Atmos. Chem. Phys. Discuss., 7, S1410–S1414, 2007
www.atmos-chem-phys-discuss.net/7/S1410/2007/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Isoprene and monoterpene fluxes from Central Amazonian rainforest inferred from tower-based and airborne measurements, and implications on theatmospheric chemistry and the local carbon budget" *by* U. Kuhn et al.

U. Kuhn et al.

Received and published: 25 April 2007

We like to thank reviewer #2 for his positive evaluations and helpful comments. Our responses to specific comments are listed below:

RC #2: "As far as I can read from the text the tower based measurements were not conducted simultaneously to the airborne measurements. If so, it is not easy to compare the results obtained from the MGL approach with those obtained from the tower based measurements. There may have been variations of VOC fluxes from day to

day. These would not have been detectable and cause the discrepancies between the results. This possibility should be mentioned."

AC: we now clarify in chapter 3.3.6: "It has to be noted that the tower-based measurements were conducted in the week after the airborne measurement campaign, which also might have contributed to the bias of results. However, the weather conditions were similar in both measurement periods, and only the respective daytime hours of the flights (10:00-12:00 and 16:00-18:00 LT) were selected for tower-based VOC fluxes shown in the comparison (Fig. 10)."

RC #2: "Adhering rigidly to kinetic laws, equations 8 and 9 are not correct because the yields of MVK and MACR are different for isoprene + OH and isoprene + ozone reactions, respectively. In order to avoid confusion for a reader I suggest to either write both equations exactly or to give both as approximations which include only OH reactions."

AC: now equations 8 and 9 are completed for the different yields of MVK and MACR in the isoprene + OH and isoprene + ozone reaction shown in chapter 3.3.5.

RC #2: "The results from the GC-FID and GC-MS measurements differed by a factor of approximately 2. The fits were conducted using GC-FID data but without really knowing whether these GC-FID data are correct or the GC-MS data. There are some apparent questions that should be answered: Is the mentioned uncertainty of concentration measurements considered in the uncertainty given for OH concentrations? If not, what would be the result of the fits if the concentrations measured with the GCFID would be multiplied by 0.55 i.e. assuming the GC-MS data to be correct? Would the use of such lower concentrations lead to non significant differences between the estimates from the fits and previous model predictions or are the uncertainties in concentration measurements not propagated linearly since concentration ratios are used for the fits?"

AC: in chapter 3.3.5 we now added more info on the influence of our input data, i.e., the uncertainty on NOx conditions and on the VOC concentration data (GC-FID versus GC-

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MS) as: “Assuming NOx free conditions, generating altered yields of MVK and MACR from isoprene reaction with OH (yMVK,OH = 0.15 and yMACR,OH = 0.18; Ruppert and Becker, 2000), an even higher best guess OH concentration of about 7.5 x 10ˆ6 molecules cm-3 is calculated. Likewise, a best estimate OH radical concentration of about 9.8 x 10ˆ6 molecules cm-3 is achieved by using the numbers for isoprene, MVK and MACR measured by the GC-MS system (two flights).”

RC #2: “Page 650 line 5: the letter “i” is missing.”

AC: couldn’t find any typo there.

RC #2: “The net CO2 uptake of the Amazon Basin is compared to the VOC emission from the global tropical forest. This comparison should be made for the same area.”

AC: we now give the respective numbers as: “The VOC carbon flux scaled up to the total area of Amazon tropical forest is one order of magnitude lower, but is assumed to be one-directional, i.e., only net emission occurs. Extrapolation of the integrated mean daily totals of emissions observed by REA (SLG), assuming similar conditions and a total forested area of 68.9 x 10ˆ5 km2 in the Amazon (Botta et al., 2002), the source strength sums up to 35.8 (68.6) Tg C a-1 for isoprene and 5.9 (8.4) Tg C a-1 for the sum of monoterpenes, which together comprises about 21% (39%) of the long-term mean modelled CO2 sink.”

RC #2: “This is different for the airborne data within the CBL, where the chemical production is smaller and the compounds are exposed to atmospheric chemistry for longer time periods.” This sentence is not easy to understand. If compounds are exposed to atmospheric chemistry for longer time periods the chemical production of the products should be higher. This sentence needs rephrasing.”

AC: now rephrased (see above) as: “Close to the canopy top the production of MVK and MACR is supposed to be largest (due to high isoprene mixing ratios) and the influence of further oxidation is small. Also the mean velocity shear is largest in this

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surface layer, with the largest turbulence kinetic energy; hence here the smallest chemical modification occurs. This is different for the airborne data within the CBL, where the chemical production of MVK and MACR is smaller (due to lower isoprene mixing ratios) and the compounds are subject to chemical degradation for longer time periods." Further details of this issue were given on page 664 line 26 to page 665 line 4.

RC #2: "These values are very consistent with the relationship of Ĕ" I suggest to delete the word "very".

AC: deleted.

RC #2: "The sentence " In spite of a good representation of the simulated isoprene flux, the SCM model analysis on the absolute mixing ratios of these compounds indicates that a state of-the-art atmospheric chemistry model might simulate appropriate vertical profiles of the (MVK+MACR)/ISO, but for the wrong reasons, i.e. too high mixing ratios of the respective compounds." I do not understand this sentence. I believe that it is intended to state that multiplying nominator and denominator of a ratio with a similar factor does not change the number drastically. If so, I suggest to exchange the word "respective" by the word "all".

AC: the word "respective" now exchanged by the word "all".

RC #2: "The chapter conclusions is more a summary than a conclusion. I suggest to change the heading to "Summary and conclusions".

AC: changed accordingly.

RC #2: "Figure 13: Please delete "[ppb]" at the x-axis."

AC: now [ppb] is deleted in Fig. 13.

The additional references now used in the paper are:: Dreyfus, G.B., Schade, G.W., and Goldstein, A.H.: Observational constraints on the contribution of isoprene oxidation to ozone production on the western slope of the Sierra Nevada, California, Journal of

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Table 2: numbers of Lloyd et al. (2007) now adjusted to most recent status.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 641, 2007.