Geophysical Research Abstracts
Vol. 12, EGU2010-7497-1, 2010
EGU General Assembly 2010

Design and Field Testing of a Fiber Laser Based Formaldehyde Laser-Induced Fluorescence Instrument During BEARPEX 2009

Joshua DiGangi (1), Joshua Paul (2), Samuel Henry (1), Aster Kammrath (1), Frank Keutsch (1), and the BEARPEX Science Team

(1) University of Wisconsin-Madison, Department of Chemistry, Madison, USA, (2) NovaWave Technologies, Redwood City, CA, USA

The oxidation of volatile organic compounds (VOCs) is central to the production of tropospheric ozone and the formation of secondary organic aerosol (SOA). Formaldehyde (HCHO) is one of the most ubiquitous VOC oxidation products and thus an important tracer of VOC oxidation. We have developed a laser-induced fluorescence (LIF) instrument for fast, high-sensitivity measurements of HCHO based on a novel UV fiber laser that is < 1 ft^3 and requires < 100 W power. The new fiber laser LIF instrument is ideal for field instrumentation as it achieves high sensitivity and selectivity in a small and very robust package and is capable of fast sampling (up to 10 Hz).

In addition to an overview of the instrument design, we will present field measurements of formaldehyde concentrations and gradients taken during the first deployment of the Madison FIber Laser-Induced Fluorescence (FILIF) Instrument during the Biosphere Effects on AeRosols and Photochemistry EXperiment (BEARPEX) 2009 at a rural forest in the Sierra Nevada mountains. Large nighttime gradients through the canopy were observed with larger HCHO concentrations above the canopy, whereas smaller reverse gradients were observed during the day. These results will be discussed in the context of rapid, in-canopy BVOC oxidation and the uncertainties in the HO_x budget inside forest canopies. The detection limit (3σ) during BEARPEX 2009 was 1.5 ppb_v/s and we will present modifications that will improve the detection limit to < 40 ppt_v/s, or < 6 ppt_v/min. We will also discuss work toward constructing a spatially optimized version of the instrument, as well as an evaluation of the ability of the instrument to measure HCHO fluxes via eddy correlation.