The Atmospheric Chemistry of Iodine and Alkenes

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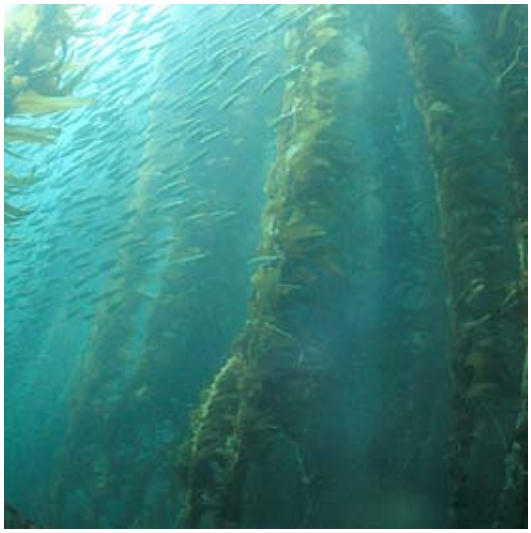
Summary

Chemical processing affects atmospheric composition, air quality and climate. The aim of this project is to characterise selected reactions of halogen species (iodine oxides), and alkene-ozone reactions, which are important, but poorly understood, components of the atmospheric system. Reactions of iodine species, released from marine sources, can lead to "ozone depletion events", when local ozone levels drop to zero in a few hours. Attempts to simulate the observed ozone loss with models frequently fail, as details of many of the reactions occurring are not known. The aim of this project is to study these reactions in the laboratory, using a new laser photolysis / UV-visible absorption spectroscopy approach, with a particular aim of understanding why iodine levels seem to be unaffected by local pollution (NO_x emissions), contrary to model predictions. In the case of alkene-ozone reactions, these have recently been shown to produce "Criegee Intermediates", CIs, which can reduce atmospheric SO_2 levels (affecting air quality and climate). The aim of the work will be to measure the absorption cross sections of selected CIs, using time-resolved UV-visible absorption spectroscopy, and so constrain their fate in the atmosphere. This project will link laboratory measurements with atmospheric models (for interpretation of the data obtained); however it is likely that the researcher will also have the opportunity to participate in related field measurement activities during the course of their studies. The project will be supervised by Dr Bloss (see www.atmos.bham.ac.uk) and will be able to collaborate with colleagues whose interests span environmental chemistry, meteorology, climatology, atmospheric chemistry and air quality.

Approach: The project will use a newly developed laboratory system, coupling laser photolysis, UV absorption spectroscopy and resonance fluorescence detection, which has recently been used to monitor criegee intermediates (Ouyang *et al*., *Phys. Chem. Chem. Phys.* 15, 17070, 2013). The candidate will use the instrument to investigate specific target reactions of the alkene-ozone system, and the criegee absorption spectrum, to determine the fundamental photochemical parameters (rate constants, absorption cross sections). These will then be interpreted using box models of atmospheric composition, to compare predictions of (e.g.) IO and CI levels with those observed in field campaigns. In the case of the CI topic, the Doctoral Researcher's work will link to our current NERC-funded project investigating CI reactions in the EUPHORE smog chamber. **Background, Support and Training:** A background in chemistry, environmental science or physics (or equivalent) is required. Full training in the specific laboratory techniques and modeling will be provided, with day-to-day help and guidance available from other researchers currently working in the group (see www.atmos.bham.ac.uk). Depending upon their background, the Doctoral Researcher will also attend selected modules from MSc courses in Applied Meteorology & Climatology and Air Pollution Management & Control, taught within the School, which will provide broader context to the project. They will be encouraged to attend the NERC NCAS summer school on Atmospheric Science, in the first year of the project. The student will be supported in preparing their results for publication, both internally, and in academic journals and at national / international conferences.



For more information, please contact Dr William Bloss, w.j.bloss@bham.ac.uk

Applicants should apply via
http://www.birmingham.ac.uk/postgraduate/courses/research/gees/environmental-health-risk-mgt.aspx
where they should click on 'Apply now' and choose the option 'PhD in Department of Division of Environmental Health and Risk Management' and give the PhD title in the 'Funding details' section of the online application.