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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Perfluorocarbons in the global atmosphere: tetrafluoromethane, hexafluoroethane, and octafluoropropane" *by* J. Mühle et al.

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Please note that we provide our replies in bold after each comment from Anonymous Referee 1 (received and published: 12 April 2010).

This manuscript presents measurements of three perfluorocarbons, CF_4, C_2F_6, and C_3F_8, from a combination of sources that include the global AGAGE network, archived air samples, and firn air. The measurements are based on improved analytical techniques and a well-defined calibration scale. The high frequency data from the in-situ network span only 3 – 7 years, but when combined with the other data sources an atmospheric time history extending back to the early 1970's is presented. Pre-industrial

estimates come from the firn air. The data are of great interest, and the manuscript should be published with some revision.

The strength of the manuscript is in the basic data record. The data appear to be of very high quality, and are suitable for evaluation of emissions. The calibration procedures used by the AGAGE project have proven to be very reliable, and there is no reason to question this aspect of the manuscript. The high precision that is demonstrated is very impressive, and lends confidence to the subsequent calculations of emissions. Previous data actually compare reasonably well to that reported here, with perhaps some calibration scale differences or offsets.

We thank the anonymous referee for the positive assessment of our analytical work.

The data are evaluated with the AGAGE 12-box 2D inversion model to arrive at emission estimates, and a time history of these emissions. If the measurements are accurate, this top-down emission estimate provides a benchmark for evaluating other estimates of emission rates.

We thank the anonymous referee for the positive assessment of our modeling work.

The authors then discuss the differences between their estimates and other estimates based on source emission reporting. They find differences between their calculated emissions and those emissions based on other methods.

I would suggest that it is sufficient for this manuscript to present the data and the resulting emission calculations, and note that they are different from emissions based on source emission reporting or hybrid methods. The authors' discussion of the possible reasons for existing differences in reports from other organizations is often speculative and not particularly useful in this context. Perhaps a separate paper from scientists and engineers who are directly involved in producing the emissions estimates would

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be more appropriate and constructive.

We believe that the discussions in the manuscript are valuable. They point out the shortcomings of the various inventories and demonstrate that the sum of available PFC bottom-up emission estimates is significantly lower than global emissions inferred from our atmospheric measurements, and that this emission gap has been increasing. We discuss in the revised manuscript that the missing CF_4 emissions likely stem from the primary aluminum *and/or* the semiconductor/electronics industry. We have made changes to the revised manuscript to avoid any bias. We acknowledge the continuing, long-term effort of the International Aluminium Institute (IAI) to identify and reduce PFC emissions and now also point out that the report of the World Semiconductor Council (WSC) on the perfluorocompound emission reduction program of the semiconductor industry contains only very limited information. We also stress that the EDGAR database does not provide all details necessary to understand how the PFC emission estimates are calculated or apportioned. At the current stage we believe that it is necessary to discuss the points made here to encourage an effort by IAI, WSC, global PFC suppliers, and EDGAR to improve estimates of CF_4 and C_2F_6 emissions, and to point out the need for global emission reporting.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 6485, 2010.