

Interactive comment on “Acetone-CO enhancement ratios in the upper troposphere based on 7 years of CARIBIC data: New insights and estimates of regional acetone fluxes” by Garlich Fischbeck et al.

Anonymous Referee #1

Received and published: 22 September 2016

Review of doi:10.5194/acp-2016-799

Overview: This paper provides an analysis of acetone-co enhancement ratios observed by IAGOS-CARIBIC flights over the periods 2006-2008 and 2012-2105. A subset of within-plume observations is used along with trajectories to derive emission fluxes, and these observationally based emission fluxes are compared to emission inventories for North America and Southeast Asia. Overall this is a very well written paper with very high quality figures. I recommend the paper for publication in ACP, but encourage the authors to address a few minor things.

C1

Page 8, Line 9: Fischer et al. [2012] and Jacob et al. [2002] include acetone production from higher alkanes (C4 –C5) in addition to propane. The contribution from C4 – C5 alkanes is not negligible, it is on the order of 20% of the contribution from propane.

Page 8, Line 13: It is worth noting that there is a relatively large range of yields reported in the literature for acetone from alpha- and beta- pinene. The yields that were chosen here are on the high end of the ranges. There are published yields for limonene, sabinene, myrcene, delta-3-carene, and ocimene as well. I am not sure if this matters, but perhaps it is worth discussing. See the following references:

Carrasco, N., M. T. Rayez, J. C. Rayez, and J. F. Doussin (2006), Experimental and theoretical study of the reaction of OH radical with sabinene, *Phys Chem Chem Phys*, 8(27), 3211-3217.

Lee, A., A. H. Goldstein, M. D. Keywood, S. Gao, V. Varutbangkul, R. Bahreini, N. L. Ng, R. C. Flagan, and J. H. Seinfeld (2006), Gas-phase products and secondary aerosol yields from the ozonolysis of ten different terpenes, *Journal of Geophysical Research*, 111(D7).

Orlando, J. J., B. Nozière, G. S. Tyndall, G. E. Orzechowska, S. E. Paulson, and Y. Rudich (2000), Product studies of the OH- and ozone-initiated oxidation of some monoterpenes, *Journal of Geophysical Research*, 105(D9), 11561. Reissell, A. (2002), Products of the OH radical- and O₃-initiated reactions of myrcene and ocimene, *Journal of Geophysical Research*, 107(D12).

Reissell, A., C. Harry, S. M. Aschmann, R. Atkinson, and J. Arey (1999), Formation of acetone from the OH radical- and O₃-initiated reactions of a series of monoterpenes, *Journal of Geophysical Research*, 104(D11), 13869.

Vinckier, C., F. Compernelle, A. M. Saleh, N. Van Hoof, and I. Van Hees (1998), Product yields of the alpha-pinene reaction with hydroxyl radicals and the implication on the global emission of trace compounds in the atmosphere., *Fresenius environmental*

C2

bulletin, 7(5-6), 361-368.

Wisthaler, A., N. R. Jensen, R. Winterhalter, W. Lindinger, and J. Hjorth (2001), Measurements of acetone and other gas phase product yields from the OH-initiated oxidation of terpenes by proton-transfer-reaction mass spectrometry (PTR-MS), *Atmospheric Environment*, 35, 6181-6191.

Page 13, Lines 5 – 14: Significantly more detail is required here with respect to how the trajectories were used to classify the samples. Did the trajectories simply have to pass through the box for one hour, or the entire trajectory? Was there any altitude requirement. What percentage of the data was classified as linked to one of the four regions? Similarly, the number of measurements (or groups of measurements, i.e. events) associated with each box mean and box plot shown in Figure 8 should be provided with the figure.

Page 14, line 11: How sensitive are the results to choice of a 10 ppb CO enhancement as the cutoff for analysis?

Overall: Do the authors see any differences in the enhancement ratio between the early data 2006 – 2008 and the later data 2012-2015? The emissions of light alkanes over North America are hypothesized to have been growing over this time period, and I am curious as to whether there is a change in the acetone EnRs.

I found only one minor wording fix: Pg 2, line 21: change “remained” to “continues to be”

Interactive comment on *Atmos. Chem. Phys. Discuss.*, doi:10.5194/acp-2016-799, 2016.