

# Atmospheric Chemistry and Physics

An Interactive Open Access Journal of the European Geosciences Union

[www.atmospheric-chemistry-and-physics.net](http://www.atmospheric-chemistry-and-physics.net)

## Advisory Board Members

### Paul J. Crutzen (Chairman)

Max Planck Institute for Chemistry,  
Mainz, Germany  
[crutzen@mpch-mainz.mpg.de](mailto:crutzen@mpch-mainz.mpg.de)

### Meinrat O. Andreae

Max Planck Institute for Chemistry,  
Mainz, Germany  
[m.andreae@mpic.de](mailto:m.andreae@mpic.de)

### Guy P. Brasseur

National Center for Atmospheric Research,  
Boulder, USA  
[brasseur@ucar.edu](mailto:brasseur@ucar.edu)

### Daniel McKenna

National Center for Atmospheric Research,  
Boulder, USA  
[danny@acd.ucar.edu](mailto:danny@acd.ucar.edu)

### Stuart A. Penkett

University of East Anglia, Norwich, UK  
[m.penkett@uea.ac.uk](mailto:m.penkett@uea.ac.uk)

### Veerabhadran Ramanathan

Scripps Inst. of Oceanography, La Jolla, USA  
[vramanathan@ucsd.edu](mailto:vramanathan@ucsd.edu)

## Executive Editors

### Ulrich Pöschl (Chief-Executive Editor)

Max Planck Institute for Chemistry,  
Mainz, Germany  
[u.poeschl@mpic.de](mailto:u.poeschl@mpic.de)

### Ken Carslaw

University of Leeds, UK  
[k.s.carslaw@leeds.ac.uk](mailto:k.s.carslaw@leeds.ac.uk)

### Thomas Koop

Bielefeld University, Germany  
[thomas.koop@uni-bielefeld.de](mailto:thomas.koop@uni-bielefeld.de)

### Rolf Sander

Max Planck Institute for Chemistry,  
Mainz, Germany  
[sander@mpch-mainz.mpg.de](mailto:sander@mpch-mainz.mpg.de)

### William Thomas Sturges

University of East Anglia, Norwich, UK  
[w.sturges@uea.ac.uk](mailto:w.sturges@uea.ac.uk)

## Co-Editors

### Jonathan Abbatt

University of Toronto, Canada  
[jabbatt@chem.utoronto.ca](mailto:jabbatt@chem.utoronto.ca)

### Ilse Aben

SRON Netherlands Institute for Space  
Research, Utrecht, The Netherlands  
[i.aben@sron.nl](mailto:i.aben@sron.nl)

### Markus Ammann

Paul Scherrer Institute, Villigen, Switzerland  
[markus.ammann@psi.ch](mailto:markus.ammann@psi.ch)

### Yves Balkanski

Laboratoire CEA-CNRS-UVSQ, LSCE/IPSL,  
Gif-sur-Yvette, France  
[yves.balkanski@lsce.ipsl.fr](mailto:yves.balkanski@lsce.ipsl.fr)

### Urs Baltensperger

Paul Scherrer Institute, Villigen, Switzerland  
[urs.baltensperger@psi.ch](mailto:urs.baltensperger@psi.ch)

### Andreas Baumgaertner

Max Planck Institute for Chemistry,  
Mainz, Germany

### Timothy Bertram

University of California, San Diego, USA  
[tbertram@ucsd.edu](mailto:tbertram@ucsd.edu)

### Wolfram Birmili

Leibniz Institute for Tropospheric Research,  
Leipzig, Germany  
[birmili@tropos.de](mailto:birmili@tropos.de)

### Jan W. Bottenheim

Environment Canada, Toronto, Canada  
[jan.bottenheim@ec.gc.ca](mailto:jan.bottenheim@ec.gc.ca)

### Jørgen Brandt

National Environmental Research Institute,  
Roskilde, Denmark  
[jbr@dmu.dk](mailto:jbr@dmu.dk)

### Stefan Buehler

Lulea University of Technology, Kiruna,  
Sweden  
[sbuehler@ltu.se](mailto:sbuehler@ltu.se)

### James B. Burkholder

NOAA Earth System Research Laboratory,  
Boulder, USA  
[james.b.burkholder@noaa.gov](mailto:james.b.burkholder@noaa.gov)

### Tim Butler

Max Planck Institute for Chemistry,  
Mainz, Germany

### Lucy Carpenter

University of York, UK  
[ljc4@york.ac.uk](mailto:ljc4@york.ac.uk)

### Chak K. Chan

Hong Kong University of Science and  
Technology, Hong Kong  
[keckchan@ust.hk](mailto:keckchan@ust.hk)

### Ronald Cohen

University of California, Berkeley, USA  
[rccohen@berkeley.edu](mailto:rccohen@berkeley.edu)

### Owen Cooper

NOAA Earth System Research Laboratory,  
Boulder, USA  
[owen.r.cooper@noaa.gov](mailto:owen.r.cooper@noaa.gov)

### John N. Crowley

Max Planck Institute for Chemistry,  
Mainz, Germany  
[john.crowley@mpic.de](mailto:john.crowley@mpic.de)

### Joachim Curtius

Johann Wolfgang Goethe-University,  
Frankfurt am Main, Germany  
[curtius@iau.uni-frankfurt.de](mailto:curtius@iau.uni-frankfurt.de)

### Daniel J. Cziczo

Pacific Northwest National Laboratory,  
Richland, USA  
[daniel.cziczo@pnl.gov](mailto:daniel.cziczo@pnl.gov)

### Martin Dameris

DLR Oberpfaffenhofen, Germany  
[martin.dameris@dlr.de](mailto:martin.dameris@dlr.de)

### Frank Dentener

European Commission, Ispra, Italy  
[frank.dentener@jrc.it](mailto:frank.dentener@jrc.it)

### Neil M. Donahue

Carnegie Mellon University, Pittsburgh, USA  
[nmd@andrew.cmu.edu](mailto:nmd@andrew.cmu.edu)

### Bryan N. Duncan

NASA Goddard Space Flight Center,  
Greenbelt, USA  
[bryan.n.duncan@nasa.gov](mailto:bryan.n.duncan@nasa.gov)

### Timothy J. Dunkerton

NorthWest Research Associates,  
Redmond, USA

### Ralf Ebinghaus

Institute for Coastal Research,  
Geesthacht, Germany  
[ralf.ebinghaus@gkss.de](mailto:ralf.ebinghaus@gkss.de)

### Maria Cristina Facchini

National Research Council (CNR),  
Bologna, Italy

### Graham Feingold

NOAA Earth System Research Laboratory,  
Boulder, USA  
[graham.feingold@noaa.gov](mailto:graham.feingold@noaa.gov)

### Qiang Fu

University of Washington, Seattle, USA  
[qfu@atmos.washington.edu](mailto:qfu@atmos.washington.edu)

### Stefano Galmarini

Joint Research Centre, Ispra, Italy  
[stefano.galmarini@jrc.it](mailto:stefano.galmarini@jrc.it)



**Timothy Garrett**

University of Utah, Salt Lake City, USA  
[tim.garrett@utah.edu](mailto:tim.garrett@utah.edu)

**Christoph Gerbig**

Max Planck Institute for Biogeochemistry,  
Jena, Germany

**Alex B. Guenther**

National Center for Atmospheric Research,  
Boulder, USA  
[guenther@ucar.edu](mailto:guenther@ucar.edu)

**Martin Gysel**

Paul Scherrer Institut, Villigen, Switzerland

**Robert Harley**

University of California, Berkeley, USA  
[harley@ce.berkeley.edu](mailto:harley@ce.berkeley.edu)

**Peter Haynes**

University of Cambridge, UK  
[pjh@damtp.cam.ac.uk](mailto:pjh@damtp.cam.ac.uk)

**Martin Heimann**

Max Planck Institute for Biogeochemistry,  
Jena, Germany  
[martin.heimann@bgc-jena.mpg.de](mailto:martin.heimann@bgc-jena.mpg.de)

**Andreas Hofzumahaus**

Forschungszentrum Jülich, Germany  
[a.hofzumahaus@fz-juelich.de](mailto:a.hofzumahaus@fz-juelich.de)

**Rupert Holzinger**

Institute for Marine and Atmospheric  
Research, Utrecht, The Netherlands

**Kaarle Hämeri**

University of Helsinki, Finland  
[kaarle.hameri@helsinki.fi](mailto:kaarle.hameri@helsinki.fi)

**Jose-Luis Jimenez**

University of Colorado, Boulder, USA  
[jose.jimenez@colorado.edu](mailto:jose.jimenez@colorado.edu)

**Patrick Jöckel**

DLR Oberpfaffenhofen, Germany  
[patrick.joekel@dlr.de](mailto:patrick.joekel@dlr.de)

**Jan Kaiser**

University of East Anglia, Norwich, UK  
[j.kaiser@uea.ac.uk](mailto:j.kaiser@uea.ac.uk)

**Maria Kanakidou**

University of Crete, Heraklion, Greece

**Thomas Karl**

National Center for Atmospheric Research,  
Boulder, USA  
[tomkarl@ucar.edu](mailto:tomkarl@ucar.edu)

**Veli-Matti Kerminen**

Finnish Meteorological Institute,  
Helsinki, Finland  
[veli-matti.kerminen@fmi.fi](mailto:veli-matti.kerminen@fmi.fi)

**Frank Keutsch**

University of Wisconsin, Madison, USA

**Thomas Kirchstetter**

Lawrence Berkeley National Laboratory,  
Berkeley, USA  
[twkirchstetter@lbl.gov](mailto:twkirchstetter@lbl.gov)

**Daniel Knopf**

Stony Brook University, USA

**Radovan Krejci**

Stockholm University, Sweden  
[radek@itm.su.se](mailto:radek@itm.su.se)

**Markku Kulmala**

University of Helsinki, Finland  
[kulmala@cc.helsinki.fi](mailto:kulmala@cc.helsinki.fi)

**Bernd Kärcher**

DLR Oberpfaffenhofen, Germany  
[bernd.kaercher@dlr.de](mailto:bernd.kaercher@dlr.de)

**Ari Laaksonen**

University of Kuopio, Finland  
[ari.laaksonen@uku.fi](mailto:ari.laaksonen@uku.fi)

**William Lahoz**

Norwegian Institute for Air Research,  
Kjeller, Norway  
[wal@nilu.no](mailto:wal@nilu.no)

**Kari Lehtinen**

Finnish Meteorological Institute and  
University of Kuopio, Finland  
[kari.lehtinen@uku.fi](mailto:kari.lehtinen@uku.fi)

**Franz-Josef Lübken**

Leibniz Institute of Atmospheric Physics,  
Kühlungsborn, Germany  
[luebken@iap-kborn.de](mailto:luebken@iap-kborn.de)

**Rob MacKenzie**

Lancaster University, UK  
[r.mackenzie@lancaster.ac.uk](mailto:r.mackenzie@lancaster.ac.uk)

**Bernhard Mayer**

Ludwig-Maximilians-University,  
Munich, Germany  
[bernhard.mayer@dlr.de](mailto:bernhard.mayer@dlr.de)

**Gordon McFiggans**

University of Manchester, UK  
[g.mcfiggans@manchester.ac.uk](mailto:g.mcfiggans@manchester.ac.uk)

**Craig McNeil**

University of Washington, Seattle, USA  
[cmcneil@apl.washington.edu](mailto:cmcneil@apl.washington.edu)

**V. Faye McNeill**

Columbia University, New York, USA  
[vfmcneill@columbia.edu](mailto:vfmcneill@columbia.edu)

**Nikolaos Mihalopoulos**

University of Crete, Heraklion, Greece  
[mihalo@chemistry.uoc.gr](mailto:mihalo@chemistry.uoc.gr)

**Paul Monks**

University of Leicester, UK  
[p.s.monks@leicester.ac.uk](mailto:p.s.monks@leicester.ac.uk)

**Jennifer G. Murphy**

University of Toronto, Canada  
[jmurphy@chem.utoronto.ca](mailto:jmurphy@chem.utoronto.ca)

**Ottmar Möhler**

Forschungszentrum Karlsruhe,  
Eggenstein-Leopoldshafen, Germany

**Athanasios Nenes**

Georgia Institute of Technology, Atlanta, USA  
[nenes@eas.gatech.edu](mailto:nenes@eas.gatech.edu)

**Spyros Pandis**

University of Patras, Greece  
[spyros@chemeng.upatras.gr](mailto:spyros@chemeng.upatras.gr)

**Markus Petters**

North Carolina State University,  
Raleigh, USA  
[markus\\_petters@ncsu.edu](mailto:markus_petters@ncsu.edu)

**Andreas Petzold**

DLR Oberpfaffenhofen, Germany  
[andreas.petzold@dlr.de](mailto:andreas.petzold@dlr.de)

**Andre S. H. Prevot**

Paul Scherrer Institute, Villigen, Switzerland  
[andre.prevot@psi.ch](mailto:andre.prevot@psi.ch)

**Alexander Pszenny**

University of New Hampshire, Durham, USA  
[alex.pszenny@unh.edu](mailto:alex.pszenny@unh.edu)

**Johannes Quaas**

Max Planck Institute for Meteorology,  
Hamburg, Germany  
[johannes.quaas@zmaw.de](mailto:johannes.quaas@zmaw.de)

**Xavier Querol**

Institute of Environmental Assessment and  
Water Research, Barcelona, Spain

**Andreas Richter**

University of Bremen, Germany  
[andreas.richter@iup.physik.uni-bremen.de](mailto:andreas.richter@iup.physik.uni-bremen.de)

**Nicole Riemer**

University of Illinois at  
Urbana-Champaign, USA

**Janne Rinne**

University of Helsinki, Finland  
[janne.rinne@helsinki.fi](mailto:janne.rinne@helsinki.fi)

**Greg Roberts**

Scripps Institution of Oceanography,  
La Jolla, USA  
[greg@fiji.ucsd.edu](mailto:greg@fiji.ucsd.edu)

**Yinon Rudich**

Weizmann Institute, Rehovot, Israel  
[yinon.rudich@weizmann.ac.il](mailto:yinon.rudich@weizmann.ac.il)

**Lynn M. Russell**

UCSD, Scripps Institution of Oceanography,  
La Jolla, USA

**Thomas Röckmann**

Utrecht University, The Netherlands  
[t.roeckmann@uu.nl](mailto:t.roeckmann@uu.nl)

**Harald Saathoff**

Karlsruhe Institute of Technology,  
Eggenstein-Leopoldshafen, Germany

**John H. Seinfeld**

California Institute of Technology,  
Pasadena, USA  
[seinfeld@caltech.edu](mailto:seinfeld@caltech.edu)

**Drew Shindell**

NASA Goddard Institute for Space Studies,  
New York, USA

**Chul Han Song**

Gwangju Institute of Science and  
Technology, Republic of Korea

**Peter Spichtinger**

ETH Zurich, Switzerland  
[peter.spichtinger@env.ethz.ch](mailto:peter.spichtinger@env.ethz.ch)

**Bjorn Stevens**  
Max-Planck-Institut für Meteorologie,  
Hamburg, Germany  
[bjorn.stevens@zmaw.de](mailto:bjorn.stevens@zmaw.de)

**Andreas Stohl**  
Norwegian Institute for Air Research,  
Kjeller, Norway  
[ast@nilu.no](mailto:ast@nilu.no)

**Joel Thornton**  
University of Washington, Seattle, USA  
[thornton@atmos.washington.edu](mailto:thornton@atmos.washington.edu)

**Ivonne Trebs**  
Max Planck Institute for Chemistry,  
Mainz, Germany

**Michel Van Roozendael**  
Belgian Institute for Space Aeronomy,  
Brussels, Belgium  
[michelv@oma.be](mailto:michelv@oma.be)

**Geraint Vaughan**  
University of Manchester, UK  
[geraint.vaughan@manchester.ac.uk](mailto:geraint.vaughan@manchester.ac.uk)

**Robert Vautard**  
LSCE/IPSL, Laboratoire CEA/CNRS/UVSQ,  
Gif sur Yvette, France  
[robert.vautard@cea.fr](mailto:robert.vautard@cea.fr)

**Bernhard Vogel**  
Karlsruhe Institute of Technology,  
Eggenstein-Leopoldshafen, Germany

**Rainer Volkamer**  
University of Colorado, Boulder, USA  
[rainer.volkamer@colorado.edu](mailto:rainer.volkamer@colorado.edu)

**Roland von Glasow**  
University of East Anglia, Norwich, UK  
[r.von-glasow@uea.ac.uk](mailto:r.von-glasow@uea.ac.uk)

**Thomas Wagner**  
Max Planck Institute for Chemistry,  
Mainz, Germany  
[thomas.wagner@mpch-mainz.mpg.de](mailto:thomas.wagner@mpch-mainz.mpg.de)

**William Ward**  
University of New Brunswick,  
Fredericton, Canada  
[wward@unb.ca](mailto:wward@unb.ca)

**Ernest Weingartner**  
Paul Scherrer Institute, Villigen, Switzerland

**Paul O. Wennberg**  
California Institute of Technology,  
Pasadena, USA

**Heini Wernli**  
ETH Zurich, Switzerland  
[heini.wernli@env.ethz.ch](mailto:heini.wernli@env.ethz.ch)

**Jonathan Williams**  
Max Planck Institute for Chemistry,  
Mainz, Germany  
[williams@mpch-mainz.mpg.de](mailto:williams@mpch-mainz.mpg.de)

## Editorial Support

**Natascha Töpfer**

Phone: +49-551-900339-40

[editorial@copernicus.org](mailto:editorial@copernicus.org)

## Publication Production

**Nadine Deisel**

Phone: +49-551-900339-50

[production@copernicus.org](mailto:production@copernicus.org)