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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Hemispheric average Cl atom concentration from $^{13}C/^{12}C$ ratios in atmospheric methane" *by* U. Platt et al.

U. Platt et al.

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We thank the reviewer for the very helpful comments. We have addressed these on a point-by-point basis and have added text to the manuscript as indicated below:

General comments:

This point by the reviewer is well taken and we have added the following sentence to the end of the abstract: "However, its impact on the methane stable carbon isotope budget is large and warrants further attention."

Comment 1: Our method derives lower limits for the Cl atom concentration. We have changed the sentence in lines 9–10 of the abstract to read: "This property can be used to estimate the likely minimum size of the methane sink attributable to MBL Cl." Further

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mention of this occurs in our reply to comment 4.

Comment 2: Yes, there is a small effect but this was taken into account by the OH climatology used to model the phase ellipses. We have changed the sentence on p. 2285 lines 10–11 to read: "Thus its concentration peaks in the ETSH in December near the time of minimum solar zenith angle."

Comment 3: At the bottom of p. 2286, we changed the sentence as follows:

They show that the size of the minor axes of these ellipses is a function of "source effects", in particular that the biomass burning source lengthens the minor axis and "broadens" the ellipse because of this source's high ^{13}C enrichment and strong seasonal amplitude. The other major conclusion of their work is that the gradient of the major axes of the ellipses. . .

Comment 4: On p. 2287, we added the following on line 7:

Recent work (W. Allan et al., Interannual variation of ^{13}C in tropospheric methane: Implications for a possible chlorine sink in the marine boundary layer, J. Geophys. Res., submitted) shows that there is considerable interannual variation in the apparent KIE derived using this technique. At Baring Head, the values ranged from -17 per mil in 1997 to -6 per mil in 1999. At Scott Base (78° S), the magnitudes of the apparent KIE were similar, but the interannual variation was different in detail.

Same page, on line 15, we added:

The interannual variation of the apparent KIE implies a similar variation in the amplitude of the Cl seasonal cycle in the marine boundary layer. The offset level of Cl atoms cannot be determined using this isotope technique, but we consider that the maximum observed amplitude of the Cl seasonal cycle provides a lower bound on the maximum Cl concentration in the ETSH marine boundary layer.

Comment 5: On p. 2290 we added:

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Thus, R10 followed by photolysis of ClO constitutes a null cycle with respect to Cl atoms providing (at 20 ppb O_3) about 60% of the Cl atoms reacting with CH_4, while about 40% would come from RS8 and RS9.

Comment 6: On p. 2292, end of line 13 we added:

Literature values derived from indirect measurements e.g. relative rates of degradation of different hydrocarbons (e.g. of . . ., also known as “hydrocarbon clock” observations) result in widely varying estimates ranging from 103 to 106 cm^{-3} (Graedel and Keene, 1995, Global Biogeochem. Cycles 9, 47–77), around or below 104 cm^{-3}, (Singh et al., 1996, GRL 23, 1523–1532), or 1.6$\times$104 cm^{-3} (taking $\frac{1}{4}$ of the noontime Cl concentration of 6.4$\times$104 cm^{-3} derived from Lagrangian experiments conducted by Wingenter et al., 1996, JGR 101, 4331–4340).

The above new references have been added to the reference list.

The Editorial Suggestions have been complied with.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 2283, 2004.