of the Cl effect on the C_3 – C_5 alkanes, hence, observations of a higher frequency are required. Nevertheless, we agree that the alkanes mixing ratios at Alert (Canada) can be affected by Cl reactions during certain periods. This can have an effect on the measured mixing ratios, although this cannot be deduced from our monthly averaged measurements.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 1939, 2009.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)