Atmos. Chem. Phys. Discuss., 14, C5507–C5509, 2014
www.atmos-chem-phys-discuss.net/14/C5507/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Satellite observations of stratospheric carbonyl fluoride" *by* J. J. Harrison et al.

Anonymous Referee #1

Received and published: 1 August 2014

This study reports first global observations of stratospheric carbonyl fluoride from MIPAS-ENVISAT and ACE-FTS. Carbonyl fluoride (COF2) is mainly produced in the stratosphere as a degradation product of CFC-12, CFC-113 and HCFC-22. Monitoring COF2 as part of the atmospheric fluorine family is important to close the budget for fluorine in the atmosphere from anthropogenic emissions. Observed COF2 is compared with calculations of the SLIMCAT chemistry transport model, constrained by surface observations of CFCs, HCFCs and halons. The paper addresses an important topic well within the scope of ACP and is generally well written. I recommend publication in ACP after consideration of the following, mostly minor, comments.

General comments

Trends of COF2 are calculated over the relatively short period from January 2004 to September 2010. As discussed in the manuscript, the calculated trends are a superposition of changes in source gas emissions and inter-annual variability of stratospheric transport. This results in very different trends at different latitudes and altitudes and one has to be careful when calculating trends from measurements at a single location. The SLIMCAT run with fixed year 2000 dynamics is extremely helpful to separate the effects of changes in source gases and changes in stratospheric dynamics. It would be very helpful to have also the global mean trend values for this SLIMCAT sensitivity simulation given (couldn't find it) to compare with the global mean trend including inter-annual changes in transport. Do the changes in stratospheric dynamics affect the global mean trend or is the global mean largely insensitive against changes in dynamics? Does the agreement of trends between MIPAS and SLIMCAT suggest any conclusion whether this trend is consistent with trends in surface mixing ratios of the source gases?

Anyway I strongly recommend providing an error estimate for the SLIMCAT trends as well (see below).

I suggest to cite and discuss also Kellmann et al. (2012), who found similar trend patterns in MIPAS observations of CFC-11 and CFC-12.

Could the change from high resolution to low resolution mode in MIPAS observations from 2005 on affect trends in COF2? Was this taken into account in the trend calculation? E.g. by allowing for a possible bias between high and low resolution retrievals?

Specific comments

p.18128, l.8: I don't think it is appropriate to count COF2 as "inorganic" fluorine. Better say product gas. However, on p.18129, l.9, "inorganic" is okay and does not need to be written in quotes.

p.18135: There is some overlap between Sections 3.1 and 2.1/2.2. I suggest moving

the first two paragraphs of Section 3.1 to Section 2.

p.18140, l.17: The smoothing error covariance is not the same as the a priori error covariance! (The smoothing error covariance is usually defined as S_smooth=(1-A)S_a(1-A)ˆT.) Please rephrase to avoid confusion.

p.18145, l.18: What is the meaning of "ERA-Interim from 1989 onwards" if SLIMCAT was run from 2000 to 2012? I believe this sentence has been "recycled" and is not relevant here, but if not, then why was ERA-Interim not used before 1989?

p.18151, l.3: I may have overlooked this, but why is September 2010 the last month for which ACE v3.0 is usable?

p.18152, l.25: why were no errors calculated for the SLIMCAT trends? Although it will not be straight-forward to estimate a "model error", it should be possible to estimate the linear regression error for SLIMCAT in the same way as for the satellite data.

p.18154, l.10: "see their Fig.10" as this refers to Fig.10 of Stiller et al.

Reference

Kellmann, S., von Clarmann, T., Stiller, G. P., Eckert, E., Glatthor, N., Höpfner, M., Kiefer, M., Orphal, J., Funke, B., Grabowski, U., Linden, A., Dutton, G. S., and Elkins, J. W.: Global CFC-11 (CCl3F) and CFC-12 (CCl2F2) measurements with the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS): retrieval, climatologies and trends, Atmos. Chem. Phys., 12, 11857-11875, doi:10.5194/acp-12-11857-2012, 2012.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 18127, 2014.