Atmos. Chem. Phys. Discuss., 11, C12605–C12608, 2011
www.atmos-chem-phys-discuss.net/11/C12605/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of the deep convection of isoprene and other reactive trace species on radicals and ozone in the upper troposphere" *by* E. C. Apel et al.

Anonymous Referee #2

Received and published: 1 December 2011

General Comments

The manuscript by Apel et al. presents a detailed chemical analysis for two deep convection events that occurred during flights over Canada in July 2008 as part of the NASA ARCTAS aircraft campaign. During several events, isoprene (very short lived) and its oxidation products were detected above 8 km in altitude at levels of hundreds of pptv. This alone is a noteworthy finding; however, a comparison between events which did and did not have lightning produced NOx allowed for an evaluation of how this influenced the upper tropospheric chemistry in the presents of highly reactive trace gases, such as isoprene, and what it's impact was on HOx chemistry. Overall, the

paper is well written, easy to follow and should be accepted for publication in ACP after addressing the minor issues listed below.

Specific Comments

p27245,L4: (OVOC) should be (OVOCs)

p27246,L8: 15 yr should be 15 yrs (plural)

p27254,L6: this is a personal preference, but I don't like the use of "conspire" in this case – makes it seem like something corrupt or fraudulent is going on during the convective events. Maybe replace it simply with something like "combine".

p27254,L21-23: I would suggest including some sort of letter or number to emphasize the important aspects of the photochemical aging discussion, for example:

"This equation holds when 1) no fresh emissions of A are introduced during the trajectory for which the lifetime is calculated, 2) there are no direct emissions of the daughter reaction product, B, and 3) there are no losses via wet or dry deposition."

p27256,L1-3: Please revise the following – it reads awkward and seems repetitive: "Also, MVK and MACR have larger deposition velocities than isoprene and, according to a recent paper by Karl et al. (2010), indeed have surprisingly high deposition velocities."

p27257,L5: I would insert "(Fig. 4b)" after "trace": "A closer look at the NOx trace (Fig. 4b) reveals. . ."

p27258,L1: Please revise this sentence and try to make a cleaner transition – reading from the previous paragraph to this one was very abrupt.

p27258,Sect3.3: I'm not sure if this is feasible, but for completeness and sequential continuity, it might be useful/insightful to include a comparable analysis for event 1.

p27258,L23-25: revise to something like:

ACPD

11, C12605–C12608, 2011

The approach taken here is to mimic, in a simplified way, this convection event by "injecting" a reasonable estimate of NOx (1500 pptv) and boundary layer isoprene

p27259,L8-10: Regarding the following:

"The results indicate that the convection is more rapid than predicted by the photochemical lifetime and are consistent with an approximate time of one hour but with a fair amount of uncertainty."

It is difficult to delineate between the two cases - maybe also include a difference plot or something that can clarify this point. Also, is this purely qualitative by visual inspection or could you include mixing ratios at the crossing points to further highlight this point. Possibly include a supplementary table as SI or something similar to Fig 7.

p27261,L22-29: Regarding the following discussion, 1) offset the axis – can't see the gray trace, 2) re-scale the y-axis for a clear presentation.

"In the absence of isoprene injection (gray trace), the model shows very low mixing ratios of MVK, MACR, and MGLY, since these products result only from isoprene oxidation. The third panel down shows formaldehyde. The pulse of isoprene results in a modest increase of formaldehyde. The gray trace shows that formaldehyde is present in the absence of isoprene because it results from the oxidation of many VOCs. There is a significant impact on the OH radical resulting from scavenging by the high isoprene levels, as shown by the difference between the black and gray traces."

p27262,L7-9: Please revise the following:

"Recall from the actual event 1 that when the air mass was intercepted by the DC-8, the ratio had already switched in favor of higher reaction products relative to isoprene indicating an aged air-mass."

p27262,L21: replace "reacting" with "oxidized"

p27262,L25-25: please revise the following portion of the sentence to be more concise:

ACPD

11, C12605–C12608, 2011

". . .principally because formaldehyde results from reactions further down the isoprene oxidation sequence."

p27263: There is an overuse of "result" – please revise accordingly.

Figure 3: Can you highlight the events with a color band so the are more pronounced visually?

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 27243, 2011.