Atmos. Chem. Phys. Discuss., 12, C6391–C6394, 2012
www.atmos-chem-phys-discuss.net/12/C6391/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global and regional emissions estimates for HCFC-22" *by* E. Saikawa et al.

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Received and published: 30 August 2012

This paper studies CFC-22 emissions. One of the reasons to do so it its planned phase-out, also in developing countries by 2013. Therefore, it is important to monitor the atmospheric mixing ratios, and to translate these to emissions using inverse modeling. Also, an attempt is made to infer region emissions. I find the paper well written and only have some major comments on the treatment of the prior and posterior errors. Also, I miss prior and posterior statistics on the stations. I think this information should be included.

1 Major remarks

In table 2 posterior global emissions are presented for the global and the regional inversions. Very striking are the larger posterior errors in the regional inversions on the global numbers. Since more data are used in the inversions I would expect a larger error reduction. In combining regions, errors should be calculated taking into account the full co-variance matrix. This leads to a reduction of the error on the global scale compared to regional scales, which is perfectly logical, because the combined observations constrain global emissions better than emissions in individual regions. It seems that the errors on the regional scale are simply added to calculate the global error. Since there are correlations between the regions, this is a wrong procedure.

Likewise, the prior error settings in the regional and global inversion should be consistent. Globally, an error of 40% is chosen. If you would split this up in two (uncorrelated) regions with equal emissions and also errors of 40%, the error on the global scale becomes larger than 40%: $\sqrt{(40^2 + 40^2)} = 56.6\%$. Error in non-equal regions (in terms of emissions) should be transformed in Gg/yr of course to arrive at an error in Gg/yr on the global scale.

In the global inversion, only background observations are used to derive global emissions. In doing so, "pollution" events are screened out from the measurements. On the model side, the model is sampled over the ocean, to prevent sampling on continental emissions. However, if the wind blows from the continent, some pollution events in the model cannot be prevented. Ideally, model and measurements should be "co-sampled". The authors should proof that their model is "pollution-event free" to allow a sound comparison to screened observations.

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2 Minor remarks

- Title: emissions estimates: replace by "emission estimates". Also at some other places.
- page 18246, line 22. I suggest: Due to its short lifetime "for an ozone depleting compound".
- page 18247, line 9 ... Montzka (2009) ...I re-read the sentence a couple of times, but it remained unclear. Rephrase.
- page 18252, line 5. Emissions inventory ...replace by.... emission inventory
- page 18254, top:specify how lifetime is calculated and provide the lifetimes for OH and O1D loss also separately
- page 18254, l13: For both inversions... Sentence unclear
- page 18255, Please specify that matrices W and S are chosen diagonal
- On page 18257 it is stated that "Because of the difference in the number of measurements in a month between high-frequency observations and weekly flask measurements, this error is approximately three to ten times lower for high-frequency observations, compared to that associated with NOAA and AGAGE flask measurements". I could easily think of a time series for which the standard error of continuous measurements is larger, e.g. a large day-night difference, pollution events etc. In contrast, flasks are normally sampled under baseline conditions. Please provide examples for typical stations
- On page 18259:These 12-box estimates are shown in 3-yr averages, and thus they are much smoother than our estimates. I directly wonder why? Remove the 3-yr average to allow for a fair comparison

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- Page 18260: at least for years between 1995 and 2009. I see in figure 3 only green symbols up to 2004.
- Please find a way to make the error bars in figures 6-10 more readable.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 18243, 2012.