

Title: What can we learn from “crowd breath” experiments? Air chemistry studies from a football match and in a cinema.

Abstract: Many breath studies are conducted on carefully selected individuals under controlled laboratory conditions. Measuring a statistically meaningful number of people takes considerable time and can yield results that are influenced by the laboratory environment. An alternative approach is to assess large groups of people (10 000-30 000) under real world conditions by measuring ambient air in crowded locations. In this talk we examine what can be learned by using a proton transfer reaction mass spectrometer (PTR-MS) to measure hundreds of volatile organic compounds every 30 seconds at a football match and in a cinema. In both cases the trace gas signatures measured in ambient air are shown to reflect crowd behavior. By applying advanced data mining techniques we have shown that groups of people reproducibly respond to certain emotional stimuli (e.g. suspense) by exhaling specific trace gases. Future experiments focused on the role of people on indoor air will be discussed.

Related papers

- C. Stöner, A. Edtbauer, J. Williams. Real world volatile organic compound emission rates from seated adults and children for use in indoor air studies. *Indoor Air*, DOI: 10.1111/ina.12405, 2017.
- P. R. Veres, P. Faber, F. Drewnick, J. Lelieveld, J. Williams. Volatile Organic Compound Measurements During a Football Match: Assessing Human Emissions in the Atmosphere. *Atmospheric Environment*, 77, 1052-1059, DOI: 10.1016/j.atmosenv.2013.05.076.
- J. Williams, C. Stöner, J. Wicker, N. Krauter, B. Derstroff, E. Bourtsoukidis, T. Klüpfel, S. Kramer. Cinema audiences reproducibly vary the chemical composition of air during films, by broadcasting scene specific emissions on breath. *Nature Scientific Reports* 6:25464, DOI: 10.1038/srep25464

Jonathan Williams

Prof. Dr. Williams is an atmospheric chemist. He received his BSc in Chemistry and French and his Ph.D. in Environmental Science from the University of East Anglia, England. Between 1995-1997 he worked as a postdoctoral researcher at the NOAA Aeronomy laboratory in Boulder, USA, and from 1998 to present at the Max Planck Institute for Chemistry as a research group leader. He has participated in many international field campaigns on aircraft, ships and at ground stations. His present research focus is the investigation of the chemistry of volatile organic compounds (VOC) in the atmosphere. He is an editor on several atmospheric journals, has over 150 peer reviewed publications on this theme and authored the award winning textbook “The Atmospheric Chemist’s Companion.” Recently he has applied gas measurement techniques to investigate how people affect the indoor environment.