

Home

Online Library ACP

Recent Final Revised Papers

Volumes and Issues

Special Issues

Library Search

Title and Author Search

Online Library ACPD

Alerts & RSS Feeds

General Information

Submission

Review

Production

Subscription

Comment on a Paper



Volumes and Issues Contents of Issue 12

Atmos. Chem. Phys., 9, 3911-3934, 2009

www.atmos-chem-phys.net/9/3911/2009/

© Author(s) 2009. This work is distributed under the Creative Commons Attribution 3.0 License.

Long-lived halocarbon trends and budgets from atmospheric chemistry modelling constrained with measurements in polar firn

P. Martinerie¹, E. Nourtier-Mazauric¹, J.-M. Barnola¹, W. T. Sturges², D. R. Worton^{2,*}, E. Atlas³, L. K. Gohar^{4,**}, K. P. Shine⁴, and G. P. Brasseur⁵

¹Laboratoire de Glaciologie et Géophysique de l'Environnement (UMR CNRS/INSU 5183), CNRS, Université Joseph Fourier-Grenoble, BP 96, 38 402 Saint Martin d'Hères, France

²School of Environmental Sciences, University of East Anglia, Norwich, NR4 7TJ, UK

³Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL 33149, USA

⁴Department of Meteorology, University of Reading, Reading RG6 6BB, UK

⁵National Center for Atmospheric Research, Boulder, CO 80307-3000, USA

* now at: Department of Environmental Science, Policy and Management, University of California, Berkeley, CA 94720-3110, USA

** now at: Met Office Hadley Centre, FitzRoy Road, Exeter. EX1 3PB, UK

Abstract. The budgets of seven halogenated gases (CFC-11, CFC-12, CFC-113, CFC-114, CFC-115, CCl₄ and SF₆) are studied by comparing measurements in polar firn air from two Arctic and three Antarctic sites, and simulation results of two numerical models: a 2-D atmospheric chemistry model and a 1-D firn diffusion model. The first one is used to calculate atmospheric concentrations from emission trends based on industrial inventories; the calculated concentration trends are used by the second one to produce depth concentration profiles in the firn. The 2-D atmospheric model is validated in the boundary layer by comparison with atmospheric station measurements, and vertically for CFC-12 by comparison with balloon and FTIR measurements. Firn air measurements provide constraints on historical atmospheric concentrations over the last century. Age distributions in the firn are discussed using a Green function approach. Finally, our results are used as input to a radiative model in order to evaluate the radiative forcing of our target gases. Multi-species and multi-site firn air studies allow to better constrain atmospheric trends. The low concentrations of all studied gases at the bottom of the firn, and their consistency with our model results confirm that their natural sources are small. Our results indicate that the emissions, sinks and trends of CFC-11, CFC-12, CFC-113, CFC-115 and SF₆ are well constrained, whereas it is not the case for CFC-114 and CCl₄. Significant emission-dependent changes in the lifetimes of halocarbons destroyed in the stratosphere were obtained. Those result from the time needed for their transport from the surface where they are emitted to the stratosphere where they are destroyed. Efforts should be made to update and reduce the large uncertainties on CFC lifetimes.

Final Revised Paper (PDF, 2251 KB) Supplement (1114 KB) Discussion Paper (ACPD)



Search ACP

Library Search

Author Search

News

- New Alert Service available
- Sister Journals AMT & GMD
- Financial Support for Authors
- Journal Impact Factor
- Public Relations & Background Information

Recent Papers

01 | ACPD, 22 Jun 2009: Elevated nitrogen-containing particles observed in Asian dust aerosol samples collected at the marine boundary layer of the Bohai Sea and the Yellow Sea

02 | ACP, 22 Jun 2009: The relationship between aerosol and cloud drop number concentrations in a global aerosol microphysics model

03 | ACPD, 22 Jun 2009: Evaluation of the volatility basis-set approach for the simulation of organic aerosol

Citation: Martinerie, P., Nourtier-Mazauric, E., Barnola, J.-M., Sturges, W. T., Worton, D. R., Atlas, E., Gohar, L. K., Shine, K. P., and Brasseur, G. P.: Long-lived halocarbon trends and budgets from atmospheric chemistry modelling constrained with measurements in polar firn, *Atmos. Chem. Phys.*, 9, 3911-3934, 2009. [Bibtex](#) [EndNote](#) [Reference Manager](#)