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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Sources and transport of $\triangle^{14}$C on CO_2 within the Mexico City Basin and vicinity" *by* S. A. Vay et al.

Anonymous Referee #2

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Vay et al. present 14C-CO2 measurements from the DC8 aircraft during MILAGRO. Values are generally more enriched than expected from the large amount of fossil fuel combustion in the area around Mexico City (MC), and the manuscript is devoted to exploring possible reasons for this.

The measurements are certainly an interesting and unique dataset, though the analysis could be improved. I recommend the paper for publication, if the authors can satisfactorily address the following points.

General comments. ———————-

The authors need to provide compelling evidence that isotopic fractionation during handling has not biased the data, especially since the canisters seem to have been ana-

lyzed for VOCs first.

In places the writing and analysis seem perfunctory, lacking in detail and in careful presentation. Some examples are given in the "Specific Comments" below.

More background and thoughtful discussion of previous work would be useful, especially in Section 1.

In Section 2.3, it would be helpful to have some discussion of the 14C sampling strategy. Which canisters were targeted for 14C analysis and why?

Please discuss in the paper why you consider 57o/oo, based on higher latitude measurements, to be an appropriate "background" value for $\sim$19degN. How much uncertainty do you expect in this value? Should it really be treated as a hard upper limit for no significant fossil contribution? (or rather, for fossil contributions being masked)?

Conclusions – "... show the complexity of radiocarbon cycling in the megacity environment ... " Please discuss why you feel your findings are something unique to megacities. Would the same apply to any large city with diverse sources of air pollution?

Conclusions – A question. "... and indicate adding detailed simultaneous measurements of other chemical tracers to the isotopic marker 14C are highly desirable..." To turn that point around, given the difficulty and expense of the measurement, the limited coverage, and (as you argue) the difficulty in clear interpretation, would you argue that the 14C measurements provide significant value in this context above and beyond what those other tracers can tell us? For future such missions, and given finite resources, would you recommend prioritizing the 14CO2 measurements at the expense of other possible measurements / model analyses, or not?

At some point in the manuscript there should be some brief discussion of the differing lifetimes of the chemical tracers used. Isoprene and isopentane are quite short-lived, whereas the others are not. This needs to be kept in mind during interpretation.

Specific comments. ———————-

Abstract, line 11 – recommend "Likely sources include" rather than "These sources included"

Abstract, line 21 – "bottoms-up" is good drinking advice, but "bottom-up" is better here

Title and elsewhere – Is "14C on CO2" standard jargon in the radiocarbon community? Seems odd to me, better "14C in CO2".

Section 2.2 – for the other chemical tracers used here, please cite specific PI papers where they are available, rather than the TRACE-P overview paper (Jacob et al., 2003).

Section 3.1 title – my dictionary defines "megaplex" as a movie theater complex having multiple screens. Choose a different word?

7219, lines 10-16 – please explain this more clearly. How does this estimate (4-15 ppm) compare with the actual CO2 concentrations?

", lines 19-22. Why was least-squares regression used, as opposed to an approach allowing for error in both X and Y?

", line 23 "the determined median". For what period? The median for the whole flight?

7220, line 9. Please use "enhancement ratio" instead of emission ratio. And remind the reader what you're talking about: "We find that our CO:CO2 molar enhancement ratio..."

", line 15 – ACN is "above background" - what is the criterion you're using here? Based on?

7221, lines 4-8 – please describe this more carefully and in more detail.

7221, lines 18-19. Your statement seems incorrect unless you explain (as I think is the case) that you are only talking about the four left-most clusters in the Figure 6 panels.

7221, lines 22-24 – ??? Please take more care in your explanation.

p. 7221, bottom. "transport characteristics associated with meteorological transport"

??? seems redundant to me.

p. 7222, lines 24-28 – please clarify this explanation and refer explicitly to figures to show the reader which datapoints you're referring to. How do you know the "minimum of 7.5 ppm of added fossil fuel CO2"? What kind of "producing field"?

p. 7223, lines 23-26 – again, please provide some more detail.

There are a couple citations mis-formatted in the text (Christen, EST, 2004), Trumbore (EOS, 2002).

p. 7225, lines 17-22 – run on. hard to understand.

Fig 2. Suggest flight tracks color coded by 14C to improve readability

Figure 4 – this might be better on a log-scale. Please clearly indicate in the caption that this is an enhancement plot. Could also label axes to signify this.

Fig 5 – yellow font and symbols too hard to see. It's difficult to interpret this plot. I suspect there is a more intuitive way to present the data to make your point.

FIg 6 – would be easier to read with a better color scheme. The current one is counterintuitive. You have green lower than red but higher than yellow. I suggest also mentioning in the caption briefly major differences between where/when the data clusters were collected – this would help clarify your discussion in the text ... four left clusters are from southbound BL leg, right?

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 7213, 2009.