University of Birmingham

Dr Marcus Köhler PhD FRMetS

Research Fellow

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About

Marcus Köhler is an atmospheric scientist, primarily interested in the interactions between atmospheric chemistry and climate. His research focuses on the numerical simulation of chemistry and transport processes in the atmosphere, and in current work he investigates the impact of cirrus clouds on atmospheric chemistry in the tropical tropopause layer. In the past his research centred on the chemical impacts of emissions from global air traffic and their role in climate change.

Before joining the University of Birmingham Marcus worked as a Lecturer in Climate-Environment Interactions at King's College London where he taught on a wide range of topics in atmospheric and climate science. Prior to that he worked for several years in atmospheric chemistry modelling as a Research Associate at the University of Cambridge. Marcus has a degree in Meteorology from the University of Karlsruhe, Germany, and Ph.D. in Atmospheric Chemistry from the University of Cambridge.

Qualifications

Postgraduate Certificate in Academic Practice, King's College London, UK – 2011

Ph.D. in Atmospheric Chemistry, University of Cambridge, UK – 2004

MSc in Meteorology (Dipl.-Met.), Universität Karlsruhe, Germany – 1999

Biography

Marcus graduated with an MSc in Meteorology (Diplom) from the University of Karlsruhe in Germany. His research there focused on simulating stratosphere-troposphere exchange processes and, during a year abroad at the University of the Witwatersrand in Johannesburg, on the impact of sulphate aerosol on regional temperatures in Southern Africa.

During his Ph.D. at the University of Cambridge Marcus contributed to collaborative EU funded research by simulating the impacts of nitrogen oxide emissions from global aviation on atmospheric composition with a 3D chemistry transport model. Subsequently he remained in Cambridge as a Post-doctoral Research Associate for several years, contributing to Research Council and industry/government-funded research projects by modelling the impact of emissions from global air traffic on atmospheric composition and chemically active greenhouse gases and related climate impacts. This work resulted in the development of a parametric model to investigate the climate impact of future aircraft designs and contributed to the development of a policy assessment tool to evaluate the climate impact of changes to the global aviation sector. This research involved close collaboration with researchers from a wider range of academic disciplines and stakeholders from the industry. As such Marcus has gained significant experience in working in inter-disciplinary teams.

In 2008 Marcus was offered a Lectureship in Climate-Environment Interactions at King's College London where he taught extensively undergraduate and postgraduate courses in Physical Geography. His teaching comprised a wide range of topics including atmospheric science, palaeoclimatology and present climate variability & change, urban air quality and air pollution, the Carbon cycle and climate mitigation through renewable energy and Geoengineering. During this time he expanded his applied research into global and regional climate impacts of air traffic and the role of biofuels in the aviation sector.

Marcus joined the University of Birmingham in 2013 to carry out more basic research on atmospheric chemistry in the upper troposphere and lower stratosphere region. His work primarily contributes to the NERC funded CAST project by investigating the role of cirrus clouds on heterogeneous chemistry in the tropical tropopause layer. A particular focus here will be the role of sub-visible cirrus in the tropics and the simulation of related microphysical and chemical processes with Eulerian and Lagrangian models.

Teaching

Marcus is a supervisor for Masters research projects.

Prior to commencing his post at the University of Birmingham Marcus has taught extensively as a Lecturer in Physical Geography at undergraduate and postgraduate level on a wide range of subjects including atmospheric science, climatology, air pollution and biogeochemical cycles.

Research

Research interests

- Atmospheric chemistry-climate interactions and composition change
- Numerical modelling of atmospheric processes
- Cirrus clouds and their role in atmospheric chemistry in the Tropical Tropopause Layer
- Impact of aviation (and other transport modes) on atmospheric composition change and climate

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Other activities

Marcus is a regular reviewer for a number of international journals in atmospheric science.

He is an Editorial Board member of the forthcoming journal *Studies in Atmospheric Science* (SIAS).

Association with the following professional bodies:

- Fellow of the Royal Meteorological Society
- Fellow of the Higher Education Academy
- Member of the European Geophysical Union
- Member of the American Geophysical Union
- Member of the Deutsche Meteorologische Gesellschaft

Publications

O. Dessens, **M.O. Köhler**, H.L. Rogers, R.L. Jones, and J.A. Pyle (2014) Global Aviation and Climate Change, *Transport Policy*, (in press) doi:10.1016/j.tranpol.2014.02.014.

P. Krammer , L. Dray, A. Evans, **M.O. Köhler** (2013) Climate-neutrality versus Carbon-neutrality for Aviation Biofuel Policy. *Trans. Res. Part D*, 23, 64–72, doi:10.1016/j.trd.2013.03.013.

M.O. Köhler, G. Rädel, K.P. Shine, H.L. Rogers, and J.A. Pyle (2013) Latitude dependence of aviation NOx emissions on ozone and methane change and related climate metrics. *Atmos. Environ.*, 64, 1–9, doi:10.1016/j.atmosenv.2012.09.013.

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M.O. Köhler, G. Rädel, O. Dessens, K.P. Shine, H.L. Rogers, O. Wild, and J.A. Pyle (2008) Impact of perturbations to nitrogen oxide emissions from global aviation. *J. Geophys. Res.*, 113, D11305, doi:10.1029/2007JD009140.

T. Reynolds, S. Barrett, L. Dray, A. Evans, **M. Köhler**, M. Vera-Morales, A. Schäfer, Z. Wadud, R. Britter, H. Hallam, R. Hunsley (2007) Modelling Environmental & Economic Impacts of Aviation: Introducing the Aviation Integrated Modelling Project. *Proceedings of the 7th AIAA Aviation Technology, Integration and Operations Conference*, Belfast, UK, 18–20 September 2007.

M.O. Köhler, O. Dessens, H.L. Rogers, O. Wild and J.A. Pyle (2007) Response in ozone and methane to small emission changes and dependence on cruise altitude. *Proceedings of the International Conference on Transport, Atmosphere and Climate (TAC)*, Oxford, U. K., 26−29 June 2006, EUR 22428, pp. 147–153.

R. Sausen, I. Isaksen, V. Grewe, D. Hauglustaine, D.S. Lee, G. Myhre, **M.O. Köhler**, G. Pitari, U. Schumann, F. Stordal, and C. Zerefos (2005) Aviation Radiative Forcing in 2000: An Update on IPCC (1999). *Meteorol. Z.*, 14(4), 555–561, doi:10.1127/0941-2948/2005/0049.

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D. Brunner, J. Staehelin, H.L. Rogers, **M.O. Köhler**, J.A. Pyle, D.A. Hauglustaine, L. Jourdain, T.K. Berntsen, M. Gauss, I.S.A. Isaksen, E. Meijer, P. van Velthoven, G. Pitari, E. Mancini, V. Grewe, and R. Sausen (2005) An evaluation of the performance of chemistry transport models by comparison with research aircraft observations, 2, Detailed comparison with two selected campaigns. *Atmos. Chem. Phys.*, 5(1), 107–129, doi:10.5194/acp-5-107-2005.

J.G. Esler, G.J. Roelofs, **M.O. Köhler**, F.M. O'Connor (2004) A quantitative analysis of grid-related systematic errors in oxidising capacity and ozone production rates in chemistry transport models, *Atmos. Chem. Phys.*, 4(7), 1781–1795, doi:10.5194/acp-4-1781-2004.

M.O. Köhler, H.L. Rogers, and J.A. Pyle (2004) Modelling the Impact of Subsonic Aircraft Emissions on Ozone: Future Changes and the Impact of Cruise Altitude Perturbations. *Proceedings of the European Conference on Aviation, Atmosphere and Climate (AAC)*, Friedrichshafen, Germany, 30th June – 3rd July 2003, in: Air pollution report 83, European Commission, EUR 21051, pp. 173-177.

M. Gauss, I. Isaksen, V. Grewe, **M. Köhler**, D. Hauglustaine, D. Lee (2004), Impact of Aircraft NOx Emissions: Effects of Changing the Flight Altitude, Proceedings of the European Conference on Aviation, Atmosphere and Climate (AAC), Friedrichshafen, Germany, 30 June – 3 July 2003. Air pollution report 83, European Commission, EUR 21051, pp. 122–127.

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