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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A new analytical inversion method for determining regional and global emissions of greenhouse gases: sensitivity studies and application to halocarbons" *by* A. Stohl et al.

Anonymous Referee #2

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This paper presents an estimation of the halocarbon emissions over the globe using an analytical inverse method specific to non-negative tracer fluxes. These gases (HFC, HCFC, CFC), not well-constrained in the actual emission inventories, have a significant impact on the radiative budget compared to other green house gases that has to be considered (in addition to the ozone depletion effect), and this study contributes to improve these estimates. Previous studies were using simpler inverse formulations and the lack of measurements was limiting the validity of the retrieved fluxes. The authors explored the different set-ups (prior emissions with their different associated uncertain-

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ties, and observations) and their impact on the inverse estimate that is not a validation of the posterior fluxes but shows the consistency of the system and its assumptions. This paper should be published in ACP after consideration of the following minor comments.

Specific comments:

- In the conclusion, the differences between the inventories and the posterior emissions for Europe and China are explained by a time-lag between comsuption and emissions. Other studies limit their interpretation of the disagreement due to large uncertainties (Prinn et al., 2000). Yokouchi et al., 2006 show similar values for HCFC-22 in China (50 kt/year) but +/- 34 kt/year using also the Hateruma station in Asia. More arguments should be included to justify this conclusion, or some realistic assumptions that could explain this time-lag as long as the posterior uncertainty is not available with the present system.

- In the method, the positive definiteness allows you to get rid of negative fluxes. However, the iterative algorithm leads to include a part of the transport model error into the flux error. The present recalculation at each step could attribute some inconsistencies in the system and so in the retrieved fluxes. At the first step, the correction of some pixels are due to transport error. The positive definiteness will balance the correction to the other pixels (included in the same SRR or response function). Could you discuss this point more clearly in the paper.

- The title of the paper implies the description of a "new" inverse system whereas the different elements were previously used in other studies, as Yokouchi et al., 2006 for the baseline component, and Eckhardt et al., 2007, 2008, for the negative flux adaptation. Offsets are often used for other gases when the variability arised from long term and short term components.

Technical comments:

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- 19065-14: Could you precise the % for Europe and China.

- 19067-16: Explain "4-10d".

- 19067-28: You demonstrate later that prior information has not a large impact on your posterior estimate. If the constraint is sufficient (large number of observations), high resolution prior wouldn't be required. Could you rephrase the sentence that is too general.

- 19068-14: The choice of 20 day backward plumes is not clear. Could you explain better.

- 19073-10: Same question for 31 day backward plumes.

- 19076-9: The part y2 is also described by the transport simulation (31d backward transport).

- 19078-3: Despite the lack of information on prior flux uncertainties, less documented countries should be less constrained than countries in the UNFCCC database. Could you justify you assumption not to distinguish documented and not documented countries.

- 19081-18: "Highly accurate" can't be demonstrated by a pseudo data experiment. Capacity of the system can be evaluated but not its accuracy.

- 19084-13: Figure 1 doesn't show the constraint on the East coast by the european stations. A regional estimate would be more clear.

- 19086-28: Figure 7 :: Could you explain the increase of negative events in the time serie compared to the a priori.

- 19096-9: "help" instead of "aide".

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 19063, 2008.

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