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Interactive comment on "Global tropospheric hydroxyl distribution, budget and reactivity" *by* J. Lelieveld et al.

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While we agree with ref#2 that there are discrepancies between estimates of the methane lifetime in the literature, and also that there is a distinct possibility that models overestimate global OH, especially in the northern hemisphere, as indicated by the ACCMIP model inter-comparison, for the time being we should recognize that these estimates constitute the range of uncertainty.

The "observationally" derived lifetime of methane is not available, unfortunately. It could be derived when the global source would be known. However, the current (and past) thinking is that the total methane sink is constrained more accurately, which is used to estimate the global methane source.

Prather et al. (2011) used the best estimate of the atmospheric lifetime of methane.

They also scaled the methyl chloroform (MCF) decay rate to that of methane. This is fine, of course, but there are uncertainties. Firstly, the distributions of both gases are assumed to be the same, which can be discussed, also in view of differences in reaction rates. Secondly, MCF sinks other than through reaction with OH need to be quantified, such as loss in the stratosphere and uptake by the oceans. Actually, the oceans might be a net MCF sink or a source (e.g., Krol and Lelieveld, 2003). Some models account for the stratosphere and others do not. Further, estimates of the total sink of MCF depend on assumptions about MCF emissions, which have been controversially discussed (e.g., Montzka et al., 2011). It is even possible that some small emissions are continuing today.

Also the methane lifetime needs to be corrected for non-OH sinks. The methane loss through reactions with O(1D) and Cl radicals in the stratosphere is relatively well known (about 3% of the methane sink), whereas other sinks, notably uptake by soils, are highly uncertain. Also here it is actually possible that soils are a net methane source rather than a sink.

Overall, we would agree that the methane lifetime needs to be better constrained, and that model results need to be confronted with observations. For this reason we are continuing our efforts to analyze methane and MCF observations. In the revised version of the manuscript we will devote more discussion to this important issue.

References:

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