Dr William Bloss PhD

Reader in Atmospheric Science
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About

My research is in the field of Air Pollution / Atmospheric Chemistry - understanding the chemical processes which control the current and future composition of our atmosphere. We approach these problems through a combination of field measurements of atmospheric constituents, laboratory studies of specific systems, and modelling simulations for comparison with observations. **See my personal group pages (http://www.atmos.bham.ac.uk/)** .

Qualifications

- PhD Physical Chemistry - University of Cambridge
- BA Natural Sciences (Chemistry) - University of Cambridge

Biography

Dr Bloss obtained his BA in Natural Sciences (Chemistry) and PhD in Physical Chemistry from the University of Cambridge. His PhD research concerned laboratory studies of atmospheric chemical kinetics. In 1999 he took up a position as a Postdoctoral Scholar at the California Institute of Technology, based at the NASA Jet Propulsion Laboratory, studying the chlorine oxide reactions responsible for polar ozone hole formation. In 2001 Dr Bloss moved to the School of Chemistry at the University of Leeds, working initially as a Research Fellow and subsequently as a lecturer in Physical Chemistry, where his research involved field measurements of tropospheric radical species. He joined the University of Birmingham in 2007.

Teaching

BSc Environmental Sciences

MSc Air Pollution Management and Control (/postgraduate/courses/taught/gees/air-pollution-mgt-ctrl.aspx)

Postgraduate supervision

Research Students since 2001

- Ajit Singh (PhD, 2013+): Bioaerosol – Atmospheric Oxidant Interactions
- Mariam Al-Adba (PhD, 2013+): Climate Change and Air Quality
- Lubna Al-Saadi (PhD, 2013+): Source Apportionment of PM in Qatar
- Daniel Blenkhorn (PhD, 2013+): Novel Applications of PTR-MS for atmospheric VOC measurements
- Jian Zhong (PhD, 2011+): Modelling Air Quality in Street Canyons
- Hao Huang (PhD, 2011+): Measurement of Ozone Production Rates
- Suad AlKindi (PhD, 2009+): Artificial Chemical Ageing of Ambient Atmospheric Aerosol
- Vivien Bright (PhD, 2008-2012): Coupled Chemistry & Dynamics in a Street Canyon
- Kate Faloon (PhD, 2007-2010) : Laboratory Studies of Peroxy Radical – Aerosol Interactions
- Salim Alam (PhD, 2007-2010) : Radical Production from Alkene Ozonolysis
- Lucy Concannon (MPhil, 2008-2009) : Impacts of Iodine Chemistry in the MBL

Research

Research group

- **Environmental health sciences (/research/activity/environmental-health/index.aspx)**
- Climate & atmosphere

Research interests

- Atmospheric Chemistry
- Production and removal of tropospheric oxidants
- Halogen oxide kinetics and photochemistry
- Iodine species in the atmosphere

Current / recent research

Measurement of Ozone Production Rates

Ozone is a critical air pollutant, harmful to human health, crops and vegetation, an important atmospheric reactant (precursor to the key radical oxidant OH), and a significant greenhouse gas. Understanding atmospheric ozone levels is therefore a key goal for atmospheric chemists, underpinning effective air quality policy measures. As ozone is a secondary pollutant, formed in the atmosphere from the complex processing of NOx and VOCs, predicting ozone levels is still a challenge for atmospheric models. We are developing an alternative approach to this problem, to directly measure the local chemical ozone production rate, as a complementary approach to model (and other observational) tools, and have made preliminary measurements in the UK and India (**see news article (/schools/gees/news/2013/01Jul--ozone-production-india.aspx)**). This work is funded by NERC and the Royal Society.

Alkene Ozonolysis: Direct and Indirect Radical Production

The gas-phase reaction between ozone and alkenes produces a range of products, including radical species which contribute to atmospheric processing, and partially oxidised organic compounds which add to atmospheric reactivity and aerosol formation. In a series of projects, we have investigated the radical (OH, HO2 and RO2) production from the ozonolysis of a range of alkenes of biogenic and anthropogenic origin, and are now exploring the role of additional ozonolysis products, criegee radicals, as atmospheric oxidants for SO2 and NOx. We use the European Photoreactor (EUPHORE) large simulation chamber facility in Valencia, Spain, as our experimental tool, and interpret the data obtained using the MCM atmospheric model. This work is funded by NERC and the EU EUROCHAMP-2 FP7 programme, and is performed in collaboration with Andrew Rickard & Mat Evans (York), Paul Monks (Leicester) and Marie Camredon (Paris / LISA).

Interactions of Aerosol with Atmospheric Oxidants

Atmospheric oxidants, gas-phase species such as OH and HO2, drive the removal of most pollutants, limit the levels of global warming gases such as methane, and initiate the formation of low-level ozone. They can also react with (chemically age) organic aerosol particles, altering their size, composition hence toxicity and reactivity, a process which can substantially affect both oxidant levels and aerosol characteristics. We are investigating these processes using a laboratory flow-tube system, and aerosol ageing experiments employing an Aerosol Time-of-Flight Mass Spectrometer. This work is being carried out by Suad Al-Kindi, and is performed in collaboration with Roy Harrison.

Point Measurements of Iodine and Bromine in the Marine Boundary Layer

Iodine compounds released from the ocean cause a range of chemical effects in the marine atmosphere - they can influence atmospheric oxidant levels, participate in catalytic ozone destruction cycles and potentially lead to the formation of new atmospheric particles, which may influence cloud formation and hence weather and climate. These natural processes are known to be important in certain coastal regions, but their significance over the open ocean, and hence overall global impact, is uncertain. We have developed a new instrument to measure halogen atoms, using the technique of Resonance Fluorescence, and applied this to measure iodine levels in the North Atlantic, in collaboration with Dwayne Heard (Leeds), and to perform simulation chamber studies of iodine chemistry in collaboration with Cornelius Zetsch (Bayreuth) and Uli Platt (Heidelberg).

Other activities

- Royal Society of Chemistry: CChem, FRSC
- Chair of the RSC **Environmental Chemistry Group (http://www.rsc.org/ecg)**
- Associate Editor, Atmospheric Science Letters

Publications

Key Publications since 2001

M.S. Alam, A. R. Rickard, M. Camredon, K. P. Wyche, T. Carr, K. E. Hornsby, P. S. Monks & **W. J. Bloss** (2013) Radical Product Yields from the Ozonolysis of Short Chain Alkenes under Atmospheric Boundary Layer Conditions. J. Phys. Chem. A, 117, 12468-12483

B. Ouyang, M. W. McLeod, R. L. Jones & **W. J. Bloss** (2013) NO_3 radical production from the reaction between the Criegee intermediate CH_2OO and NO_2, Phys. Chem. Chem. Phys. 15, 17070-17075

R. Sommariva, **W.J. Bloss** & R. von Glasow (2012) Uncertainties in Gas-Phase Iodine Chemistry, Atmos. Environ. 57, 219-232, 2012.

M. S. Alam, M. Camredon, A. R. Rickard, T. Carr, K. P. Wyche, K. Hornsby, P. S. Monks and **W. J. Bloss** (2011) Total Radical Yields from Tropospheric Ethene Ozonolysis, Phys. Chem. Chem. Phys., 13, 11002-11015, 2011.

W.J. Bloss, M. Camredon, J. D. Lee, D. E. Heard, J. M. C. Plane, A. Saiz-Lopez, S. J.-B. Bauguitte, R. A. Salmon, and A. E. Jones (2010) Coupling of HOx, NOx and halogen chemistry in the Antarctic boundary layer, Atmos. Chem. Phys., 10, 10187-10209, 2010.

A. K. Mollner, L. Feng, M. K. Sprague, M. Okumura, D. B. Milligan, **W. J. Bloss**, S. P. Sander, P. T. Martien, R. A. Harley, A. B. McCoy and W.P. Carter (2010) Rate of gas phase association of hydroxyl radical and nitrogen dioxide, Science, 330, 646-649, 2010.

M. Camredon, J. F. Hamilton, M. S. Alam, K. P. Wyche, T. Carr, I. R. White, P. S. Monks, A. R. Rickard, and **W. J. Bloss** (2010) Distribution of gaseous and particulate organic composition during dark α-pinene ozonolysis, Atmos. Chem. Phys. 10, 2893-2917

C.S.E. Bale, T. Ingham, R. Commane, D.E. Heard and **W.J. Bloss** (2008) Novel Measurements of atmospheric iodine species by resonance fluorescence, J. Atmos. Chem. 60, 51-70 (2008) Novel Measurements of atmospheric iodine species by resonance fluorescence,. 60, 51-70

W.J. Bloss, J.D. Lee, D.E. Heard, R.A. Salmon, S. J.-B. Bauguitte, H.K. Roscoe and A.E. Jones (2007) Observations of OH and HO2 Radicals in coastal Antarctica. Atmos. Chem. Phys. 7, 4171-4185

W.J. Bloss, M.J. Evans, R. Sommariva, D.E. Heard, M.J. Pilling (2005) The oxidative capacity of the troposphere: Coupling of field measurements of OH and a global chemistry transport model. Faraday Discuss. 130, 425-436.

W.J. Bloss, J.D. Lee, G.P. Johnson, D.E. Heard, R. Sommariva, J.M.C. Plane, A. Saiz-Lopez, G. McFiggans, H. Coe, M. Flynn, P. Williams, A. Rickard and Z. Fleming (2005) Impact of Halogen Monoxide Chemistry upon Boundary Layer OH and HO2 concentrations at a Coastal Site. Geophys. Res. Lett. 32, doi:10.1029/2004GL022084.

W.J. Bloss, S.N. Nickolaisen, R.J. Salawitch, R.R. Friedl and S.P. Sander (2001) Kinetics of the ClO Self-Reaction and 210 nm Absorption Cross Section of the ClO Dimer. J. Phys. Chem. A, 105, 11226-11239.

W.J. Bloss, D.M. Rowley, R.A. Cox and R.L. Jones (2001) Kinetics and Products of the IO Self-Reaction. J. Phys. Chem. A, 105, 7840-7854