**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Re-evaluation of the lifetimes of the major CFCs and CH$_3$CCl$_3$ using atmospheric trends" *by* M. Rigby et al.

Anonymous Referee #1

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This study presents new estimates for the atmospheric lifetimes of the important ozone depleting substances, CFC-11, -12, -113, and of CH3CCl3 based on atmospheric measurements, emission estimates, and an inversion method. Accurate estimates for the lifetimes of these species is needed in order to be able to determine the rate of stratospheric ozone recovery, and is therefore an important study. I recommend this manuscript for publication after some minor changes.

General comments

The methods used are sound and well described and overall the manuscript is well written, therefore, only a few points need clarification:

p24480: The authors state that 5-10 iterations were used, however, what criteria used

to know that the cost function was at minimum? In other words, how was the number of iterations necessary determined?

p24481: The authors mention that eddy diffusion transport parameters were included in the optimization but not advective parameters. Therefore, could the authors please clarify if any of the parameter(s) for transport between the lowermost stratospheric box and the uppermost tropospheric box were optimized? The stratosphere to troposphere exchange rate would be an important parameter for the rate of loss of CFC species, which are predominantly lost in the stratosphere.

p24481: Due to numerical considerations, the log of the inverse lifetime was optimized. Could the authors please clarify, was this transform also applied to the observations, which are the log of the mixing ratios?

p24481: Regarding the transform to optimize the log of the state variables ([OH], inverse lifetime and eddy diffusion coefficients) was the sensitivity matrix H recalculated for this transformation?

p24481: Again regarding the transformation to optimize the log of certain state variables, how were the uncertainty covariance matrices R, P, redefined?

p24487: Fig. 4 shows considerable inter-annual variability in the lifetime after the peak in atmospheric abundance. Is this variability within the uncertainty ranges calculated on each mean lifetime? If it is not, how does the mean lifetime depend on the time window selected?

Technical comments

p24476, l21: "by Daniel et al (2007)"

p24477, l13: the reviewer could not find where "TEAP" is defined, this should be defined somewhere

p24484, l6: "in Sect. 3.1 do not. . ."

Table 2: in the caption of this table "emission uncertainties" is misleading as the table only shows the lifetimes and their associated uncertainties.

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